

# PROJECT MANUAL

LINCOLN HALL CONSTRUCTION  
NORTHERN STATE UNIVERSITY  
ABERDEEN, SD  
OSE# R0122--05X

Prepared By

BUREAU OF ADMINISTRATION  
OFFICE OF THE STATE ENGINEER

Joe Foss Building  
523 East Capitol  
Pierre, South Dakota 57501-3182  
605-773-3466  
STACY WATTERS, P.E.  
STATE ENGINEER



This Project Manual provides for liquidated delay damages in the amount of **\$1850 per calendar day after the Substantial Completion date of December 9, 2025** for the Contractor's delay in completion of the work.  
See the Bid Form and Article 10 of the General Conditions for details.

**April 9, 2024**

**INDEX**  
**FOR**  
**STATE SPECIFICATION**  
**HEAD SECTIONS, GENERAL CONDITIONS,**  
**SPECIAL CONDITIONS, TECHNICAL SPECIFICATIONS**  
**AND PLANS**

- 1 INDEX
- 2 INVITATION TO BID
- 3 BIDDER'S CHECKLIST
- 4 ASBESTOS CONTAINING MATERIALS STATEMENT
- 5 INSTRUCTIONS TO BIDDERS
  - A..... BID FORM AND/OR EXPLANATION OF UNIT PRICES & ALTERNATES
  - B..... ELECTRONIC BIDDING INSTRUCTIONS
  - C..... BID BOND
  - D..... PERFORMANCE & PAYMENT BOND WITH ACKNOWLEDGMENT OF SURETY
  - E ..... NON-RESIDENT BIDDER AFFIDAVIT
  - F ..... CONTRACTOR'S STATEMENT OF SKILLS & CAPABILITIES
  - G ..... RESIDENT SUBCONTRACTOR CERTIFICATION
- 6 AGREEMENT FOR CONSTRUCTION
- 7 GENERAL INDEX AND GENERAL CONDITIONS
- 8 ARPA SUPPLEMENTAL CONDITIONS
- 9 SPECIAL INDEX AND SPECIAL CONDITIONS
- 10 TECHNICAL INDEX AND TECHNICAL SPECIFICATIONS
- 11 PLAN INDEX AND PLANS

## **INVITATION TO BID**

## Invitation to Bid

Electronic bids will be accepted by the State Engineer on behalf of the South Dakota Board of Regents at [https://www.sd.gov/cs?id=sc\\_cat\\_item&sys\\_id=e84dabf287918a509f69c9d5cebb35b2](https://www.sd.gov/cs?id=sc_cat_item&sys_id=e84dabf287918a509f69c9d5cebb35b2) until April 30, 2024 at 2:00 PM CT for the Lincoln Hall Construction, Northern State University, Aberdeen, South Dakota, OSE# R0122--05X.

There will be an on-site pre-bid meeting on April 16, 2024 at 10:00 AM CT. All bidders can meet at Missouri River Room in the lower level of Graham Hall. This pre-bid meeting is optional but is the bidders only opportunity to review the site. Campus contact is Doug Leidholt, 605-228-5237, [douglas.leidholt@northern.edu](mailto:douglas.leidholt@northern.edu). OSE contact is Sean Campbell, 605-295-4165, [sean.campbell@state.sd.us](mailto:sean.campbell@state.sd.us).

Copies of the Plans and Specifications may be obtained by bidders at the office of Collaborative Operandi Architecture, LLC, 1108 S Main Street, Suite 102, Aberdeen, SD 57401. A/E Contact: Spencer Sommers, 605-262-0243, [spencer@co-oparch.com](mailto:spencer@co-oparch.com). Anyone requesting, reviewing, or copying Plans and Specifications for this project agrees that they are doing so for the sole purpose of submitting a bid on the project. Bidder further agrees the Plans and Specifications are the sole property of the State;

Each bid in excess of \$100,000.00 must either pre-mail a certified check, cashier's check, or draft in the amount of 5% of the base bid and all add alternates and drawn on a State or National Bank to the Office of the State Engineer, Joe Foss Building, 523 East Capitol Ave, Pierre, SD 57501-3182, or upload a copy of their 10% bid bond to their electronic bid issued by a surety authorized to do business in the State of South Dakota and made payable to the Board of Regents of the State of South Dakota. The BOR reserves the right to reject any or all bids and to waive any irregularities therein. All active bids can be found here: <https://boa.sd.gov/state-engineer/adv-advertisements.aspx>

Published twice at the total approximate cost of \_\_\_\_\_.

## BIDDER'S CHECKLIST

The following items need to be submitted along with your bid, via the electronic bidding platform. All bids and any modifications to bids must be in the hands of the State Engineer or the State Engineer's representative, via the electronic bidding platform, on or before the time set for opening bids in the Invitation for Bids.

- All blanks on the electronic Bid Form are filled in.
- Receipt of all addenda is noted on the electronic Bid Form.
- Bid Form is electronically signed by an officer of the corporation or, if not a corporation, a proprietor or partner.
- For bids of \$100,000.00 or higher, a copy of the bid bond or security is submitted with the electronic bid and is mailed to the Office of the State Engineer.
- If a foreign contractor, a fully executed "Non-Resident Bidder Affidavit" is submitted with the bid.

## **ASBESTOS STATEMENT**

#### ASBESTOS CONTAINING MATERIALS CAUTION:

It is brought to the contractor's attention that asbestos containing materials (greater than 1%) may be present outside the project requirements yet within the building or area. The contractor shall take the necessary precautions so as not to disturb this material. If asbestos containing materials are disturbed, the contractor shall follow and comply with the state rules promulgated under SDCL 34-44 pertaining to asbestos, and 29 CFR 1926.58, 40 CFR Part 61, 40 CFR Part 763 as in effect and the United States Environmental Protection Agency publication entitled "Guidance for Controlling Asbestos Containing Materials in Buildings" (EPA 560/5-85-024, June 1985).

#### ASBESTOS CONTAINING MATERIALS STATEMENT:

In accordance with the provisions of SDCL 34-44-8, all bidders and contractors are hereby notified that to the best knowledge of the owner or those representing him in any capacity, this project **does not** involve asbestos containing materials (greater than 1%). Bidders are further instructed that no asbestos containing materials are to be installed in this project.

The contractor is cautioned that hidden materials unknown to the owner and inaccessible for testing may be found during the demolition work of this project which may be asbestos containing materials. Proper procedures shall be followed upon discovery of these materials. The owner or those representing the owner in any capacity shall not be held responsible or liable for any injury or cost to any person resulting from handling of or proximity to such materials.

#### ASBESTOS LIABILITY STATEMENT

In accordance with amended SDCL 34-44, neither the owner, employees, or agents of the owner, nor any other person may have any claim, right or action against the prime contractor for any asbestos related injury or damage arising from the activities of a certified asbestos abatement subcontractor. Unless exempt under applicable state and federal law, no asbestos abatement work may be performed except by a certified asbestos contractor. A certified asbestos abatement subcontractor shall hold the owner and general contractor harmless from any liability arising from such subcontractor's activities on the project. A certified asbestos abatement contractor shall cause the owner and, if acting as a subcontractor, the general contractor to be named as additional insureds and provide sufficient proof of insurance for purposes of this section.

## **INSTRUCTIONS TO BIDDERS**



## **Instructions to Bidders**

### **1. Examination of Plans, Specifications and Site.**

Bidders should carefully examine the site of the proposed work, subsurface conditions, the Plans and Specifications, and the bid and contract documents governing the project. The submission of bids is conclusive evidence that the bidder has investigated and is satisfied as to the conditions to be encountered; the character, quality, and scope of the proposed work; the quality and quantity of the materials to be furnished; and the requirements of the bid, the Plans and Specifications, and the other Contract Documents.

The Plans and Specifications are to be used only with respect to this project and are not to be used for any other project or purposes other than preparing a bid for this project; the Plans and Specifications will not be disseminated to any person or entity for purposes other than obtaining pricing information without the express written approval of the state; all information contained in the Plans and Specifications is confidential; and should the bidder disseminate the Plans and Specifications to an individual or entity for purposes of obtaining pricing information, the bidder will require that individual or entity to adhere to the terms set forth herein. The bidder, however, assumes no liability for the misuse of the Plans and Specifications by such third party or such third party's failure to comply with the provisions contained herein.

Any copies of the Plans and Specifications obtained directly from the State will be returned to the office of the Architect/Engineer immediately after the State provides notice that bidder will not be awarded a contract, or thirty (30) days after the bid opening for the project, whichever occurs first. Any copies of the Plans and Specifications made by the bidder will be destroyed immediately after the State provides notice that bidder will not be awarded a contract, or thirty (30) days after the bid opening for the project, whichever occurs first. If bidder does not submit a bid, bidder will fulfill the requirements previously outlined on or before the date of the bid opening. Should bidder be awarded a contract for construction of the project, bidder does not need to return or destroy Plans and Specifications until after completion of the project.

### **2. Submission of Bids.**

Each bid must:

- a. Be submitted via the electronic bidding platform;
- b. Include any addenda issued during the time of advertising for bids the same as though it had been included in the original Plans and Specifications; and

All bids and any modifications to bids must be in the hands of the State Engineer or the State Engineer's representative, via the electronic bidding platform, on or before the time set for opening bids in the Invitation for Bids. Bids will not be received after the time for bid opening.

### **3. Modification of Bids.**

- a. Bids may be modified, via the electronic bidding platform, at any time, not later than the time set for the opening of bids. No bid made shall be changed or altered by telephone. No oral changes, alterations or conditions will be accepted under any circumstance.

#### **4. Contractor's Qualification Statement.**

For bids of \$100,000.00 or more, the low bidder, upon request, must submit to the Office of the State Engineer, within 48 hours of said request, Contractor's Statement of Skills and Capabilities (Exhibit "F") with their bids. The Contractor's Qualification Statement (AIA Document A305) or the AGC's Contractor Qualification Statement may be used provided it includes all the information required by the OSE document, minus the financial statement.

#### **5. Bid Security.**

Each bid over \$100,000.00 must be accompanied by a bid security as follows:

- a. Certified Check, Cashier's Check or Draft. A certified check, cashier's check or draft for five percent (5%) of the amount of the bid, including all add alternates, such check to be certified or issued by either a State or National Bank and payable to said public corporation or officer. A certified check, cashier's check or draft shall be received at the Office of the State Engineer no later than the date and time of the bid opening.
- b. Bid Bond. In lieu of a certified check as a bid guarantee, a bid bond of ten percent (10%) of the total amount of the bid, including all add alternates, may be furnished by the Contractor. See Exhibit "C" for Bid Bond form. Such bond to be issued by a surety authorized to do business in the State of South Dakota. Such bond shall be payable to said public corporation or officer as guaranty that such bidder will enter into a contract with said public corporation, its Board or officers thereof, in accordance with the terms of such letting and bid in case such bidder be awarded the contract. A copy of the bid bond shall be attached to the bid, via the electronic bidding platform.

No bidder shall be required to leave his/her certified check or other guaranty or bid bond posted for a longer period than thirty (30) days if the bid is not accepted. The certified check or other guaranty of the successful bidder shall be returned to him forthwith upon the execution of the contract and surety herein provided for.

#### **6. Withdrawal of Bids.**

Any bid may be withdrawn, via the electronic bidding platform, at any time before the time specified in the advertisement therefor. Withdrawal of a bid does not prejudice a bidder's right to submit a new bid within the time designated for the submission of bids. No bids may be withdrawn after the time designated in the Invitation to Bid for the opening of bids.

#### **7. Request for Interpretation.**

Any person who plans to bid on the project may submit to the Owner a written request for an interpretation of any part of the Plans and Specifications or Contract Documents. Requests for interpretations shall be made not less than ten (10) days prior to the opening of bids. Any interpretation will be in writing and furnished to each person receiving Plans and Specifications for bidding. The Owner will not be responsible for any other explanation or interpretation.

**8. Or Equal Clause.**

Whenever a material, article, or piece of equipment is identified on the Plans or in the Specifications by reference to manufacturers' or vendors' names, trade names, catalogue numbers, etc., it is intended merely to establish a standard; and any materials, article, or equipment of other manufacturers and vendors which will perform adequately the duties imposed by the general design will be considered equally acceptable provided the requirements of Article 6.3.4 of the General Conditions are met and the material, article, or equipment so proposed is, in the opinion of the Architect and State Engineer, of equal substance and functions.

**9. Preference for South Dakota Products, Labor and Materials.**

By virtue of statutory authority in SDCL § 5-18A-6(10) et seq. preference will be given to South Dakota products, labor and materials as provided by law.

**10. Opening of Bids.**

Bids will be received until the time for opening designated in the Invitation to Bid. All bids received within the designated time will be opened and read aloud at the time and place designated in the Invitation to Bid. Bidders and their authorized agents are invited to attend in person or online.

**11. Relief from Mistake in Bid.**

A bidder claiming a mistake in a bid must give the State written notice of the alleged mistake within five calendar days after the bids are opened, specifying in detail how the mistake occurred. Relief will only be granted for clerical or mathematical mistakes which can be documented to the satisfaction of the State Engineer.

**12. Consideration of Bids.**

At the time of opening bids, the State will verify ~~the bidder is prequalified for the specified work type and the bidder's bidding capacity at that time is sufficient to handle the work for which the bidder submitted a bid proposal.~~ The State reserves the right to refuse to accept a bid for any of the following reasons:

- ~~a. Lack of competency or adequate machinery, plant, or other equipment, as shown by the Contractor's Prequalification Statement;~~
- b. Uncompleted work which the State determines, in its sole discretion, may hinder or prevent the prompt completion of additional work;
- c. Failure to pay or satisfactorily settle any legal obligation due for labor or material on any contract at the time of issuance of bid;
- ~~d. Failure to comply with the State's prequalification regulations;~~
- e. Default under any previous contract or contracts;
- f. Debarment by the State or the federal government;
- g. Disqualification by the State. The following reasons will be considered sufficient for disqualifying a bidder and rejecting the bid or bid proposals:
  - 1. Submittal of more than one bid for the same work from an individual, firm, or corporation under the same or different name; or,

2. Evidence of collusion among bidders. A participant in collusion will not receive recognition as a bidder for future work with the State until reinstated as a qualified bidder;
- ~~h. Lack of overall bidding capacity as established by the Contractor's prequalification statement, considering the uncompleted work currently under contract;~~
- ~~i. Lack of per contract bidding capacity as established by the Contractor's prequalification statement; or~~
- j. Unsatisfactory performance on previous work or any current contract or contracts consisting of, but not limited to:
  1. Noncompliance with contract specifications, contract requirements, or Engineer's directives;
  2. Failure to complete work on time;
  3. Instances of substantial corrective work prior to acceptance;
  4. Instances of completed work that requires acceptance at reduced pay;
  5. Production of work or materials not meeting required specifications, and when applicable, requiring price reductions or corrective work;
  6. Failure to provide adequate safety measures or appropriate traffic control that endangers the safety of the work force and public;
  7. Questionable moral integrity as determined by the Attorney General of the State, or the State; or,
  8. Failure to reimburse the State for monies owed on any previously awarded contract including any contract where the prospective bidder is a party to a joint venture and the joint venture has failed to reimburse the State for monies owed.

After opening, the State will compare the bids on the basis of the summation of the products of the quantities shown in the bid by the lump sum, and/or alternates, and/or unit bid prices. The State will make results of such comparisons available to the public. In the event of a discrepancy between unit bid prices and extensions, the unit bid price will govern.

The State reserves the right to reject any bid(s), the right to waive technicalities, and the right to reject all bids and advertise for new bids, if in the sole judgment of the State the rejection or waiver will promote the best interest of the State.

### **13. Rejection of Bids.**

Bids may be rejected if they show any alteration of form, additions not called for, conditional bids, incomplete bids, unexplained erasures, or irregularities of any kind. The State may waive any informality in the bids received. When bids are signed by an agent other than an authorized corporate officer or member of a partnership, a power of attorney must be filed with the bid. Otherwise, the bid will be rejected as irregular and unauthorized. If there is reason to believe that collusion among the bidders exists, any or all bids may be rejected. The State reserves the right to reject all bids if in the judgment of the State Engineer it is in the best interest of the State.

**14. Award of Contract.**

If the contract is awarded, it will be awarded to the responsible bidder submitting the lowest bid, subject to paragraph 18 below, which complies with the Invitation to Bid and with these instructions. The successful bidder will be notified within thirty (30) calendar days of the date bids are opened. Subsequent to notice of award, the successful bidder will be presented with a contract agreement. The contract will require the completion of work according to the Plans and Specifications and the Contract Documents. Conditional bids will not be accepted.

**15. Responsibility.**

The Owner may make such investigations as he/she deems necessary to determine the ability of the bidder to perform the work, and the bidder shall furnish to the Owner all such information and data for this purpose as the Owner may request. The Owner reserves the right to reject any bid if the evidence submitted by, or investigation of, such bidder fails to satisfy the Owner that such bidder is properly qualified to carry out the obligations of the contract and to complete the work contemplated therein.

**16. Nonresident Bids.**

SDCL § 5-18A-26, provides that the Contract shall be let to the lowest responsible bidder; provided, however, a resident bidder may be allowed a preference on any such contract as against the bid of any bidder from any other State or foreign province which enforces or has a preference for resident bidders. The amount of the preference given to the resident bidder shall be equal to the preference in the other state.

**17. Subcontractor Certification.**

SDCL§ 5-18B-6, provides that prior to execution of a public improvement project a successful bidder shall certify on the prescribed form (Exhibit "G"):

- (1) That no more than twenty-percent of the cost of labor included in the contract is being provided by nonresident subcontractors; or
- (2) That more than twenty percent of the cost of labor included in the contract is being provided by nonresident subcontractors because resident contractors are not available and at competitive prices.

**18. Method of Award.**

- a. Bidding procedure involving only a base bid: If the base bid is within the amount of funds available to finance the construction contract, then contract award will be made to that responsible bidder submitting the low base bid. If the low bid exceeds the funds available to finance the construction, the State may negotiate with the low bidder to produce a bid amount within the availability of funds.
- b. Bidding procedure involving a base bid and alternate bids: If the base bid is within the amount of funds available to finance the construction contract and the Owner wishes to accept alternate bids, then contract award will be made to that responsible bidder submitting the low combined bid, consisting of the base bid and any combination of add or deduct alternative bids found to be most advantageous to the Owner. Under this procedure, if the Owner wishes to make award on low base bid only, then contract award will be made to that responsible bidder submitting the low base bid. If the low bid exceeds the funds available to finance the construction, the State may negotiate with the low bidder to produce a bid amount within the availability of funds.

**19. Execution of Agreement.**

Within ten (10) calendar days after the proposed contract agreement is presented to the successful bidder for execution, the successful bidder must execute the contract documents and, *if the Contract is for more than \$100,000.00*, provide a performance and labor and material payment bond.

**20. Performance & Labor and Material Payment Bond.**

If the Contract is for more than \$100,000.00, provide a performance and labor and material payment bond produced by a South Dakota licensed insurance producer (agent) and issued by a South Dakota licensed surety in an amount not less than the amount of the awarded contract. The performance and labor and material payment bond Surety or Sureties shall meet all requirements of South Dakota Law.

This bond is to secure the faithful performance of the contract and the payment of those to whom the bidder may become legally indebted for labor, materials, tools, equipment, or services of any kind used or employed by the bidder in performing the work. The surety bond shall be on the form attached hereto as Exhibit "D". *(Failure on the part of the bidder to furnish such bond in the time stated shall be cause for consideration by the State of awarding the Contract to the second low bidder and the retention of the bid deposit.)*

**21. Power of Attorney.**

Attorneys-in-fact who sign bid bonds or contract bonds must file with each bond a certified and effectively dated copy of their power of attorney.

**22. Default.**

The failure to execute the contract documents or to furnish bonds required by these instructions within ten (10) calendar days after the proposed contract agreement is presented for execution constitutes a default. In the event of a default, the State may award the contract to the next lowest bidder or may re-advertise for bids. The State may charge against the defaulting bidder the difference between the amount of the bid and the amount for which a contract for the work is subsequently executed plus the State's additional administrative cost necessitated by the bidder's failure to execute the Contract Documents, irrespective of whether the amount thus due exceeds the amount of the bid bond. If a more favorable bid is received by re-advertising, the defaulting bidder shall have no claim against the State for a refund.

**23. Commencement of Work/Time of Completion.**

The contractor for the general construction shall commence work under the contract within ten (10) consecutive calendar days after issuance of written Notice to Proceed and shall substantially complete all work under the contract within the timeframe specified in the Bid Form.

**24. Liquidated Damages.**

See Article 10.3.4 of the General Conditions.

**25. Applicable Laws and Regulations.**

The bidder's attention is directed to the fact that all applicable South Dakota laws, and the rules and regulations of all authorities having jurisdiction over construction of the project shall apply to the contract throughout and they will be deemed to be included in the contract the same as though herein written out in full.

**26. South Dakota Tax Information for Public Contracts.**

Contractors performing public contracts in South Dakota may become responsible for two types of taxes: the excise tax upon realty improvement contracts and the sales/use tax upon materials.

All contractors must secure a license from the Department of Revenue before engaging in the construction activities in this State. Detailed information on tax requirements may be obtained from the Department of Revenue, Anderson Building, Pierre, South Dakota 57501. Telephone 605.773.3311.

**27. Applicable Standards.**

In addition to codes, Standards and Regulations referenced for compliance in the various sections of the Specifications, the work shall be in compliance with the following:

ANSI Z53.1 - 1971, and as revised  
Safety color code for marking physical hazards.

ANSI A13.1 - 1975, and as revised  
Scheme for the identification of piping systems.

ANSI C2, and as revised  
National Electrical Safety Code.

**28. Affirmative Action Plan.**

The State of South Dakota requires that all contractors, vendors, and suppliers, employing fifty or more persons, doing business with any State Agency, Department, or Institution, place on file a statement of Affirmative Action that said contractor, vendor, or supplier does not discriminate in its employment practices with regard to race, color, religion, sex or national origin.

No award of any contract with the State of South Dakota shall be executed or awarded and approved by the State for any service, supply, or commodity unless the successful bidder submits such statement.

Above statement may be submitted to the State Engineer with the contractor's bid, or prior to award of contract.

**29. Procurement Law.**

This project is subject to the provisions of SDCL § 5-18A and 5-18B et seq.

**30. Federal Registration.**

All bidders shall be registered with SAM.gov.

**EXHIBIT "A"**

**BID FORM**



## BID FORM

All bids shall be submitted via the OSE Electronic Bidding Platform, details below:



## OSE Electronic Bidding

Submit Bid

### Overview

The undersigned, being familiar with the local conditions affecting the work, and with the Contract Documents, including the Invitation to Bid, Instructions to Bidders, Bid Form, Explanation of Alternates, Modification to Bid Form, Bid Bond Form, Performance and Payment Bond, Acknowledgment of Surety, Sample Certification of Surety, Non-Resident Bidder Affidavit, Form of Agreement for Construction, General Conditions, Special Conditions, Technical Specifications, Plans and Addenda which govern the purchase of material and labor and the awarding of contracts hereby proposes to do all the work and provide all the material and equipment for the project.

Bid Opening Date: **April 30, 2024**

Bid Opening Time: **2:00 PM CT**

Date of Project Manual: **April 9, 2024**

Date of Plans: **April 9, 2024**

Substantial Completion Date: **December 9, 2025** w/ Liquidated Damages: **\$1850** per calendar day

Final Completion Date: **January 12, 2026** w/ Liquidated Damages: **\$925** per calendar day

Total value of material subject to tax: **\$0.00**  
*Any material furnished by the State for use in this project is subject to Use Tax and Excise Tax.*

Link to Bidding: [https://www.sd.gov/cs?id=sc\\_cat\\_item&sys\\_id=e84dabf287918a509f69c9d5cebb35b2](https://www.sd.gov/cs?id=sc_cat_item&sys_id=e84dabf287918a509f69c9d5cebb35b2)

### **ATTENTION BIDDERS!**

- **TECHNICAL DIFFICULTIES:** *OSE is not responsible for technical difficulties resulting from the electronic bidding platform.*
- **MODIFY BIDS:** *It is highly recommended that contractors submit their bid early and modify as needed prior to the bid closing. Please note, bids may be modified as many times as desired prior to the bid opening date/time as well as withdrawn at any point prior to the bid opening.*
- **SESSION TIMEOUT:** *The online bidding platform session will timeout if left open for too long, therefore bids need to be submitted in a timely manner as to ensure the information is not lost and other errors do not occur.*

## EXPLANATION OF ALTERNATES

### ALTERNATES

- ALT01. LVT vs Sealed Concrete
- ALT02. Carpet vs Sealed Concrete
- ALT03. All Glass - Double Glazed vs Single Glazed
- ALT04. SA-1: Exterior Metal Soffit Panels vs Stucco Soffits
- ALT05. South Drive Hardscape vs Patch and Repair
- ALT06. Trash Enclosure
- ALT07. Skyfold Partition, Rms 101/102
- ALT08. Acoustical Wall paneling add (SAP1-4)
- ALT09. Horizontal Operable Partition - Rm 212
- ALT10. Monument Sign
- ALT11. Sidewalk adds - West
- ALT12. Site Walls
- ALT13. Free Standing Wall between Lincoln Hall and Graham
- ALT14. Graham Hall Connector / Addition
- ALT15. Replace Lincoln Hall Boilers
- ALT16. Replace Lincoln Hall Chiller

**EXHIBIT “B”**

**ELECTRONIC BIDDING INSTRUCTIONS**

May 9, 2022

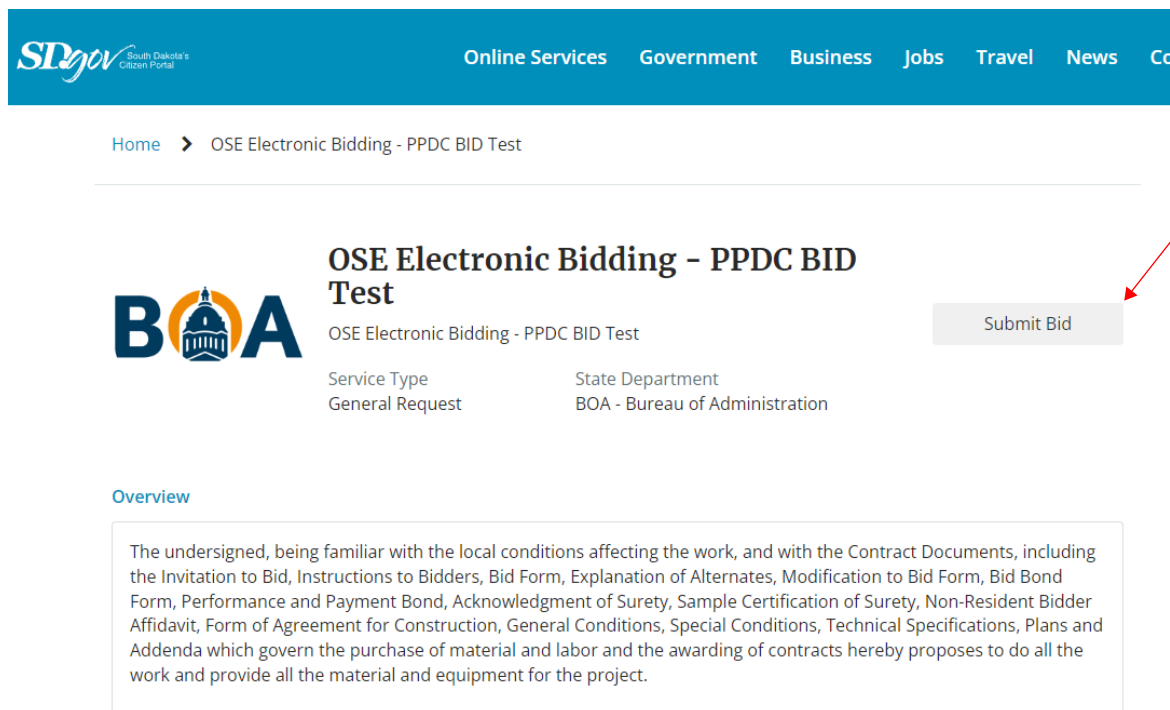
**RE: ELECTRONIC BIDDING**

The State of South Dakota, Office of the State Engineer (OSE), has switched to an electronic bidding platform! Please find below screen shots and information on submitting an electronic bid.

The State of SD has switched to a “single sign on” platform for all State services. Therefore, the username and password you use for purchasing a SD hunting or fishing license would be the same username and password you would use to submit an electronic bid on an OSE project. We just want you to be cognizant of that as you set up your SD.gov account.

Each project will have its own unique web address for bidding. This can be found in the advertisement on our website for that specific project, the builders exchanges advertisements, as well as the newspapers. If you ever cannot find the link, please reach out to OSE at the contact information above and we can assist you.

When you click the link, it will ask you to log on. Once you have logged on, you’ll see the project title and a button to click for “Submit Bid.”



**SD.gov** South Dakota's Citizen Portal

Online Services Government Business Jobs Travel News Co

Home > OSE Electronic Bidding - PPDC BID Test

**BOA**

## OSE Electronic Bidding - PPDC BID Test

OSE Electronic Bidding - PPDC BID Test

Submit Bid

Service Type: General Request  
State Department: BOA - Bureau of Administration

**Overview**

The undersigned, being familiar with the local conditions affecting the work, and with the Contract Documents, including the Invitation to Bid, Instructions to Bidders, Bid Form, Explanation of Alternates, Modification to Bid Form, Bid Bond Form, Performance and Payment Bond, Acknowledgment of Surety, Sample Certification of Surety, Non-Resident Bidder Affidavit, Form of Agreement for Construction, General Conditions, Special Conditions, Technical Specifications, Plans and Addenda which govern the purchase of material and labor and the awarding of contracts hereby proposes to do all the work and provide all the material and equipment for the project.

Once you click "Submit Bid" you will see the project information populate and the path on top. The Contractor will be prompted to enter their company information.

## OSE Electronic Bidding - PPDC BID Test



\* Indicates required

OSE #:

Project Name:

Project Location:

Project Campus:

Bid Opening Date

The project information will auto populate, including the bid opening date.

The undersigned, being familiar with the local conditions affecting the work, and with the Contract Documents, including the Invitation to Bid, Instructions to Bidders, Bid Form, Explanation of Alternates, Modification to Bid Form, Bid Bond Form, Performance and Payment Bond, Acknowledgment of Surety, Sample Certification of Surety, Non-Resident Bidder Affidavit, Form of Agreement for Construction, General Conditions, Special Conditions, Technical Specifications, Plans and Addenda which govern the purchase of material and labor and the awarding of contracts hereby proposes to do all the work and provide all the material and equipment which pertains to this project.

\* Bidder:

\* Name Of Firm's Representative:

\* Title Of Firm's Representative:

\* Phone


\* Email

\* Firm's Business Address:

\* State of Incorporation:

Required information

Bidder:  Title Of Firm's Representative:  Firm's Business Address:  State of Incorporation:

 Add attachments

Next

# OSE Electronic Bidding - PPDC BID Test



\* Indicates required

\* Dollar amount: \$

Review

Please click on the pencil icon in the Actions column below and enter an Alternate bid for each line item.

\* Bid Information

Actions	Alternate	Zero Dollar Change/Add/Deduct from the base bid the sum of:	DOLLARS \$
	Construction funds approved in legislation this FY		

Required information

Dollar amount: \$

Add attachments

Back

Next

Once you click next, it will bring you to the bid form for the project. This will have base bid plus any alternates. The base bid must be filled in with numbers only (no symbols). Once you fill base bid in and click outside of that field, the review tab will auto populate with symbols for you to review.

If your bid is over \$100,000 an additional line will appear asking for a copy of a bid bond. This will only show up, if your bid exceeds that threshold. Please attach a copy (jpg, pdf, or similar) to your bid. If you prefer to mail a certified check, there is also a button you can select that says, "I have mailed a check to OSE, in lieu of a bid bond."

This project has one alternate listed. Click on the pencil to edit the value for the alternate.

**Edit Row** ×

Alternate  
Construction funds approved in legislation this FY

\*Zero Dollar Change/Add/Deduct from the base bid the sum of:

Add

Search

-- None --

Add

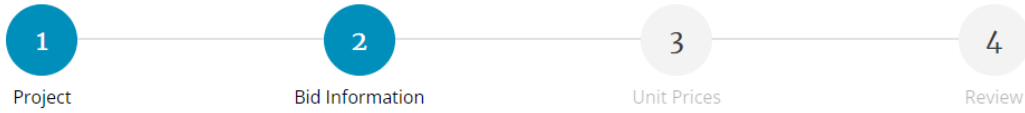
Deduct

Zero Dollar Change

Cancel Save

Once you click the pencil, it will ask from a drop down menu if you want to add, deduct, or zero dollar change for the alternate. The alternate title will be listed for reference. Once you make your selection, enter your dollar value and click save.

# OSE Electronic Bidding - PPDC BID Test



\*Dollar amount: \$

100001.00

Review

\$100,001.00

\*Only applicable for bid is greater than \$100,000 Uploaded to this proposed bid is a copy of a 10% bid bond, for the base bid and all alternates, issued by a surety authorized to do business in the state of South Dakota, in the amount of

10000.10

Review

\$10,000.10

Please attach a copy of your Bid Bond. At the bottom of the page you will see the "Add Attachment" paperclip icon.

Check this box if you have mailed a certified check or cashier's check in the amount of 5% of the base bid and all add alternates in lieu of a 10% bid bond. Mailing address: Office of the State Engineer, 523 East Capitol Ave, Pierre SD 57501

Please click on the pencil icon in the Actions column below and enter an Alternate bid for each line item.

\*Bid Information

Actions	Alternate	Zero Dollar Change/Add/Deduct from the base bid the sum of	DOLLARS \$
	Construction funds approved in legislation this FY	Add	500,000,000

Add attachments

Back

Next

Alternate Title

This will then bring you to your bid form filled out for your review. Then click "Next."




## OSE Electronic Bidding - PPDC BID Test




No Unit Prices are needed for this project

Review

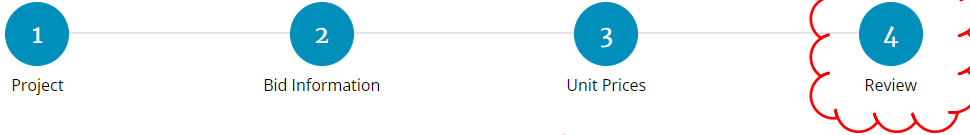
 Add attachments

Back

 Next

If your project has unit prices, they will populate next for you to fill out. You would enter those in the same fashion that you entered your alternate. Click "Next" to proceed.

## OSE Electronic Bidding - PPDC BID Test



This then brings you to your final review page

\* Indicates required

OSE #:

ASW22--FUN/PPDC

Project Name:

PPDC BID Test

Project Location:

Drifters Bar and Grille

Project Campus:

Capital Complex

Bid Opening Date

06/03/2022 10:30:00

The undersigned, being familiar with the local conditions affecting the work, and with the Contract Documents, including the Invitation to Bid, Instructions to Bidders, Bid Form, Explanation of Alternates, Modification to Bid Form, Bid Bond Form, Performance and Payment Bond, Acknowledgment of Surety, Sample Certification of Surety, Non-Resident Bidder Affidavit, Form of Agreement for Construction, General Conditions, Special Conditions, Technical Specifications, Plans and Addenda which govern the purchase of material and labor and the awarding of contracts hereby proposes to do all the work and provide all the material and equipment which pertains to this project.

\* Bidder:

South African Construction

\* Name Of Firm's Representative:

Stacy Watters

\* Title Of Firm's Representative:

Grunt

\* Phone

(605) 484-6754

\* Email

Wattersstacy@gmail.com

\* Firm's Business Address:

523 East Capital Ave. Pierre SD 57501

\* State of Incorporation:

SD

**Review all information!**

\*Dollar amount: \$  
100001.00

Review  
\$100,001.00

\*Only applicable for bid is greater than \$100,000 Uploaded to this proposed bid is a copy of a 10% bid bond, for the base bid and all alternates, issued by a surety authorized to do business in the state of South Dakota, in the amount of  
10000.10

Review  
\$10,000.10

Please attach a copy of your Bid Bond. At the bottom of the page you will see the "Add Attachment" paperclip icon.

Check this box if you have mailed a certified check or cashier's check in the amount of 5% of the base bid and all add alternates in lieu of a 10% bid bond. Mailing address: Office of the State Engineer, 523 East Capitol Ave, Pierre SD 57501

Please click on the pencil icon in the Actions column below and enter an Alternate bid for each line item.

\*Bid Information

Actions	Alternate	Zero Dollar Change/Add/Deduct from the base bid the sum of:	DOLLARS \$
	Construction funds approved in legislation this FY	Add	500,000,000

No Unit Prices are needed for this project

Review

The above bid includes all applicable State and Municipal Sales and Use Taxes on materials, and State and Municipal Excise Taxes and all other State and Federal Taxes that would affect the amount of the bid. (See Instructions to Bidders-SD Sales and Use Tax Information for Public Contracts.)

In addition, any material furnished by the State for use in this project is subject to Use Tax and Excise Tax. The total taxable value of materials furnished by the State for this project is:

0

A Performance and Payment Bond as required by General Conditions will not be required on contracts which do not exceed One Hundred Thousand Dollars (\$100,000). (See SDCL 5-21-1.1 as amended). If discrepancies remain at the time of substantial completion, a value will be assigned to each of the discrepancies and two (2) times their estimated value will be retained from payment to the Contractor until completed and accepted. (See SDCL 5-18-13 as amended).

Within ten (10) days after Contractor's receipt of the Agreement for Construction, the Contractor shall submit to the Office of the State Engineer, the executed Agreement for Construction, Performance and Payment Bond, Certificates of Insurance and Affirmative Action Plan (if applicable).

Work shall be commenced within ten (10) consecutive calendar days after written Notice to Proceed by the State Engineer and shall be substantially completed by:

12/31/2022

The undersigned acknowledges that they have read and understand the Asbestos-Containing Materials Statement contained in the project manual.

**Review all information!**

In submitting this bid, it is understood that the right is reserved by the Owner to reject any and all bids and to waive any irregularities. It is further understood by the Bidder that he may not withdraw their Bid within 30 days after the actual opening thereof.

In submitting this bid, bidder asserts they have reviewed all provisions of the General Conditions including the provision for assessment of liquidated damages found in Article 10 of the General Conditions. Bidder agrees that the damages anticipated by the Owner in the event of delay in completion of the project are uncertain in amount and difficult to prove; the amount stipulated in Article III of the Agreement for Construction is a reasonable amount in light of the anticipated loss and injury; and the Owner's actual damages in the event of delay would be impracticable or extremely difficult to fix. Bidder agrees to be bound by the liquidated damages set forth in Article III of the Agreement for Construction. Bidder further agrees that the liquidated amount stipulated in Article III of the Agreement for Construction is not a penalty.

For contractors, vendors, suppliers, or subcontractors with five (5) or more employees who enter into a contract with the State of South Dakota that involves the expenditure of one hundred thousand dollars (\$100,000) or more, by submitting a response to this solicitation or agreeing to contract with the State, the bidder or offeror certifies and agrees that the following information is correct:

The bidder or offeror, in preparing its response or offer or in considering proposals submitted from qualified, potential vendors, suppliers, and subcontractors, or in the solicitation, selection, or commercial treatment of any vendor, supplier, or subcontractor, has not refused to transact business activities, has not terminated business activities, and has not taken other similar actions intended to limit its commercial relations, related to the subject matter of the bid or offer, with a person or entity on the basis of Israeli national origin, or residence or incorporation in Israel or its territories, with the specific intent to accomplish a boycott or divestment of Israel in a discriminatory manner. It is understood and agreed that, if this certification is false, such false certification will constitute grounds for the State to reject the bid or response submitted by the bidder or offeror on this project and terminate any contract awarded based on the bid or response. The successful bidder or offeror further agrees to provide immediate written notice to the contracting executive branch agency if during the term of the contract it no longer complies with this certification and agrees such noncompliance may be grounds for contract termination.

\*The signer acknowledges that they have read, understand, and agree to the information stated in the Instructions to Bidders


Yes

If you need to withdraw your bid after it's submitted, please click on the "Take Action" tab. You will see a Close Request button there.

Submit

#### Required information

The signer acknowledges that they have read, understand, and agree to the information stated in the Instructions to Bidders

 Add attachments

Back

[Home](#) > [OSE Electronic Bidding - PPDC BID Test](#)

## OSE Electronic Bidding - PPDC BID Test

### Request Confirmation



Thank you for submitting request CS0002377

View Request

Go Home

Once you click submit, you will see this screen. If you click, view request, you can view and/or edit at any time.

Number  
CS0002377

Created just now Updated just now State Bid Received

## OSE Electronic Bidding - PPDC BID Test

Show more ▾

### OSE Electronic Bidding - PPDC BID Test

CS0002377 Bid Received

#### Details

Opened  
06/01/2022 08:51:13

Task type  
Office of the State Engineer

Updated  
06/01/2022 08:51:22

Bid Details Comments Attachments Take Action

#### Variables

OSE #:

ASW22--FUN/PPDC

Number  
CS0002377

Created 1m ago Updated 1m ago State Bid Received

## OSE Electronic Bidding - PPDC BID Test

Show more ▾

### OSE Electronic Bidding - PPDC BID Test

CS0002377 Bid Received

#### Details

Opened  
06/01/2022 08:51:13

Task type  
Office of the State Engineer

Updated  
06/01/2022 08:51:22

Bid Details Comments Attachments Take Action

Type your message here...

Send



S

system  
Electronic Bidding PPDC.pdf  
218.6 KB

1m ago

SW

Stacy Watters  
CS0002377 Created

1m ago

Start

Comments on the project are here. Any addendum's issued would show up in the comments (as well as emailed).

Number  
CS0002377

Created 1m ago Updated 1m ago State **Bid Received**

## OSE Electronic Bidding - PPDC BID Test

Show more ▾

### OSE Electronic Bidding - PPDC BID Test

CS0002377 Bid Received

#### Details

Opened  
06/01/2022 08:51:13

Task type  
Office of the State Engineer

Updated  
06/01/2022 08:51:22

Bid Details Comments **Attachments** Take Action

Any attachments are under the "Attachments Tab"

Electronic Bidding PPDC.pdf (218.6 KB)

1m ago

Number  
CS0002377

Created 2m ago Updated 2m ago State **Bid Received**

## OSE Electronic Bidding - PPDC BID Test

Show more ▾

### OSE Electronic Bidding - PPDC BID Test

CS0002377 Bid Received

#### Details

Opened  
06/01/2022 08:51:13

Task type  
Office of the State Engineer

Updated  
06/01/2022 08:51:22

Bid Details Comments Attachments **Take Action**

Close Request

Click on "Close Request" only if you want to withdraw your bid entirely.

Once you submit your bid, you will receive an email similar to the snapshot below. You will receive similar emails for any addendum's issued.



RE: Electronic Bid received

Location: Drifters Bar and Grille

Campus: Capital Complex

OSE# ASW22--FUN/PPDC

Dear Stacy Watters,

Your bid for the above referenced project has been received and will be opened publicly on the date and time of the advertisement, which is when bidding officially closes for this project. You can modify your bid any time up until the bidding is closed. You will be notified via email if any addendum's are issued that need to be acknowledged. They will also be posted on the website.

We will be opening bids via Zoom on our live channel that can be found at this link: <https://zoom.us/j/3043640283>

**Password: BID**

If you are unable to watch, a bid tab will be posted to the website shortly after the bids have been opened and read. Thank you for your interest in working with the State of South Dakota.

Respectfully,

The Office of the State Engineer

- Make sure the email address you use is checked regularly
- When an addendum is issued, you will be notified via email to log back on and acknowledge the addendum(s)
- For projects over \$100K, there will be a link to attach a copy of your bid bond or an address to send a cashier's check to (we prefer bid bond over check if possible)
- Any bids submitted will not be visible to those of us at OSE until the day/time of the bid opening
- Once you submit your bid, you will receive an email acknowledging that it was received automatically
- You may withdraw your bid electronically at any time before the bid closes
- Bid Tabulations can be found here, after the bid closes
  - [OSE Pr https://www.sd.gov/cs/?id=ose\\_projects - Citizen Services \(sd.gov\)](https://www.sd.gov/cs/?id=ose_projects - Citizen Services (sd.gov))

**EXHIBIT "C"**

**BID BOND**



**BID BOND**

KNOW ALL MEN BY THESE PRESENTS, that we, the undersigned, \_\_\_\_\_

\_\_\_\_\_

as Principal, and \_\_\_\_\_

as Surety, are hereby held and firmly bound unto \_\_\_\_\_

as owner for the penal sum of \_\_\_\_\_ of which, well and truly to be made, we hereby jointly and severally bind ourselves, our heirs, executors, administrators, successors and assigns.

Signed, this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_\_.

The condition of the above obligation is such that whereas the Principal has submitted to \_\_\_\_\_ a certain Bid, attached hereto and hereby made a part hereof to enter into a contract in writing for the \_\_\_\_\_

NOW, THEREFORE,

- (a) If said Bid shall be rejected, or in the alternate
- (b) If said Bid shall be accepted and the Principal shall execute and deliver a contract in the Form of Contract, attached hereto (properly completed in accordance with said bid) and shall furnish a bond for his faithful performance of said contract, and for the payment of all persons performing labor or furnishing materials in connection therewith, and shall in all other respects perform the agreement created by the acceptance of said Bid.

Then this obligation shall be void, otherwise the same shall remain in force and effect: it being expressly understood and agreed that the liability of the Surety for any and all claims hereunder shall, in no event, exceed the penal amount of this obligation as herein stated.

The Surety, for value received, hereby stipulates and agrees that the obligations of said Surety and its bond shall be in no way impaired or affected by any extensions of the time within which the Owner may accept such Bid; and said Surety does hereby waive notice of any such extension.

IN WITNESS WHEREOF, the Principal and the Surety have hereunto set their hands and seals, and such of them as are corporations have caused their corporate seals to be hereto affixed and these presents to be signed by their proper officers, the day and year first set forth above.

\_\_\_\_\_  
Principal (L.S.)

\_\_\_\_\_  
Surety

SEAL

By: \_\_\_\_\_

## **EXHIBIT “D”**

### **PERFORMANCE AND PAYMENT BOND**

**Performance and Payment Bond form must be from OSE Website or the version sent from OSE with Contract.  
If example below is used, bond WILL BE REJECTED.**

**PERFORMANCE AND PAYMENT BOND**

KNOW ALL MEN BY THESE PRESENTS, THAT WE \_\_\_\_\_

\_\_\_\_\_

(Contractor – Name and address)

hereinafter called "Principal", and \_\_\_\_\_

\_\_\_\_\_

(Surety – Name and address)

a corporation, organized and existing under the laws of the State of \_\_\_\_\_, and duly authorized to transact business in the State of South Dakota, hereinafter called "Surety", are held and firmly bound unto the State of South Dakota, hereinafter called "Obligee", in the just and full sum of \_\_\_\_\_ Dollars(\$\_\_\_\_\_)

lawful money of the United States of America to be paid to the State of South Dakota, which payment to be made, we bind ourselves, our heirs, administrators, executors, successors and assigns, jointly and severally, firmly by these presents.

The condition of this obligation is such that:

WHEREAS, Principal has been awarded a contract with Obligee for the construction of:

PROJECT NAME: Lincoln Hall Construction \_\_\_\_\_

\_\_\_\_\_

PROJECT LOCATION: Northern State University, Aberdeen, SD \_\_\_\_\_

\_\_\_\_\_

PROJECT NUMBER: R0122--05X \_\_\_\_\_

which Contract is herein referred to and made a part hereof as fully and to the same extent as if the same were entirely written herein; and

WHEREAS, it was one of the conditions of the award by Obligee of the Contract that these presents should be executed.

PROVIDED, FURTHER, that the Surety, for consideration received, hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of the Contract, to work to be performed thereunder or to the specifications accompanying the Contract shall in any manner affect its obligation on this Bond. The Surety hereby does waive notice of any such change, extension of time, alteration or addition to the terms of the Contract, to the work or to the specifications. The Surety further stipulates and agrees that this Bond shall be valid and enforceable regardless of the time period between the date of execution of the Bond by the Surety and the date of execution of the Bond by the Principal.

PROVIDED, FURTHER, that no final settlement between the Obligee and the Principal shall abridge the right of any beneficiary hereunder whose claim may be unsatisfied.

NOW, THEREFORE, if the Principal in all respects complies with the terms and conditions of the Contract and his (their or its) obligations thereunder, including specifications therein referred to and made a part thereof and any alteration made in such specifications as herein or therein provided, then this obligation is void, but otherwise remains in full force and effect.

A further condition of this bond is that in the event the Principal fails to pay all just claims and demands on the part of any employee, person, firm or corporation for labor and materials furnished for or used in connection with the prosecution of the work under the Contract, or fails to pay any tax which may accrue to the State of South Dakota under the provisions of the "Use Tax Act of 1939 and The Excise Tax on Realty Improvements under SDCL 10-46A," and Sections 5-21-3 and 5-21-4 of the South Dakota Codified Laws, this bond and the sureties thereon shall be responsible to such person, firm or corporation and to the State of South Dakota for the full payment of the value of such labor and materials so furnished, including payment of South Dakota use taxes and excise taxes on realty improvements.

SIGNED AND SEALED THIS \_\_\_\_\_ DAY OF \_\_\_\_\_, 20\_\_\_\_.

**INDIVIDUAL PRINCIPAL**

By \_\_\_\_\_ Typed Name \_\_\_\_\_  
(Affix Seal if available)

**PARTNERSHIP, CORPORATE, OR LLC PRINCIPAL**

By \_\_\_\_\_ Typed Name \_\_\_\_\_

Title \_\_\_\_\_ Business Name \_\_\_\_\_  
(Affix Corporate Seal if available)

Address \_\_\_\_\_

**INDIVIDUAL, PARTNERSHIP OR CORPORATE SURETY**

By \_\_\_\_\_ Typed Name \_\_\_\_\_

Title \_\_\_\_\_ Business Name \_\_\_\_\_  
(Affix Corporate Seal if available)

Address \_\_\_\_\_

Surety's South Dakota License Number: \_\_\_\_\_

Insurance Producer's Name: \_\_\_\_\_

Insurance Producer's South Dakota License Number: \_\_\_\_\_

**ACKNOWLEDGMENT OF PRINCIPAL  
(Individual)**

State of \_\_\_\_\_ )

) ss

County of \_\_\_\_\_ )

On this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_, before me personally  
appeared \_\_\_\_\_, known to me to be the individual described in  
and who executed the foregoing instrument and acknowledged to me that he/she executed the same.

\_\_\_\_\_  
Notary Public

My commission expires the \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_\_.

**ACKNOWLEDGMENT OF PRINCIPAL  
(Partnership)**

State of \_\_\_\_\_ )  
 ) ss  
County of \_\_\_\_\_ )

On this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_, before me personally appeared \_\_\_\_\_, who acknowledged himself/herself to be one of the partners of \_\_\_\_\_, a partnership, and that he/she, as such partner, being authorized so to do, executed the foregoing instrument for the purposes therein contained, by signing the name of the partnership by himself/herself as a partner.

\_\_\_\_\_  
Notary Public

My commission expires the \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_\_.

**ACKNOWLEDGMENT OF PRINCIPAL  
(Corporation)**

State of \_\_\_\_\_ )  
 ) ss  
County of \_\_\_\_\_ )

On this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_\_ before me personally appeared \_\_\_\_\_, who acknowledged himself/herself to be the \_\_\_\_\_ of \_\_\_\_\_, a corporation, and that he/she, as such \_\_\_\_\_ being authorized so to do, executed the foregoing instrument for the purposes therein contained, by signing the name of the corporation by himself/herself as \_\_\_\_\_.

\_\_\_\_\_  
Notary Public

My commission expires the \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_\_.

**ACKNOWLEDGMENT OF PRINCIPAL  
(LLC)**

State of \_\_\_\_\_ )  
 ) ss  
County of \_\_\_\_\_ )

On this \_\_\_\_\_ day of \_\_\_\_\_, 20 \_\_\_\_\_ before me personally appeared \_\_\_\_\_, who acknowledged himself/herself to be the \_\_\_\_\_ of \_\_\_\_\_, a limited liability company, and that he/she in such capacity, being authorized to do so, executed the foregoing instrument for the purposes therein contained, by signing the name of the limited liability company by himself/herself as \_\_\_\_\_.

\_\_\_\_\_  
Notary Public

My commission expires the \_\_\_\_\_ day of \_\_\_\_\_, 20 \_\_\_\_\_.

**ACKNOWLEDGMENT OF SURETY  
(Corporate Officer)**

State of) \_\_\_\_\_ )ss  
County of \_\_\_\_\_ )

On this \_ day of \_\_\_\_\_, 20\_\_\_\_, before me, a Notary Public in and for said County, personally appeared \_\_\_\_\_ personally known to me, who being by me duly sworn, did say that he/she aforesaid officer of the \_\_\_\_\_ of \_\_\_\_\_, a corporation duly organized and existing under the laws of the State of \_\_\_\_\_, that the seal affixed to the foregoing instrument is the corporate seal of said corporation, that the said instrument was signed, sealed and executed in behalf of said corporation by authority of its Board of Directors, and further acknowledges that the said instrument and the execution thereof to be the voluntary act and deed of said corporation.

IN WITNESS WHEREOF, I have hereunto subscribed by name and affixed by official seal at \_\_\_\_\_, the day and year last above written.

\_\_\_\_\_  
Notary Public

My commission expires the \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_\_.



**ACKNOWLEDGMENT OF SURETY  
(Attorney-In-Fact)**

State of \_\_\_\_\_ )  
 )ss  
County of \_\_\_\_\_ )

On this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_, before me personally appeared \_\_\_\_\_ known to me or satisfactorily proven to the person whose name is subscribed as attorney in fact for \_\_\_\_\_ and acknowledged that he/she executed the same as the act of his/her principal for the purpose therein contained.

IN WITNESS WHEREOF, I hereunto subscribed my name and affixed my official seal at \_\_\_\_\_, the day and year last above written.

\_\_\_\_\_  
Notary Public

My commission expires the \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_\_.

**APPROVAL AS TO FORM**

Approved as to form this \_\_\_\_\_ day of \_\_\_\_\_, 20 \_\_\_\_\_.

\_\_\_\_\_  
Assistant Attorney General

**EXHIBIT "E"**

**NON-RESIDENT BIDDER AFFIDAVIT**

**NON-RESIDENT BIDDER AFFIDAVIT**

Country of \_\_\_\_\_ )

)ss

State or Province of \_\_\_\_\_ )

Business Name: \_\_\_\_\_

Business Address: \_\_\_\_\_

\_\_\_\_\_

Affiant's Name and Title: \_\_\_\_\_

Project Name and Location: **Lincoln Hall Construction, Northern State University, Aberdeen, SD** \_\_\_\_\_

OSE Project Number: **R0122--05X** \_\_\_\_\_

**AFFIDAVIT WHEN NO PREFERENCE IS GIVEN**

I do hereby affirm that \_\_\_\_\_ resides in the country of \_\_\_\_\_

\_\_\_\_\_ in the state or province of \_\_\_\_\_

and that said country and/or state or province does not grant a preference to resident bidders for work on behalf of said country, state or province.

Dated: \_\_\_\_\_

Signed \_\_\_\_\_

**AFFIDAVIT WHEN PREFERENCE IS GIVEN**

I do hereby affirm that \_\_\_\_\_ resides in the country of \_\_\_\_\_  
\_\_\_\_\_ in the state or province of \_\_\_\_\_  
and that said country and/or state or province does grant a preference to resident bidders for work on behalf of  
said country, state, or province, the nature and extent of such preference being \_\_\_\_\_  
\_\_\_\_\_.

Dated: \_\_\_\_\_

Signed \_\_\_\_\_

**ACKNOWLEDGEMENT OF AFFIANT**

Country of \_\_\_\_\_ )

)ss

State or Province of \_\_\_\_\_ )

On this \_\_\_\_\_ day of \_\_\_\_\_, 20, before me personally appeared  
\_\_\_\_\_, known to me to be the affiant who, being duly  
sworn, declares all statements made in this affidavit to be true and correct to the best of his or her knowledge.

\_\_\_\_\_  
Notary Public

My commission expires the \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_\_.

**EXHIBIT "F"**

**CONTRACTOR'S STATEMENT OF SKILLS AND CAPABILITIES**

**STATE OF SOUTH DAKOTA  
OFFICE OF THE STATE ENGINEER**

**Contractor's Statement of Skills and Capabilities**

Send Completed Form to: Office of the State Engineer  
523 East Capitol  
Pierre, South Dakota 57501-3182  
Phone: 605.773.3466

**OSE Project:**

**Project Name: Lincoln Hall Construction**  
**Location: Northern State University, Aberdeen, SD**  
**OSE# R0122--05X**

**CONTRACTOR INFORMATION**

**A. Business Structure**

**Submitted By:**

1. Current Business Name and Address.

Business Name:

Address:

Phone:

E-mail:

2. How many years has your company been in business under the name listed above?
3. Has your company been in business under any other business name(s)?  
If so, list previous business name(s) and the years your company operated under each name:
4. If a corporation, provide the:
- Date and State of incorporation:
- Type of corporation:

Names of Officers

President:

Vice-president(s):

Secretary:

Treasurer:

5. If a partnership, provide the:

State of Organization:

Partnership type:

Date of organization:

Names of partners:

6. If individual, provide:

Date of organization:

Name of owner:

7. Use this space to describe your company's business structure if it differs from those listed above:

8. List the states and trades in which you may legally do business where applicable. Provide registration or license number(s).

9. If your company is organized under the laws of another state, has it registered with the Secretary of State for the State of South Dakota and/or the Department of Revenue?

## **B. Background and History**

1. What types of Work does your company perform with its own forces?
  
2. Has your company ever failed to complete Work it had contracted to perform? Provide details if the answer is “yes.”
  
3. Within the last five years, has any officer or principal of your company been an officer or principal of another company that failed to complete Work that the latter company contracted to perform? Provide details if “yes.”
  
4. List any and all judgments, claims, suits at law, or arbitration proceedings pending or outstanding against your company or its officers regarding any construction contracts:
  
5. Within the last five years, has your company filed law suits or requested arbitration regarding any construction contracts?
  
6. On separate paper, provide a list of major construction projects your company is currently working on. For purposes of this document “major construction projects” shall be considered anything of average size or greater for your company. Provide name of owner, location, architect, contract amount, and scheduled completion.
  
7. On separate paper, list the major construction projects your company has completed in the last five years. For purposes of this document “major construction projects” shall be considered anything of average size or greater for your company. Provide name of owner, project, location, architect, contract amount, and scheduled completion.
  
8. On separate paper, list the construction background/experience of the key personnel in your company.
  
9. What is the average annual value of all construction work your company performed within the last five years?



**C. References**

1. List your company's Business/Industry References:
  
  
  
  
  
  
  
  
  
  
2. List your company's Financial References:
  
  
  
  
  
  
  
  
  
  
3. Provide the name and address of your company's Surety, as well as the name and address of the Agent:

SIGNATURE AND NOTARIZATION

Date \_\_\_\_\_

Typed Name: \_\_\_\_\_

Title: \_\_\_\_\_

\_\_\_\_\_

Business Name: \_\_\_\_\_

Signature

Address: \_\_\_\_\_

(Affix Seal)

\_\_\_\_\_

On this \_\_\_\_\_ day of \_\_\_\_\_, 20, before me personally appeared \_\_\_\_\_, known to me to be the affiant who, being duly sworn, declares all statements made in this affidavit to be true and correct to the best of his or her knowledge.

\_\_\_\_\_  
Notary Public

My commission expires the \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_\_

**EXHIBIT "G"**

**RESIDENT AND NON-RESIDENT SUBCONTRACTOR BREAKOUT**

### Resident and Non-resident Subcontractor Breakout

Company: \_\_\_\_\_

Contract Amount: \_\_\_\_\_

Date: \_\_\_\_\_

Re: **Lincoln Hall Construction  
Northern State University  
Aberdeen, SD  
OSE# R0122--05X**

Resident Contractors

Company	Location	Labor Cost	% Value of Contract
Total:			

Non- Resident Contractors

Company	Location	Labor Cost	% Value of Contract
Total:			

As defined in 5-18A:

(26) "Resident," any person, partnership, association, limited liability company, foreign limited liability company, corporation, or foreign corporation licensed to do business within this state that has maintained a substantial and bona fide place of business and has conducted business from within this state for at least one year prior to the date on which a contract was awarded. The members of the partnership or association shall have been bona fide residents of the state for one year or more immediately prior to bidding upon the contract. A foreign corporation licensed pursuant to §§ 47-1A-1501 to 47-1A-1532, inclusive, is not a resident as defined by this section if the state or country in which it is organized enforces or has a preference for resident bidders;

If more than 20% of the labor cost included in the contract is being provided by nonresident subcontractors, please explain: \_\_\_\_\_

---



---



---



---



---

# **AGREEMENT FOR CONSTRUCTION**

PLANS AND SPECIFICATIONS PREPARED  
BY  
???

PROJECT: ???  
???  
???  
OSE# ???

**AGREEMENT FOR CONSTRUCTION**  
PRIME CONTRACT

THIS Agreement is made the ??? day of ???, ??? by and between ???, ???, ??? (the "Contractor") and the ??? represented by its legal officers (the "Owner").

WITNESSETH, that the Contractor and the Owner for the consideration stated herein agree as follows:

**ARTICLE I, CONTRACT DOCUMENTS:**

The following documents and any other documents incorporated in them by reference constitute the contract documents:

1. This Agreement
2. The Project Manual dated \_\_\_\_\_ ???
3. The Project Drawings dated \_\_\_\_\_ ???
4. Addenda issued prior to execution of this Agreement
5. Contractor's Performance and Labor and Material Payment Bond
6. Value Engineering Letter dated \_\_\_\_\_ (if there is a VE letter, list here or add "N/A")

These documents constitute the entire and integrated agreement between the parties hereto and supersede prior negotiations, representations, or agreements, either written or oral. The Index for items 2 and 3 is attached hereto as Exhibit "A."

**ARTICLE II, STATEMENT OF WORK:**

To the extent not otherwise provided in the contract documents, contractor shall furnish and pay for all labor, tools, equipment, supplies, materials, appurtenances, utilities, charges, fees, permits, and all other construction accessories and services required to complete the work specified in the contract documents in strict compliance with the contract documents.

**ARTICLE III, DATE OF COMMENCEMENT AND COMPLETION:**

The work shall be commenced within ten (10) consecutive calendar days after the date of issuance of the Notice to Proceed by the Owner and shall be substantially completed not later than ???, and completed and ready for final inspection/acceptance no later than ???, subject to adjustments of the contract time as provided in the contract documents. Should the Contractor fail to substantially complete the work within the time set forth herein, or within such extra time as may have been allowed by increases in the contract, or by formally approved extensions granted by the Owner, the Contractor and the Contractor's surety shall be liable for and shall pay the Owner \$??? per calendar day as liquidated damages for each calendar day of delay until the work is substantially complete. After Substantial Completion, if the Contractor shall neglect, refuse, or fail to complete the remaining Work as outlined in the approved punch list, subject to adjustments of the contract time as provided in the contract documents, the Contractor shall be liable for and shall pay the Owner \$??? as liquidated damages for each calendar day of delay until the Work is completed and ready for final inspection/acceptance.

If split completion date, use the following language: "...by the Owner, Phase 1 shall be substantially completed not later than ???, and Phase 2 shall be substantially completed not later than ???, subject to..."

Or

If split completion date, use the following language: "...by the Owner, Phase 1 shall be substantially completed not later than ???, and Phase 2 shall be substantially completed not later than ???, and completed and ready for final inspection/acceptance no later than ??? subject to...

**ARTICLE IV, CONTRACT SUM:**

- A. For the performance of the work specified in the Contract Documents, Owner will pay Contractor and Contractor will accept as full compensation the sum of ??? (???), subject to additions or deductions as provided in the contract documents;
- B. Contract sum includes the following alternates, if any, which are described in the Contract Documents and are hereby, accepted by the Owner: **N/A** (if there are alternates, list below AND remove "N/A")

Alternate	Short Description	Price
1		\$
2		\$

- C. Unit Prices, if any, are as follows: **N/A** (if there are unit prices, list below AND remove "N/A")

Unit Price	Short Description	As-bid Price
1		\$ per Unit
2		\$ per Unit

Where the quantities originally contemplated are so changed that application of the agreed unit price to the quantity of work performed is shown to create a hardship to the Owner or the Contractor, there shall be an equitable adjustment of the contract to prevent such hardship.

- D. Contract sum includes the following value engineering items, if any, which are described in the Contract Documents and are hereby, accepted by the Owner: **N/A** (if there are VE items, list below AND remove "N/A")

VE Item	Short Description	Modified Price
1		(\$)
2		(\$)

**ARTICLE V, PROGRESS PAYMENTS:**

The Owner shall make progress payments on a monthly basis for work accomplished in accordance with General Conditions, Article 11.

**ARTICLE VI, ACCEPTANCE AND FINAL PAYMENT:**

Final payment less amounts withheld to cover the cost of nonconforming work, shall be made by the Owner in accordance with General Conditions Sub-Article 11.8.

Prior to issuing final payment, the Contractor shall provide Operation and Maintenance Manuals for all material and equipment that requires operation and maintenance work. Operation and Maintenance Manuals shall be as follows:

- A. Hard Copies: ??? 3-ring bound copy

- B. Electronic Copies: 1 single PDF file

**ARTICLE VII, NOTICE:**

All notices, demands and other communications required by the Contract Documents shall be in writing and shall be deemed to have been duly given if personally delivered, mailed first class (postage prepaid), or e-mailed:

**If to Contractor:**

???  
???  
???  
???  
Phone: ???  
???

**If to the Architect/Engineer:**

???  
???  
???  
???  
Phone: ???  
???

**If to Owner:**

Stacy Watters, P.E., State Engineer  
Office of the State Engineer  
523 East Capitol  
Pierre, South Dakota 57501-3182  
Phone: 605.773.3466  
[Stacy.Watters@state.sd.us](mailto:Stacy.Watters@state.sd.us)

Either party may change the addresses set forth for notice herein upon written notice thereof to the other.

**ARTICLE VIII, CERTIFICATION REGARDING DEBARMENT, SUSPENSION, INELIGIBILITY, AND VOLUNTARY EXCLUSION:**

- A. Compliance with SDCL ch. 5-18A

Contractor certifies, by signing this Agreement, that neither it nor its principals is presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participation, by any Federal department or agency, from transactions involving the use of Federal funds.

- B. Pursuant to Executive Order 2020-01, for contractors, vendors, suppliers, or subcontractors with five (5) or more employees who enter into a contract with the State of South Dakota that involves the expenditure of one hundred thousand dollars (\$100,000) or more, by signing this Contract ??? certifies and agrees that it has not refused to transact business activities, has not terminated business activities, and has not taken other similar actions intended to limit its commercial relations, related to the subject matter of the Contract, with a person or entity that is either the State of Israel, or a company doing business in or with Israel or authorized by, licensed by, or organized under the laws of the State of Israel to do business, or doing business in the State of Israel, with the specific intent to accomplish a boycott or divestment of Israel in a discriminatory manner. It is understood and agreed that, if this certification is false, such false certification will constitute grounds for the State to terminate this Contract. ??? further agrees to provide immediate written notice to the State if during the term of the Contract it no longer complies with this certification, and agrees such noncompliance may be grounds for contract termination.”

- C. Compliance with SDCL ch. 5-18A

Contractor certifies and agrees that the following information is correct:

Contractor is not an organization, association, corporation, partnership, joint venture, limited partnership, limited liability partnership, limited liability company, or other entity or business





OWNER: STATE OF SOUTH DAKOTA **(DELETE ANY UN-NEEDED SIGNATURE BLOCKS)**

\_\_\_\_\_  
??? (Date)  
\_\_\_\_\_  
???  
\_\_\_\_\_  
???

\_\_\_\_\_  
NAME (Date)  
\_\_\_\_\_  
Title  
\_\_\_\_\_  
AGENCY/CAMPUS

\_\_\_\_\_  
NAME (Date)  
\_\_\_\_\_  
Title  
\_\_\_\_\_  
AGENCY/CAMPUS

\_\_\_\_\_  
NAME (Date)  
\_\_\_\_\_  
Title  
\_\_\_\_\_  
AGENCY/CAMPUS

\_\_\_\_\_  
NAME (Date)  
\_\_\_\_\_  
Title  
\_\_\_\_\_  
AGENCY/CAMPUS

\_\_\_\_\_  
NAME (Date)  
\_\_\_\_\_  
Title  
\_\_\_\_\_  
AGENCY/CAMPUS

All Required Documents Received

\_\_\_\_\_  
??? (Date)  
\_\_\_\_\_  
???

REVIEWED BY: **(AND/DELETE ANY UN-NEEDED REVIEW BLOCKS - replace "NAME" with approver's name)**

NAME \_\_\_\_\_  
NAME \_\_\_\_\_  
NAME \_\_\_\_\_  
NAME \_\_\_\_\_

Exhibit "A"  
AGREEMENT FOR CONSTRUCTION  
Enumeration of Contract Documents

1. This agreement
2. The General and Special Conditions contained in the Project Manual dated ???.
3. The Invitation for Bids and Instruction to Bidders contained in the Project Manual dated ???.
4. The Specifications are those contained in the Project Manual dated ??? and are as follows:

Section	Title	Pages
See Attached Index		???

5. The drawings are as follows:

Number	Title	Date
See Attached Sheet Index		???

6. The addenda, if any, are as follows:

Number	Date	Pages
####	DATE	# OF PAGES
####	DATE	# OF PAGES
####	DATE	# OF PAGES

7. Value Engineering Letter dated **N/A** [if there are VE items, enter letter date AND remove "N/A"]

8. The Performance and Labor and Material Payment Bond dated \_\_\_\_\_  
Issued by \_\_\_\_\_ . Bond # \_\_\_\_\_.

9. Other documents forming a part of the Contract Documents are:

**GENERAL CONDITIONS**

TO

AGREEMENT FOR CONSTRUCTION

FOR

**Lincoln Hall Construction  
Northern State University  
Aberdeen, SD  
OSE# R0122--05X**

Definitions ..... 1

Execution, Correlation & Intent..... 2

Ownership, Use of Documents, Confidentiality of Documents ..... 3

Ownership of Work Product ..... 3.1

Confidentiality of Documents ..... 3.2

Return of Documents ..... 3.3

Terms to Be Included in Subcontracts..... 3.4

A/E's Responsibilities..... 4

Owner's Rights & Responsibilities ..... 5

Information & Services Required of the Owner ..... 5.1

Owner's Right to Stop the Work..... 5.2

Owner's Right to Carry Out the Work ..... 5.3

Owner's Right to Access for Observation or Other Work ..... 5.4

Contractor's Responsibilities ..... 6

Review of Contract Documents..... 6.1

Supervision & Construction Procedures..... 6.2

Labor & Materials ..... 6.3

Substitutions..... 6.3.4

Guarantees/Warranty ..... 6.4

Taxes..... 6.5

Permits, Fees & Notices..... 6.6

Superintendent..... 6.7

Construction Progress Schedule..... 6.8

Documents & Samples at the Site ..... 6.9

Shop Drawings, Product Data & Samples..... 6.10

Shop Drawing & Product Data Procedures ..... 6.10.9

Samples Procedures ..... 6.10.10

Use of Site..... 6.11

Cutting & Patching of Work..... 6.12

Cleaning Up ..... 6.13

Communications..... 6.14

Royalties & Patents ..... 6.15

Indemnification ..... 6.16

Default ..... 6.17

Subcontractors ..... 7

Definitions ..... 7.1

Award of Subcontracts & Other Contracts..... 7.2

Subcontractual Relations..... 7.3

Work by Owner or by Separate Contractors ..... 8

Owner's Right to Perform Work & Award Separate Contracts ..... 8.1

Mutual Responsibility ..... 8.2

Owner's Right to Clean Up ..... 8.3

Miscellaneous Provisions .....	9
Governing Law .....	9.1
Successors & Assigns .....	9.2
Written Notice .....	9.3
Claims for Damages .....	9.4
Performance & Labor and Material Payment Bond .....	9.5
Rights & Remedies .....	9.6
Tests .....	9.7
Litigation .....	9.8
Time .....	10
Definitions .....	10.1
Progress & Completion .....	10.2
Delays & Extensions of Time .....	10.3
Beneficial Occupancy .....	10.4
Payments & Completion .....	11
Contract Sum .....	11.1
Schedule of Values .....	11.2
Monthly Application for Payment .....	11.3
Recommendation for Payment .....	11.4
Progress Payments .....	11.5
Payments Withheld .....	11.6
Substantial Completion .....	11.7
Final Completion & Final Payment .....	11.8
Protection of Persons & Property .....	12
Safety Precautions & Programs .....	12.1
Safety of Persons & Property .....	12.2
Emergencies .....	12.3
Insurance .....	13
Commercial General Liability Insurance .....	13.1.1
Business Automobile Liability Insurance .....	13.1.2
Worker’s Compensation Insurance .....	13.1.3
Builder’s Risk Insurance .....	13.1.4
Installation Floater Insurance .....	13.1.5
Changes in the Work .....	14
Change Orders .....	14.1
Site Conditions .....	14.4
Claims for Additional Cost .....	14.5
Minor Changes in the Work .....	14.6
Uncovering & Correction of Work .....	15
Uncovering of Work .....	15.1
Correction of Work .....	15.2
Acceptance of Defective or Non-Conforming Work .....	15.3
Termination of the Contract .....	16
Termination by the Contractor .....	16.1
Termination by the Owner .....	16.2
Termination for Convenience .....	16.3

## **Article 1**

### **Definitions**

- 1.1 Owner: The owner is the State of South Dakota acting through the legally appointed commissioner for the Bureau of Administration and his representative, the Office of the State Engineer.
- 1.2 Architect/Engineer: The term "architect/engineer" (hereinafter A/E) means the person or entity identified as such on the cover sheet to the drawings or plans and his/her authorized representative including his/her consulting engineer(s).
- 1.3 Contractor: The term "contractor" means the person or entity identified as such in the Agreement for Construction and his authorized representatives.
- 1.4 Subcontractor: Any individual, firm or corporation to whom the Contractor sublets any part of the contract for supplying materials and labor, or only labor, at the site of the project.
- 1.5 The Contract Documents: The documents identified as the Contract Documents in the Agreement for Construction.
- 1.6 The Contract: The Contract Documents form the contract. The contract may be amended or modified only in writing in the manner set forth in Article 14. Nothing contained in the Contract Documents shall create any contractual relationship between the owner and any subcontractor, sub-subcontractor or supplier.
- 1.7 The Work: The completed construction required by the Contract Documents, and every part thereof, and includes all labor necessary to produce such construction, and all materials and equipment incorporated or to be incorporated into such construction.
- 1.8 The Project: The total construction of which the work performed under the Contract Documents may be the whole or a part.
- 1.9 The Drawings or Plans: The graphic and pictorial portions of the Contract Documents showing the design, dimensions and layout of the work including, but not limited to, plan views, elevation views, details, sections, schedules, and diagrams.
- 1.10 The Specifications: The written requirements in the Contract Documents for materials, equipment, construction systems, standards and workmanship.
- 1.11 The Project Manual: The manual compiled for the work containing the Invitation for Bid, Instructions to Bidders, blank form of Bid Bond, blank form of Agreement for Construction, blank form of Performance and Labor and Material Payment Bond, sample forms, General Conditions, and Special Conditions.

**Article 2**  
**Execution, Correlation and Intent**

2.1 By executing the contract, the contractor represents he has examined the plans, specifications, site of the proposed Work and Contract Documents in accordance with the requirements of the Instructions to Bidders.

2.2 The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work. The Contract Documents are complementary, and what is required by any one shall be as binding as if required by all. Work not covered in the Contract Documents will not be required unless it is consistent therewith and is reasonably inferable therefrom as being necessary to produce the intended results. Words and abbreviations which have well-known technical or trade meanings are used in the Contract Documents in accordance with such recognized meanings. All work mentioned or indicated in the Contract Documents shall be performed by the Contractor as part of this Contract unless it is specifically indicated in the Contract Documents that such work is to be done by others. Should the Drawings or the Specifications disagree in themselves or with each other, the Contractor shall provide the better quality or greater quantity of work and/or materials unless otherwise directed by written change.

2.3 The organization of the Specifications into Divisions, Sections and Articles, and the arrangement of Drawings shall not control the Contractor in dividing the Work among Subcontractors or in establishing the extent of work to be performed by any trade.

2.4 Neither the Owner nor the A/E assumes any liability arising out of jurisdictional issues raised or claims advanced by trade organizations or other interested parties based on the arrangement or manner of subdivision of the content of the Specifications and Drawings.

2.5 The Contractor and all Subcontractors shall refer to all of the Drawings, including those showing primarily the work of the mechanical, electrical, and other specialized trades, and to all of the Sections of the Specifications, and shall perform all work reasonably inferable therefrom as being necessary to produce the indicated results. The Contractor shall promptly report any discrepancy or omission which it observes in the Construction Documents and any need for clarification or interpretation to the Owner and the A/E. The Contractor's failure to do so will cause any additional cost incurred by the Contractor to be its sole responsibility. The Contractor shall number Requests for Information in consecutive order. The Contractor shall maintain a log of each Request for Information indicating the date it was issued, the date or dates of any correspondence and/or discussions on the Request for Information, and the date a final answer is received.

2.6 The General Conditions and the Special Conditions are a part of each Section of the Specifications. The Special Conditions for Mechanical and Electrical Trades, if any, are part of each Section of the Specifications referenced therein, and apply to the work of the trades affected thereby.

2.7 A typical or representative detail indicated on the Drawings shall constitute the standard for workmanship and material throughout corresponding parts of the Work. Where necessary, and where reasonably inferable from the Construction Documents, the Contractor shall adapt such representative detail for application to such corresponding parts of the Work. The details of such adaptation shall be subject to prior approval by the A/E. Repetitive features shown in outline on the drawings shall be in exact accordance with corresponding features completely shown.



2.8 The layout of mechanical and electrical systems, equipment, fixtures, piping, ductwork, conduit, specialty items, and accessories indicated on the Drawings is diagrammatic, and all variations in alignment, elevation, and detail required to avoid interferences and satisfy architectural and structural limitations are not necessarily shown. Actual layout of the Work shall be carried out without affecting the architectural, engineering and structural integrity and limitations of the Work and shall be performed in such sequence and manner as to avoid conflicts, provide clear access to all control points, including valves, strainers, control devices, and specialty items of every nature related to such systems and equipment, obtain maximum headroom, and provide adequate clearances as required for operation and maintenance.

2.9 The Drawings shall not be scaled for dimensions. If figured dimensions are not given on the Drawings, the Contractor shall request same from the A/E giving reasonable advance notice.

2.10 All indications or notations which apply to one of a number of similar situations, materials or processes shall be deemed to apply to all such situations, materials or processes wherever they appear in the Work, except where a contrary result is clearly indicated by the Contract Documents.

2.11 Where codes, standards, requirements and publications or public and private trade associations or other bodies are referred to in the Specifications, references shall be understood to be in the latest revision prior to the date of receiving bids, except where otherwise indicated.

2.12 Where no explicit quality or standards for materials or workmanship are established for work, such work is to be of good quality for the intended use and consistent with the quality of the surrounding work, of the construction of the Project generally, and industry standards.

2.13 All manufactured articles, materials, and equipment shall be applied, installed, connected, erected, used, cleaned, and conditioned in accordance with the manufacturer's written or printed directions and instructions unless otherwise indicated in the Contract Documents. A copy of the manufacturer's written or printed directions shall be provided to the Owner upon completion of the project.

**Article 3**  
**Ownership, Use of Documents, Confidentiality of Documents.**

**3.1 Ownership of Work Product**

Any plans, specifications, engineering calculations, technical data, reports, miscellaneous drawings, and all information contained therein provided by the State, its consultants, employees, contractors and agents to the contractor for the contractor's performance of its obligations under this agreement are the property of the State. They are to be used only with respect to this Project and are not to be used for any other project. The contractor may not disseminate these materials to any person or entity nor may the contractor use these materials for purposes other than work for the state, without the express written approval of the state. The state shall not unreasonably withhold such approval for dissemination of these materials as necessary to subcontractors and suppliers.

**3.2 Confidentiality of Documents**

All reports, plans, specifications, engineering calculations, technical data, miscellaneous drawings, and information contained therein provided to or prepared by the contractor, its owners, officers, employees, agents, consultants, suppliers, and subcontractors in connection with the contractor's performance under this Agreement are confidential and the contractor, its owners, officers, employees, agents, consultants, suppliers, and subcontractors shall not disclose this information to any person, individual, or entity without the express written permission of the state.

**3.3 Return of Documents**

All documents covered by Article 3 shall be delivered to the A/E at the completion of the work. The contractor may not retain any such documents for its own use without the express written permission of the state and any documents that are retained, with or without state permission, shall be subject to all of the requirements of Article 3.

**3.4 Terms to be Included in Subcontracts**

The contractor shall include the requirements of Article 3 in any contract it enters into with any consultants, subcontractors, suppliers, persons, individuals, or entities for the performance of any of the contractor's obligations under this agreement.

**Article 4**  
**A/E'S RESPONSIBILITIES**

4.1 The A/E, under the direction of the State Engineer, will provide administration of the Contract as hereinafter described. The A/E will represent the Owner during construction. The A/E will advise and consult with the Owner. The Owner's instructions to the Contractor may be forwarded through the A/E. The A/E will have authority to act on behalf of the Owner only to the extent provided in the Contract Documents, unless otherwise modified by written instrument in accordance with Sub-Article 4.15.

4.2 The Contractor shall accept instructions only from the A/E or State Engineer, and not the A/E's consulting engineers, except as the A/E and State Engineer shall authorize in writing.

4.3 The A/E will visit the construction site at intervals appropriate to the stage of construction to keep generally familiar with the progress and quality of the work completed and to determine in general if the Project is being constructed in a manner such that when completed it would be in conformance with the plans and specifications and other Contract Documents. The A/E will not, however, be required to make exhaustive or continuous on-site inspections to check the quality or quantity of work. On the basis of such observations or inspections, the A/E shall keep the Owner informed of the progress and quality of the work on the Project and endeavor to guard the Owner against defects and deficiencies in the work of the Contractor. The A/E will maintain written reports of all site visits.

4.4 The A/E shall not have control over or charge of and shall not be responsible for construction means, methods, techniques, sequences or procedures, or for safety precautions and programs in connection with the Project, since these are solely the Contractor's responsibilities under the Agreement for Construction. The A/E shall not be responsible for the Contractor's schedules or failure to carry out the Project in accordance with the Contract Documents. The A/E shall not have control over or charge of acts or omissions of the Contractor, Subcontractors, or their agents or employees, or of any other persons performing portions of the Project, except to the extent that the A/E may formally notify the Contractor of the unacceptability of various portions of the Project or failure to carry out the Work on the Project in accordance with the Contract Documents.

4.5 The A/E will inform the Contractor on behalf of and in consultation with the Owner to cease work on the Project or portions thereof affected by those items that are unacceptable and remain uncorrected until such time as corrections are made.

4.6 The A/E shall at all times have access to the Work wherever it is in preparation and progress. The Contractor shall provide facilities for such access so the A/E may perform his functions under the Contract Documents.

4.7 Except as may otherwise be provided in the Contract Documents or when direct communications have been approved by the A/E, the Owner and its representatives and the Contractor shall communicate through the A/E. Communications by and with the A/E's consultants shall be through the A/E.

4.8 The A/E will determine the amounts owing to the Contractor based on inspections and observations at the site, and on evaluations of the Contractor's Monthly Applications for Payment, and shall issue Certificates of Payment for amounts due on forms provided by the State Engineer. A Certificate of Payment constitutes a representation by the A/E to the Owner, based upon the inspections and the information provided by the Contractor in the Application, that the Project has progressed to the point indicated; that to the best of the A/E's knowledge, information and belief, the quality of the work on the Project is in accordance with the Contract Documents; and that the Contractor is entitled to payment in the amount certified.

4.9 The A/E shall have authority to reject work on the Project which does not conform to the Contract Documents. Whenever the A/E considers it necessary or advisable for implementation of the intent of the Contract Documents, the A/E will have authority to recommend to the Owner additional inspection or testing of the Work in accordance with the provisions of the Contract Documents, whether or not such work is fabricated, installed or completed. However, neither this authority of the A/E nor a decision made in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the A/E to any Construction Contractor, Subcontractors, material and equipment suppliers, their agents or employees or other persons performing portions of the work on the Project.

4.10 The A/E shall review and approve or take other appropriate action on Shop Drawings, Product Data and Samples submitted by Construction Contractors to determine if they conform with the design concept for the Project and with the information provided in the Contract Documents, and submit these documents or information to the Owner indicating the A/E's approval or comments with reasonable promptness so as to cause no delay to the prosecution of the Project.

Approval or acceptance of a specific item shall not necessarily indicate the A/E's approval of an assembly of which the item is a component. When professional certification of equipment is required by the Contract Documents, the A/E will be entitled to rely upon that certification to determine that the materials, systems, or equipment will meet the performance criteria required in the Contract Documents.

4.11 The A/E will conduct, at the time and place approved by the Owner, with representatives of the State agencies involved in the Project and the Contractor, inspections to establish dates of Project acceptance and completion. The A/E shall have other A/Es, Structural, Mechanical, or Electrical Engineers, or other consultants in their employ in attendance at this and at various progress inspections as may be necessary to evaluate whether the work completed on the Project is in conformance with the Contract Documents. The A/E will receive and forward to the Owner, with comments on completeness or acceptability, those warranties, operation manuals, and other documents required by the Contract Documents and assembled by the Contractor.

4.12 The A/E will review the final estimate for final payment to the Contractor and provide a Certificate of Final Payment to the Owner.

4.13 The A/E will provide to the Owner or the Contractor, upon written request in the form of a Request for Information, interpretations and decisions in writing, or in the form of drawings, on matters concerning performance under the Contract Documents, and execution or performance of the Work on the Project. Response to such requests shall be made with reasonable promptness and within any time limits agreed upon. The final decision on all such questions shall be made by the State Engineer.

4.14 The A/E will prepare Change Orders in accordance with Article 14, and will have authority to order minor changes in the Work as provided in Sub-Article 14.6.

4.15 The duties, responsibilities and limitations of authority of the A/E as the Owner's representative during construction as set forth in the Contract Documents will not be modified or extended without written consent of the Owner, the Contractor and the A/E.

4.16 In case of the termination of the employment of the A/E, the Owner shall appoint a replacement A/E whose status under the Contract Documents shall be that of the former A/E.

**Article 5**  
**OWNER'S RIGHTS AND RESPONSIBILITIES**

5.1 Information and Services Required of the Owner.

5.1.1 The Owner shall furnish a survey describing the legal limitations and utility locations for the site of the project.

5.1.2 The Owner shall secure and pay for necessary easements, and other property rights required for the construction of the Project.

5.1.3 Information under the Owner's control shall be furnished by the Owner with reasonable promptness after receipt from the Contractor of a written request for such information.

5.1.4 Unless otherwise provided in the Contract Documents, the Contractor will be furnished, free of charge, 2 sets of paper prints of Drawings and 3 sets of Specifications necessary for the execution of the Work.

5.1.5 The Owner may forward instructions to the Contractor through the A/E or give instructions through the State Engineer.

5.1.6 The foregoing are in addition to other duties and responsibilities of the Owner enumerated herein and especially those in respect to Work by the Owner or by separate contractors, Payments and Completion, and insurance in Articles 8, 10, 11 and 13.

5.2 Owner's Right to Stop the Work: If the Contractor fails to correct defective Work as required by Article 15 or fails to carry out the Work in accordance with the Contract Documents in any material respect, the Owner, in addition to its other remedies, by a written order signed by the State Engineer or by the State Engineer's designated representative may order the Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, this right of the Owner to stop the Work shall not give rise to any duty on the part of the Owner to exercise this right for the benefit of the Contractor or any other person or entity.

5.3 Owner's Right to Carry Out the Work: If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents in any material respect and fails within three working days after receipt of written notice from the Owner or in such time as may be established in written notice from Owner to commence and continue correction of such default or neglect with diligence and promptness, or if the Work is not being performed properly or in accordance with the scheduling provisions of the Contract Documents in any material respect, whether or not the Contractor is in default, the Owner may, after the expiration of such notice period and without prejudice to any other remedy he may have, make good such deficiencies. In such case an appropriate Change Order shall be issued deducting from the payments then or thereafter due the Contractor the cost of correcting such deficiencies, including compensation for the A/E's and State Engineer's additional services made necessary by such default, neglect or failure. If the payments then or thereafter due the contractor are not sufficient to cover such amount, the Contractor shall pay the difference to the Owner upon demand. If, in the sole judgment of the Owner, an emergency exists as a result of the Contractor's default, neglect or failure to correct defective work, which in the Owner's opinion, requires more immediate corrective action than the Contractor is able to provide, then the Owner may, without notice to the Contractor, perform such corrective work or cause it to be performed by others. The Owner shall also have the right to carry out the Work, or any part thereof, during the period of any work stoppage without terminating the Contract. If the Owner wishes to exercise this right it will give the Contractor three days notice of its intent to do so. In any such case, an appropriate deductive Change Order shall be issued in accordance with Article 14, the amount of which shall not exceed an amount which equals the estimated direct cost, including the State Engineer's fees, of performing the work which the Owner elects to perform and the proportionate amount of the Contractor's fee associated therewith.

5.4 Owner's Right to Access for Observation or Other Work: The Owner reserves the right of access to any part of the Work, at any time, for the purpose of observation, or testing, or to install other work, either with its own forces or with separate contractors. Such access is not to be construed to mean partial occupancy by Owner, and no claim for additional compensation by the Contractor because of such access or installation of work will be considered. Contractor shall cooperate with Owner during Owner's access or performance of work.

**ARTICLE 6**  
**CONTRACTOR'S RESPONSIBILITIES**

6.1 Review of Contract Documents: The Contractor shall carefully study and compare the Contract Documents and shall at once report to the Owner and the A/E any error, inconsistency or omission he may discover. The Contractor shall not be liable to the Owner or the A/E for any damage resulting from any such errors, inconsistency or omission he may discover and report, nor for any damage resulting from any such errors, inconsistencies or omissions which he could not reasonably have discovered. The Contractor shall perform no portion of the work at any time without Construction Documents or, where required, Shop Drawings, Product Data or Samples for such portions of the Work bearing the A/E's appropriate action stamp.

6.2 Supervision and Construction Procedures.

6.2.1 The Contractor shall supervise and direct the Work, using the skill and attention necessary to complete the Work in a workmanlike manner. The Contractor shall be solely responsible for all construction means, methods, techniques, sequences and procedures and for coordinating all portions of the Work under the contract. Neither the Owner nor the A/E shall have control over, or responsibility for, any such matters.

6.2.2 Nothing contained in the Contract Documents shall be interpreted by implication or otherwise as a direction by the A/E or the Owner to the Contractor as to construction means, methods, techniques, sequences and procedures. If there is express reference to such means, methods, techniques, sequences and procedures, it is solely for the purpose of insuring that the Work will be produced in accordance with the desired objectives as set forth in the Construction Documents but such express reference shall in no way relieve the Contractor of his responsibilities in connection therewith. If the Contractor does not wish to accept the responsibility for any means, techniques, sequences or procedures which are expressly set forth in the Construction Documents, then the contractor shall notify the A/E in writing of the actual means, methods, techniques, sequences and procedures which he will employ on the Work if these differ from those expressly referred to in the Construction Documents. All loss, damage or liability or cost of correcting defective Work arising from the employment of any construction means, methods, techniques, sequences or procedures shall be borne by the Contractor notwithstanding that any of the same shall have been referred to expressly in the Construction Documents.

6.2.3 The Contractor shall be responsible to the Owner for the acts and omissions of his employees, Subcontractors, Sub-subcontractors, materialmen and suppliers and their agents and employees, and other persons performing any of the Work.

6.2.4 The Contractor shall not be relieved from his obligations to perform the Work in accordance with the Contract Documents either by the activities or duties of the A/E in his administration of the Contract, by the use or occupancy of part of the Work by the Owner as provided in Sub-Article 5.4, by the performance of work related to the Project by others as provided in Sub-Article 8.1, or by inspections, tests or approvals required or performed under Sub-Article 9.7 by persons other than the Contractor.

6.2.5 The Contractor shall retain a competent Registered Professional Engineer or Registered Land Surveyor, acceptable to the Owner and A/E, who shall establish the exterior lines and required elevations of all buildings and structures to be erected on the site and shall establish sufficient lines and grades for the construction of associated work such as, but not limited to, roads, utilities and site grading. The Engineer or Land Surveyor shall certify as to the actual location of the constructed facilities in relation to property lines, building lines, easements, and other restrictive boundaries.

6.2.6 The Contractor shall establish the building grades, lines, levels, column, wall and partition lines required by the various Subcontractors in laying out their work.

6.2.7 The Contractor shall coordinate and supervise the work performed by Subcontractors to the end that the work is carried out without conflict between trades or jurisdictional disputes and so that no Subcontractor, at any time, causes delay to the general progress of the Work. The Contractor and all Subcontractors shall at all times afford each other Subcontractor, any separate contractor, and the Owner, every reasonable opportunity for the installation of work and the storage of materials, and shall provide access to and the use of necessary loading dock and hoist facilities, adequate storage room and necessary utilities and other services.

6.2.8 Wherever the work of a Subcontractor is dependent upon the work of other Subcontractors, or the Contractor, the Contractor shall require the Subcontractor to:

6.2.8.1 Coordinate his work with the dependent work;

6.2.8.2 Provide necessary dependent data and requirements;

6.2.8.3 Supply and/or install items to be built into dependent work of others;

6.2.8.4 Make provisions for dependent work of others;

6.2.8.5 Examine dependent drawings and specifications;

6.2.8.6 Examine previously placed dependent work;

6.2.8.7 Check and verify dependent dimensions of previously placed work;

6.2.8.8 Notify Contractor of previously placed dependent work or dependent dimensions which are unsatisfactory or will prevent a satisfactory installation of his work; and

6.2.8.9 Not proceed with his work until the unsatisfactory dependent conditions have been corrected.

Installation of Work by a Subcontractor in any given area shall constitute acceptance by the Subcontractor and Contractor of the previously placed dependent work.

### 6.3 Labor and Materials.

6.3.1 Unless otherwise provided in the Contract Documents, the Contractor shall provide and pay for all labor, materials, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation, and other facilities and services necessary for the proper execution and completion of the Work, whether temporary or permanent and whether or not incorporated or to be incorporated in the Work. The word "provide" shall mean furnish and install complete, including connections, unless otherwise specified. All connection charges, assessments or inspection fees which may be imposed by any public agency or utility company are included in the Contract Sum and shall be the Contractor's responsibility, except the final water and sewer connection charges which shall be paid by the Owner.



6.3.2 The Contractor shall at all times enforce strict discipline and good order among his employees and shall not employ on the Work any unfit person or anyone not skilled in the task assigned to him. The Contractor shall be responsible to maintain and observe, and to require his Subcontractors to maintain and observe, sound labor practices, and shall require each Subcontractor to take all steps reasonably necessary to avoid labor disputes or stoppages.

6.3.3 Except in the event of emergency, no substantial field operations shall be performed outside of regular working hours without the prior notification of the A/E and the Owner. The Contractor will not be entitled to additional compensation for work performed outside of regular working hours except as otherwise expressly agreed in writing by the Owner prior to the performance of such overtime work. Additional compensation for such authorized overtime shall be limited to the direct cost of the premium portion only of such authorized overtime. No additional indirect cost or fee shall be included.

#### 6.3.4 Substitutions

6.3.4.1 The products, materials and equipment of manufacturers referred to in the Specifications and on the Drawings are intended to establish the standard of quality and design required by the A/E; however, products, materials and equipment manufacturers, other than those specified, may be used, if equivalent and approved in writing by the A/E.

6.3.4.2 It is deemed that the term 'or approved equal' is included after all products, materials and equipment referred to in the Specifications or on the Drawings.

6.3.4.3 The Owner in consultation with the A/E will be the sole judge of equivalency of proposed substitute products, materials, and equipment. The A/E will make written recommendation of acceptance or rejection to the Owner. The Owner will then authorize the A/E to issue to the Contractor written approval or rejection of the substitution.

6.3.4.4 If the Contractor desires to use a substitute item, he shall make application to the A/E in writing in sufficient time (having regard to the progress of the Work, the period of delivery of the goods concerned and adequate time for the Owner's and A/E's review) stating and fully identifying the proposed substitute, cost changes (if any), and submitting substantiating data, sample, brochures, etc. of item proposed. It is the Contractor's responsibility to provide sufficient evidence by tests or other means to support any request for approval of substitution.

6.3.4.5 Prior to proposing any substitute item, the Contractor shall satisfy himself that the item he proposes is, in fact, equal to that specified, that it will fit into the space allocated, that it affords comparable ease of operation, maintenance and service, that its appearance, longevity and suitability for the climate and use are comparable to that specified, and that the substitution is in the Owner's best interest.

6.3.4.6 The burden of proof that a proposed substitution is equal to a specified item shall be upon the Contractor, who shall support his request with sufficient test data and other means to permit the State Engineer and A/E to make a fair and equitable decision on the merits of the proposal. Any item by a manufacturer other than those cited in the Contract Documents, or of brand name or model number or of generic species other than those cited in the Contract Documents will be considered a substitution.

6.3.4.7 Materials and methods proposed as substitutions for specified items shall be supported by certification of their acceptance for use by an authority, person or persons having jurisdiction over the use of the specified material or method.

6.3.4.8 Acceptance of substitutions shall not relieve the Contractor from responsibility for compliance with all the requirements of the Construction Documents. The Contractor shall be responsible at his own expense for any changes in other parts of the work of his Contract or the work of other contractors caused by his substitutions, including cost of all design and redesign services related thereto incurred by the A/E and his consultants.

6.3.4.9 The Contract completion time shall not be extended by any circumstances resulting from a proposed substitution, nor shall the Contractor be entitled to any compensation for any delay caused thereby or related thereto.

6.3.4.10 All costs for the evaluation of proposed substitutions, whether approved or not, shall be borne by the Contractor.

6.3.5 All materials and equipment shall be delivered, handled, stored, installed and protected to prevent damage in accordance with best current practice in the industry, in accordance with manufacturers' specifications and recommendations, and in accordance with Contract Document requirements. The Contractor will store packaged materials and equipment in their original and sealed containers, marked with the brand and manufacturer's name, until ready for use, and deliver materials and equipment in ample time to facilitate inspections and tests prior to installation. The term 'delivery' in reference to any item specified or indicated, means the unloading and storing with proper protection at the project site. Damaged materials or equipment will be rejected and removed from the site by the Contractor.

6.3.6 Before ordering materials, equipment, or performing Work, the Contractor shall verify indicated dimensions. If a discrepancy exists, the Contractor shall notify the A/E of same immediately. The A/E will then clarify the intended design. The Contractor shall take field measurements required for the proper fabrication and installation of the Work. Upon commencement of any item of Work, the Contractor shall be responsible for dimensions related to such item of Work.

#### 6.4 Guarantees/Warranty.

6.4.1 The Contractor guarantees and warrants to the Owner that all materials and equipment furnished under this Contract will be new unless otherwise specified, and that all Work will be of good quality, free from faults and defects and in conformance with the Contract Documents. All Work not conforming to these requirements, including substitutions not properly approved and authorized, may be considered defective. If required by the A/E or Owner, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment. This guarantee/warranty is not limited by the provisions of Sub-Article 15.2.

6.4.2 The Contractor will indemnify the Owner against loss, including loss of use and lost revenues resulting from a breach of the Contractor's guaranty and warranty under Sub-Article 6.4.1, whether the loss arises before or after the Owner's acceptance of the Project.

6.4.3 Where the contract documents provide for equipment and material warranties in addition to the Contractor's guarantees' and warranty contained in Sub-Article 6.4.1, such warranties shall at a minimum:

6.4.3.1 Provide that the term of the warranty shall start on the date of substantial completion of the project or the date the Owner takes beneficial occupancy of any portion of the project that requires the use or start-up of the warranted equipment or material, whichever date occurs first.

6.4.3.2 Provide for complete repair or replacement of defective equipment or material;

6.4.3.3 Provide all materials, shipping, and labor necessary to repair or replace defective equipment or material at no expense to the Owner;

6.4.3.4 Provide that any replacement parts used in repairing or replacing defective equipment or material shall be new or in a like-new condition.

6.4.3.5 Provide for the complete repair or replacement of defective equipment or material within two weeks after receiving written notice of the defect, provided however, that the Owner can, at its sole discretion, grant an extension of time for good cause shown; and

6.4.3.6 Provide for no limitation of liability should the Contractor and/or manufacturer fail to repair or replace defective equipment or material within the time specified in Sub-Article 6.4.3.4 or should the remedy of repair or replacement otherwise fail.

6.4.3.7 Be construed under South Dakota law.

6.4.3.8 Provide that any legal action brought on the warranty shall be brought only in a South Dakota court.

6.5 Taxes: The Contractor shall pay all sales, consumer, use, excise, and other similar taxes for the Work or portions thereof which are to be provided by the Contractor which are legally enacted at the time bids are received, whether or not yet effective.

6.6 Permits, Fees and Notices.

6.6.1 The Contractor shall secure and pay for all permits and governmental fees, licenses and inspections necessary for the proper execution and completion of the Work which are customarily secured after execution of the Contract and which are legally required at the time the bids are received. The State does not require that inspection and license fees be paid to a municipality for work performed on State property.

6.6.2 The Contractor shall give all notices and comply with all laws, ordinances, rules, regulations and lawful orders of any public authority bearing on the performance of the Work and shall indemnify the Owner and the A/E against all costs, fines and damages, and all actions, claims and proceedings, due to its failure to do so.

6.6.3 The Contractor and its Subcontractors shall acquaint themselves with all codes governing their work and shall complete the work in conformance with all codes governing their work.

6.6.4 It is not the responsibility of the Contractor to make certain that the Contract Documents are in accordance with applicable laws, statutes, building codes and regulations. If the Contractor observes that any of the Contract Documents are at variance therewith in any respect, he shall promptly notify the Owner and the A/E in writing, and any necessary changes shall be accomplished by appropriate modification.

6.6.5 If the Contractor performs any Work knowing it to be contrary to such laws, ordinances, rules and regulations, and without such notice to the Owner and the A/E, he shall assume full responsibility therefor and shall bear all costs attributable thereto.

6.7 Superintendent: The Contractor shall employ a competent superintendent and necessary assistants all of whom are acceptable to the Owner and who shall be in attendance at the Project site during the progress of the Work. The Superintendent shall represent the Contractor and all communications given to the superintendent shall be as binding as if given to the Contractor. Important communications shall be confirmed in writing. Other communications shall be so confirmed on written request in each case. The Superintendent shall not be changed without the Owner's consent.

#### 6.8 Construction Progress Schedule.

6.8.1 The Contractor shall, within 5 days, or within such time as determined by the A/E, after date of Notice to Proceed, prepare and submit to the A/E for approval a reasonable schedule showing the critical path, order in which the Contractor proposes to carry on the work and, the date on which he will start the several salient features (including procurement of materials, plant and equipment). The progress schedule shall indicate appropriately the percentage of work scheduled for completion at any time. If at any time the sequence of work is modified, the Construction Progress Schedule shall be updated.

6.8.2 The Construction Progress Schedule shall reflect the time required for the preparation and processing of shop drawings and submittals and the lead time required in connection with the procurement of manufactured or processed materials and equipment.

6.8.3 The Contractor shall furnish sufficient forces, construction plant, and equipment, and shall work such hours, including night shifts, overtime operations, and Sunday and holiday work, as may be necessary to insure the prosecution of the work in accordance with the approved progress schedule.

6.8.4 Whenever major portions of the Work fall behind the planned schedule, the Owner and A/E shall be notified and advised of action being taken to return the project to its original schedule and such action shall be indicated on the Construction Progress Schedule which shall then be reissued. If, in the opinion of the A/E and Owner, the Contractor is not taking adequate steps to improve or maintain the progress of the work, the A/E and Owner may require him to increase the number of shifts, and/or overtime operations, days of work, and/or the amount of construction plant, all without additional cost to the Owner.

6.9 Documents and Samples at the Site: The Contractor shall maintain at the site for the Owner one record copy of all Drawings, Specifications, Addenda, Change Orders and other Modifications, in good order and marked currently to record all changes made during construction, and approved Shop Drawings, Product Data and Samples. These shall be available to the A/E and Owner and shall be delivered to A/E for the Owner upon completion of the Work.

#### 6.10 Shop Drawings, Product Data and Samples.

6.10.1 Shop Drawings are drawings, diagrams, schedules or other data specially prepared for the Work by the Contractor or any Subcontractor, manufacturer, supplier, or distributor to illustrate some portion of the Work.

6.10.2 Product Data are illustrations, standard schedules, performance charts, instructions brochures, diagrams and other information furnished by the Contractor to illustrate a material, product or system for some portion of the Work.

6.10.3 Samples are physical examples which illustrate materials, equipment or workmanship and establish standards by which the Work will be judged.

6.10.4 The Contractor shall submit a schedule for submittal of Shop Drawings, Product Data and Samples to the A/E for review. The Contractor shall review, approve and submit to the A/E, with reasonable promptness and in such sequence as to cause no delay in the Work or in the work of the A/E or any separate contractor, all Shop Drawings, Product Data and Samples required by the Contract Documents, in accordance with the schedule reviewed by the A/E.

6.10.4.1 The A/E reserves the right to review Shop Drawings, Product Data, Samples and submittals in a sequence consistent with the sequence of erection, installation and assembly of the various elements of the Work.

6.10.4.2 The Contractor's identification of Shop Drawings, Product Data and Samples shall include verification of information required in Sub-Articles 6.10.9.2 and 6.10.10.2.

6.10.4.3 No extension of time will be granted, nor will any consideration be given to claims arising out of the Contractor's failure to submit any Shop Drawing, Product Data, Samples or related submittals according to the schedule or otherwise in a manner which does not allow adequate lead time for A/E's review, or does not allow ample time for revision, resubmission and subsequent review by the A/E as required.

6.10.4.4 Composite Drawing: In the interest of coordination and expediting the work in critical areas, i.e. exterior wall components, mechanical/electrical systems, and other areas so requested by the A/E, the Contractor shall prepare and submit, to the A/E for review, Composite Drawings embodying the Work of the various trades and/or Subcontractors involved. After review, the Contractor shall distribute prints or reviewed Composite Drawings to affected trades and/or Subcontractors. The Contractor shall require that the involved trades and/or Subcontractors cooperate in preparation of the Composite Drawings to assure proper coordination between trades and/or Subcontractors. The participating trades and/or Subcontractors shall indicate their approval on these drawings.

6.10.5 By approving and submitting Shop Drawings, Product Data and Samples, the Contractor represents that he has determined and verified all materials, field measurement, and field construction criteria related thereto, checked the Shop Drawings, Product Data, and Samples for complete dimensional accuracy; that he has checked to insure that work contiguous with and having bearing on the work shown on the Shop Drawings is accurately and clearly shown, that he has checked the Shop Drawings against the Composite Drawings prepared by the Contractor, that the Work has been coordinated and that the equipment will fit into the assigned spaces, and that he has checked and coordinated the information contained within such submittals with the requirements of the Work and of the Construction Documents.

6.10.5.1 Any Shop Drawing, Product Data or Sample submitted without Contractor's approval will not be processed for review by the A/E, but will be returned to the Contractor for his compliance with the above procedures, in which event it will be deemed that the Contractor has not complied with the provisions herein specified and the Contractor shall bear the risk of all delays as if no Shop Drawing, Product Data and Sample had been submitted.

6.10.5.2 Shop Drawings shall bear a coordination and approval stamp signed by the Contractor and each contiguous Subcontractor, which shall confirm the representations set forth in Sub-Article 6.10.5. Shop Drawings shall bear the seal of a registered professional engineer or A/E when required by the Specifications or State Law.

6.10.6 The Contractor shall not be relieved of responsibility for any deviation from the requirements of the Construction Documents by the A/E's approval of Shop Drawings, Product Data or Samples under Sub-Articles 4.10 and 6.10.9 unless the Contractor has specifically informed the A/E in writing of such deviation at the time of submission and the A/E has given written approval to the specific deviation. The Contractor shall not be relieved from responsibility for errors or omissions in the Shop Drawings, Product Data or Samples by the A/E's approval thereof. Any deviation shall also be indicated on such Shop Drawing, Product Data, Sample, or related submittal by circling or other approved means.

6.10.7 The Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, Product Data or Samples, to revisions other than those requested by the A/E on previous submittals. Unless such written notice has been given, the A/E's Action on a resubmitted Shop Drawing, Product Data, or Sample shall not constitute Review and Action of any changes not requested on the prior submittal.

6.10.8 No portion of the Work requiring submission of a Shop Drawing, Product Data or Sample shall be commenced until the submittal has been approved by the A/E as provided in Sub-Article 6.10.9. All such portions of the Work shall be in accordance with approved submittals.

6.10.8.1 No Shop Drawing, Product Data or Sample shall be issued to the field without the A/E's Action Stamp affixed thereto.

#### 6.10.9 Shop Drawing & Product Data Procedures

6.10.9.1 Shop Drawing Requirements: Shop Drawings shall show design, materials (kind, thickness and finish), dimensions, connections, rough openings, routing details, and other details necessary to insure that they accurately interpret Contract Drawings and Specifications and also show adjoining work in such detail as required to provide proper connection with same. Shop Drawings shall be numbered consecutively and insofar as possible shall be uniform in size.

6.10.9.2 Identification: All Shop Drawings and Product Data shall be identified with the name of the Project, Project Number, building or buildings for which the Shop Drawings and Product Data are being submitted, and shall contain the A/E's name, Contractor's name, Subcontractor's name, date of submittal, drawing number, revision, if any, as well as the Specification Section under which the Work is to be performed and the Drawing and detail numbers that relate to the Shop Drawings and Product Data.

6.10.9.3 Transmittals: All Shop Drawings and Product Data shall be accompanied by a letter of transmittal from the Contractor setting forth the same identification information as required above under Sub-Article 6.10.9.2. Contractor shall number transmittals consecutively in sequence with the sample transmittals and shall indicate the Submittal Procedure number being followed. Transmittal shall also indicate if Shop Drawing is resubmittal and note A/E's file number for original submittal.

6.10.9.4 Submittal Procedures: The Contractor shall submit copies of Shop Drawings and Product Data to the A/E in accordance with the Submittal Procedures listed below.

6.10.9.4.1 Shop Drawings and Product Data shall be sent by the Contractor to the Architect/Engineering team.

6.10.9.4.2 Shop Drawings and Product Data can be sent via an electronic method (email or other electronic platform) or via original paper copy. Contract, Architect/Engineer, and Owner shall agree on submittal method (email, other electronic platform, original paper copy, etc.).

6.10.9.4.3 Shop Drawings and Product Data shall be clearly legible and physical product samples shall be provided whenever necessary.

6.10.9.5 A/E's Distribution & Stamp: Following the A/E's review of each Shop Drawing and Product Data submission, the A/E will retain a copy of the submittal for their records as well as return a copy to the Contractor and Owner with the A/E's stamp and signature affixed thereto, annotated as follows:

6.10.9.5.1 "A Action": "A Action" means the submission is in general conformance with the design concept. Construction, fabrication and/or manufacture can proceed subject to the provision that the Work shall be in accordance with the requirements of the Construction Documents. Final acceptance of the Work shall be contingent upon such compliance.

6.10.9.5.2 "B Action": "B Action" means the submission is in general conformance with the design concept subject to notations by the A/E on the returned Shop Drawings. Construction, fabrication and/or manufacture can proceed subject to the provision that the Work shall be carried out in compliance with all annotations and/or corrections indicated on the returned Shop Drawings and Product Data and in accordance with the requirements of the Construction Documents. Final acceptance of the Work shall be contingent upon such compliance.

6.10.9.5.3 "C Action": "C Action" means that the Contractor shall revise and resubmit the Shop Drawings and Product Data in accordance with all annotations and/or corrections indicated therein. Construction, fabrication and/or manufacture cannot proceed. Shop Drawings and Product Data bearing "C Action" stamp shall not be permitted on the Project Site.

6.10.9.5.4 "D Action": "D Action" means that the submission is rejected for nonconformance with the design concept and the Contractor shall make a new submittal which shall comply with the requirements of the Construction Documents. Construction, fabrication and/or manufacture cannot proceed. Shop Drawings and Product Data bearing "D Action" stamp shall not be permitted on the Project Site.

6.10.9.6 Contractor's Distribution: When transparencies are returned "A Action" or "B Action", the Contractor shall obtain and provide such number of prints to the Subcontractor as may be required by the Subcontractor for his distribution. The Contractor shall have copies of all "A Action" or "B Action" Shop Drawings and Product Data at the Project Site at all times and shall make them available to the A/E's representatives.

6.10.9.7 Cost of Submittal and Distribution: All charges in connection with the delivery of Shop Drawings and Product Data to the A/E shall be paid by the Contractor. All charges in connection with the distribution of Shop Drawings and Product Data to the Contractor shall be paid by the Contractor.

#### 6.10.10 Samples Procedures

6.10.10.1 Sample Requirements: Where possible, all samples required for a particular Specification Section shall be submitted together.

6.10.10.1.1 Samples shall be submitted from the same source which will supply the actual job. Samples shall be of adequate size to show quality, type, color, range, finish, texture and other specified characteristics.

6.10.10.1.2 Samples of materials or products which are normally furnished in containers or packages, which bear descriptive labels and/or application or installation instructions, shall be submitted with such labels and/or instructions.

6.10.10.2 Identification: All Samples shall be labeled, tagged, or otherwise clearly identified. Labels or tags shall set forth the name of the Project, the project number, buildings for which the Sample is being submitted, A/E, Contractor, Subcontractor, and/or supplier, the name of the manufacturer, fabricator, or processor, the trade designation, grade and quality of the material or product, the date of submittal, and specific identification of each sample and a precise reference to the Specification Article and Sub Article wherein the material, product, or element of the Work is specified. Each label or tag shall have sufficient clear space to permit the application of the approval stamp of the Contractor, and the action stamp of the A/E.

6.10.10.3 Transmittals: All samples shall be accompanied by a letter of transmittal from the Contractor setting forth the same identification information as required above under Sub-Article 6.10.4.2. Contractor shall number transmittals consecutively in sequence with the Shop Drawings and Product Data transmittals. Where appropriate, test data and/or manufacturers' certificates shall be referenced in and forwarded with the letter of transmittal. Samples without accompanying certificates or test data will be returned without action.

6.10.10.4 Submittal Procedure: The Contractor shall submit the number of samples as indicated below:

6.10.10.4.1 In the event that a range of variations in texture, graining, color or other characteristics may be anticipated in furnished materials, assemblies, or elements of the Work, a sufficient number of samples of such materials or products shall be submitted to indicate the full range of characteristics which will be present in the materials or products proposed for the Work. Any such materials or products delivered or erected prior to approval of full range samples shall be subject to rejection.

6.10.10.4.2 All Samples shall be submitted in triplicate to the A/E's home office, or where directed by the A/E, except as otherwise set forth in other Sections of the Contract Documents.

6.10.10.5 A/E's Distribution & Stamp: Following the A/E's review of each Sample submission, the A/E will return one set of each submission to the Contractor with the A/E's stamp and signature affixed thereto and annotated in a manner conforming to the convention established in Sub-Article 6.10.9.5.

6.10.10.6 Contractor's Distribution: When Samples are returned 'Action A' or 'Action B', the Contractor shall retain such Samples in a suitable place at the Project Site for use by the Contractor, his Subcontractors, the A/E and his authorized representatives to insure that all work is being installed in accordance with these Samples. The remaining Samples will be retained by the A/E.



6.10.10.7 Cost of Submittal and Distribution: All charges in connection with the delivery of Samples to the A/E's home office or where directed by A/E (and all charges in connection with the subsequent distribution thereof by the A/E) shall be paid by the Contractor.

#### 6.11 Use of Site.

6.11.1 The Contractor shall confine operations at the Site to areas permitted by law, ordinances, permits and the Contract Documents and shall not unreasonably encumber the Site with any unnecessary or surplus materials or equipment or debris.

6.11.2 Notwithstanding the designation of construction limits or the indication of temporary fences or barricades, the provisions of the Contract Documents governing certain portions or phases of the Work may require that certain operations be carried out beyond such designated limits. Trenching, utility work, site development, landscaping and all other work, if required beyond such designated limits, shall be scheduled in such a manner as to cause or occasion a minimum of inconvenience or disturbance or interference with the normal operation of the Owner, abutters, and the public. The Contractor shall obtain the Owner's prior approval for such operations, prosecute such operations expeditiously and restore the affected area and other areas needed for access to their original condition immediately upon completion of such operations, unless otherwise specified herein.

6.11.3 All operations, including pumping, draining and control of surface and ground water shall be carried out so as to avoid endangering the Work of any adjacent facility or property, or interrupting, restricting or otherwise infringing or interfering with the use thereof.

6.11.4 The Contractor shall confine operations at the site to work related activities. The Contractor shall not use the site for lodging or as a personal residence.

#### 6.12 Cutting and Patching of Work.

6.12.1 The Contractor shall be responsible for all cutting, fitting or patching that may be required to complete the Work or to make its several parts fit together properly.

6.12.2 The Contractor shall not damage or endanger any portion of the Work or the work of the Owner or any separate contractors or adjacent facilities by cutting, patching or otherwise altering any work, or by excavation. The Contractor shall not cut or otherwise alter the work of the Owner or any separate contractor except with the written consent of the Owner and of such separate contractor. The Contractor shall not unreasonably withhold from the Owner or any separate contractor his consent to cutting or otherwise altering the Work.

6.12.3 Structural elements of the Work shall not be cut, patched or otherwise altered or repaired without prior written authorization by the A/E.

6.12.4 Authorization to proceed with remedial operations for any damaged or defective element or portion of the Work shall not constitute a limitation or a waiver of the A/E's right to require the removal and replacement of any work which fails to fulfill the requirements of the Contract Documents.

#### 6.13 Cleaning Up.

6.13.1 The Contractor at all times shall keep the Site and related streets free from accumulation of waste materials or rubbish caused by his operations. At the completion of the Work he shall remove all his waste materials and rubbish from and about the Project as well as his tools, construction equipment, machinery and surplus materials. All waste and rubbish shall be removed from the Site at least weekly and more often if necessary.

6.13.2 If the Contractor fails to maintain a clean and safe Project and/or fails to clean up at the completion of the Work, the Owner may do so as provided in Sub-Article 5.3 and the cost thereof shall be charged to the Contractor.

6.14 Communications: Except where otherwise directed by the A/E or otherwise provided in the Contract Documents, the Contractor shall forward all communications to the Owner through the A/E.

6.15 Royalties and Patents: The Contractor shall pay all royalties and license fees. He shall defend all suits or claims for infringement of any patent rights and shall save the Owner harmless from loss on account thereof, except that the Owner shall be responsible for all such loss when a particular manufacturer or manufacturers is specified, but if the Contractor has reason to believe that the design, process or product specified is an infringement of a patent, he shall be responsible for such loss unless he promptly gives such information to the A/E and Owner in writing.

6.16 Indemnification.

6.16.1 To the fullest extent permitted by law, the Contractor shall indemnify, defend and hold harmless the Owner, the A/E and its consulting engineers, and their respective successors, agents and employees from and against all claims, damages, liabilities, losses and expenses, including but not limited to attorney's fees, arising out of or resulting from the performance of the Work, provided that any such claim, damage, loss or expense (1) is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (including the Work itself) including the loss of use resulting therefrom, and (2) is caused in whole or in part by any tortious act or omission of the Contractor, any Subcontractor, anyone directly or indirectly employed by any of them or anyone for whose acts any of them may be liable, regardless of whether or not it is caused in part by a party indemnified hereunder. Such obligations shall not be construed to negate, abridge or otherwise reduce any other right or obligation or indemnity which would otherwise exist as to any party or person described in this Sub-Article 6.16.

6.16.2 In any and all claims against the Owner, the A/E or any of its consultants, and their respective successors, agents or employees by any employee of the Contractor, any Subcontractor, anyone directly or indirectly employed by any of them or anyone for whose acts any of them may be liable, the indemnification obligation under this Article 6.16 shall not be limited in any way by any limitation on the amount or type of damages, compensations or benefits payable by or for the Contractor or any Subcontractor under workers' or workmen's compensation acts, disability benefit acts or other employee benefit acts.

6.16.3 The obligations of the Contractor under this Sub-Article 6.16 shall not extend to indemnification of the A/E or other design consultants employed by him, his consultant, agents or employees for damages, claims, losses or expenses arising out of: (a) the preparation or approval by the A/E or his design consultants of maps, drawings, opinions, reports, Change Orders, designs or specifications, or (b) the giving of or the failure to give directions or instructions by the A/E or his design consultants provided such giving or failure to give is the primary cause of the damage, claim, loss or expense.

6.16.4 The Contractor agrees to defend, indemnify and save the Owner, and A/E, or any of its consulting engineers, and their respective successors, agents or employees harmless from all costs, liabilities, damages or expenses, including reasonable attorneys' fees, incurred by them, by virtue of any claim or claims whatsoever filed by any Subcontractor, Sub-subcontractor, mechanic, laborer or materialman making claims arising from the Work by, through, or under the Contractor. The Contractor also hereby agrees to defend, indemnify and hold harmless, protect, and defend the Owner, the A/E and its consulting engineers, and their respective successors, agents or employees from and against any liability, claim, judgment, loss, damage, including but not limited to direct, indirect and incidental and consequential damages, attorneys fees, court costs and expense of collection, occasioned in whole or in part by the failure of the Contractor, its Subcontractor, or Sub-subcontractors to comply with any of the terms or provisions of the Contract Documents.

6.16.5 This article does not require the Contractor to indemnify the Owner, its officers, agents, or employees from claims or liability arising solely from the acts or omissions of the Owner, its officers, agents, or employees.

## 6.17 Default.

6.17.1 The Contractor shall be in default of the Contract if:

6.17.1.1 Contractor refuses or fails to prosecute the Work in accordance with the Contract Documents in any material respect;

6.17.1.2 Contractor fails to make proper payment to Subcontractors or for materials or labor (provided Owner shall have paid to Contractor any payments due from Owner in connection with such materials or labor);

6.17.1.3 Contractor disregards laws, ordinances, rules, building codes and regulations or orders of any public authority having jurisdiction;

6.17.1.4 Contractor fails to coordinate its work with other contractors and Subcontractors as required under Article 8 of these General Conditions;

6.17.1.5 Contractor fails to comply with the scheduling requirements of the Contract;

6.17.1.6 Contractor fails to promptly replace rejected material or correct rejected workmanship;  
or

6.17.1.7 Contractor fails in any material respect to observe any other terms, provisions, conditions, covenants and agreements in the Contract to be observed and performed on the part of the Contractor.

6.17.2 In the event of any default by Contractor under the Contract, Owner shall have the right to take such measures as it deems necessary to correct the default, at the Contractor's sole cost and expense and to deduct such costs, including but not limited to the State Engineer's and A/E's fees, as it may incur from amount otherwise owing to the Contractor, or to terminate the Contract in accordance with Sub-Article 16.2 of the General Conditions in addition to any and all other remedies that Owner may now or hereafter have. If the amounts owing to the Contractor are insufficient to cover the Owner's cost of corrections, the Contractor shall pay such amount promptly upon demand.

**Article 7**  
**SUBCONTRACTORS**

7.1 Definitions.

7.1.1 A Subcontractor is a person or entity who has a direct contract with the Contractor to perform any of the Work at the site. The term Subcontractor is referred to throughout the Contract Documents as if singular in number and masculine in gender and means a Subcontractor or his authorized representative. The term Subcontractor does not include any separate contractor or his subcontractors.

7.1.2 A Sub-subcontractor is a person or entity who has a direct or indirect contract with a Subcontractor to perform any of the Work at the site. The term Sub-subcontractor is referred to throughout the Contract Documents as if singular in number and masculine in gender and means a Sub-subcontractor or an authorized representative thereof.

7.2 Award of Subcontracts and Other Contracts for Portions of the Work. The Contractor shall conduct an investigation of each of its proposed Subcontractor's capabilities to assure each is responsible and has the requisite experience, skill, physical plant, and financial strength necessary to perform each Subcontractor's respective Work. The Contractor shall not contract with any Subcontractor that is not responsible or does not have the requisite experience, skill, physical plant, and financial strength necessary to perform its part of the Work.

7.3 Subcontractual Relations.

7.3.1 The Contractor shall not include any provisions in its Contracts with its Subcontractors which will in any way prejudice the rights of the Owner and the Architect/Engineer under the Contract between the Owner and the Contractor.

7.3.2 The Subcontract agreement shall require the Subcontractor to consent to any assignment of the Subcontract to the Owner in the event of a default by the Contractor hereunder.

7.3.3 Nothing in Article 7 shall be construed to create a privity of Contract between the Owner and any Subcontractor.

**Article 8**  
**WORK BY OWNER OR BY SEPARATE CONTRACTORS**

8.1 Owner's Right to Perform Work and to Award Separate Contracts.

8.1.1 The Owner reserves the right to perform work related to the Project with his own forces, and to award separate contracts in connection with such work. Such work may include Work assigned to the Contractor under the Contract Documents which Work is not being performed properly or in accordance with the scheduling provisions of the Contract Documents, whether or not the Contractor is in default under Sub-Article 6.17 and whether or not the Owner has terminated the Contract under Sub-Article 16.2. If the Owner elects to exercise this right it will do so upon reasonable notice to the Contractor. There shall be an appropriate adjustment in amounts payable to the Contractor to reflect the Work undertaken by the Owner, which the parties shall confirm by Change Order in accordance with Article 14. If the Contractor claims that delay is involved because of such action by the Owner, he shall make such claim as provided elsewhere in the Contract Documents.

8.1.2 When separate contracts are awarded for different portions of the Project or other work on the site, the term Contractor in the Contract Documents in each case shall mean the Contractor who executes each separate Owner-Contractor Agreement.

8.1.3 The Owner will provide for the coordination of the work, of his own forces and of each separate contractor with the Work of the Contractor, who shall cooperate therewith as provided in Sub-Article 8.2.

8.2 Mutual Responsibility.

8.2.1 The Contractor shall afford the Owner and separate contractors reasonable opportunity and all required facilities for the introduction and storage of their materials and equipment and the execution of their work, and shall connect and coordinate his Work with theirs as required by the Contract Documents.

8.2.2 If any part of the Contractor's Work depends for proper execution or results upon the work of the Owner or any separate contractor, the Contractor shall, prior to proceeding with the Work, promptly report to the A/E any apparent discrepancies or defects in such other work that render it unsuitable for such proper execution and results. Failure of the Contractor to report shall constitute an acceptance of the Owner's or separate contractor's work as fit and proper to receive his Work, except as to defects which may subsequently become apparent in such work by others.

8.2.3 Any costs caused by defective or ill-timed work shall be borne by the party responsible therefor.

8.2.4 Should the Contractor wrongfully cause damage to the work or property of the Owner or of a separate Contractor, or to other work on the site, the Contractor shall promptly remedy such damage as provided in Sub-Article 12.2.5.

8.2.5 Should the Contractor wrongfully cause damage to the work or property of any separate contractor, the Contractor shall upon due notice promptly attempt to settle with such other contractor by agreement, or otherwise to resolve the dispute. If such separate contractor sues or initiates a litigation proceeding against the Owner on account of any damage alleged to have been caused by the Contractor, the Owner shall notify the Contractor who shall participate in the defense of such proceedings at the Contractor's expense, and if any judgment or award against the Owner arises therefrom the Contractor shall pay or satisfy it and shall reimburse the Owner for all attorneys' fees and court costs which the Owner has incurred.

8.3 Owner's Right to Clean Up: If a dispute arises between the Contractor and separate contractors as to their responsibility for cleaning up the Project, the Site and related streets and walks on a routine basis as required by Sub-Article 6.13, the Owner may clean up and charge the cost thereof to the contractors responsible therefore as the Owner shall determine to be just.

**Article 9**  
**MISCELLANEOUS PROVISIONS**

9.1 Governing Law: The Contract shall be governed by South Dakota Law.

9.2 Successors and Assigns: The Owner and the Contractor each binds himself, his successors, assigns and legal representatives to the other party hereto and to the successors, assigns and legal representatives of such other party in respect to all covenants, agreements and obligations contained in the Contract Documents. The Contractor shall not assign the Contract or sublet it as a whole without the written consent of the Owner, nor shall the Contractor assign any money due or to become due to him hereunder, without the previous written consent of the Owner.

9.3 Written Notice: All notices, demands and other communications hereunder shall be in writing and shall be deemed to have been given if sent pursuant to Article VII of the Agreement for Construction.

9.4 Claims for Damages: Should either party to the Contract suffer injury or damage because of any act or omission of the other party or of any of his employees, agents or others for whose acts he is legally liable, claim shall be made in writing to such other party within 14 days after the first observance of such injury or damage.

9.5 Performance and Labor and Material Payment Bond: Before commencing the Work, the Contractor shall provide a Performance and Labor and Material Payment Bond in accordance with the requirements of the Instructions to Bidders.

9.6 Rights and Remedies.

9.6.1 The duties and obligations imposed by the Contract Documents and the rights and remedies available thereunder shall be in addition to and not a limitation of any duties, obligations, rights and remedies otherwise imposed or available by law. This provision relates particularly to the Contractor's obligations under Sub-Article 15.2.2.

9.6.2 No action or failure to act by the Owner, A/E or Contractor shall constitute a waiver of any right or duty afforded any of them under the Contract, nor shall any such action or failure to act constitute an approval of or acquiescence in any breach thereunder, except as may be specifically agreed in writing.

9.7 Tests.

9.7.1 If the Construction Documents, laws, ordinances, rules, regulations or orders of any public authority having jurisdiction require any portion of the Work to be inspected, tested or approved, the Contractor shall give the A/E and Owner timely notice of its readiness so the A/E and Owner may observe such inspection, testing or approval. The Contractor shall perform and bear all costs of such inspections, tests and approvals, unless otherwise provided.

9.7.1.1 Where certain testing and inspection requirements are set forth in the various Sections of the Construction Documents to be performed at the expense of the Owner, the Owner will retain the services of testing laboratories, agencies, or consultants, to perform such tests or inspections and render such services as may be required to verify that the work fulfills the requirements and intent of the Construction Documents. Such services will be performed in a manner consistent with the requirements of the Owner and the various agencies having jurisdiction over the Work and in accordance with reasonable standards of architectural and engineering practice.

9.7.1.2 The Owner reserves the right to modify the scope of or to re-allocate any of the testing and inspection services specified in the various Sections of the Construction Documents to be performed by a testing laboratory, agency or consultant retained by the Owner in connection with the Work when it can be satisfactorily established that such adjustment in scope is consistent with the intent of the Construction Documents. In the event that the Contractor shall not concur with such modification of scope or re-allocation of such services, he shall immediately notify the A/E and Owner in writing.

9.7.2 If the A/E determines that any Work requires special inspection, testing, or approval which Sub-Article 9.7.1 does not include, he will upon written authorization from the Owner, order the performance of such services by qualified independent testing laboratories, agencies or consultants as may reasonably be required or instruct the Contractor to order such special inspection, testing or approval, and the Contractor shall give notice as provided in Sub-Article 9.7.1. If such special inspection or testing reveals a failure of the Work to comply with the requirements of the Construction Documents, the Contractor shall bear all costs thereof, including the cost of the tests, correction of the Work, the cost of retesting, and compensation for the A/E's additional services made necessary by such failure; otherwise the Owner shall bear such costs, and an appropriate Change Order shall be issued.

9.7.2.1 If A/E's observation or any inspection or testing undertaken pursuant to Sub-Article 9.7 reveals a failure in any one of a number of identical or similar items or elements incorporated in the Work to comply with (1) the requirements of the Construction Documents or, (2) with respect to the Performance of the Work, with laws, ordinances, rules, regulations, building codes or orders of any public authority having jurisdiction, the A/E will have the authority to order inspection and/or testing of all such items or elements of the Work, or of a representative number of such items or elements of the Work, as he may in his reasonable opinion consider necessary or advisable, and the Contractor shall bear all costs thereof, including the cost of the tests, correction of the Work, the cost of retesting, and the A/E's additional services, if any are required, made necessary thereby. However, neither the A/E's authority to act under Sub-Article 9.7 nor any decision made by him in good faith either to exercise or not to exercise such authority, shall give rise to any duty or responsibility of the A/E to the Contractor, any Subcontractor, any of their agents or employees, or any other person performing any of the Work.

9.7.3 Required certificates of inspection, testing or approval shall be secured by the Contractor and promptly delivered by him to the A/E and the Owner.

9.7.3.1 The Contractor shall obtain and deliver promptly to the Owner any certificates of final inspection of any part of his Work or operating permits for any mechanical or electrical apparatus, such as elevators, escalators, boilers, air compressors, fire alarms, etc., which may be required by law to permit full use and occupancy of the premises by the Owner. Except as is otherwise provided in Sub-Article 10.1.3, receipt of such permits or certificates by the Owner shall be a condition precedent to Completion of the Work.

9.7.3.2 Copies of reports issued as a result of services performed at the expense of the Owner pursuant to the provisions of this Article will be distributed to all parties to the Contract.

9.7.4 If the A/E or owner is to observe the inspections, tests or approvals required by the Contract Documents, they will do so promptly and, where practicable, at the source of supply.

9.7.5 In connection with testing and inspection services performed at the expense of the Owner, the Contractor shall provide Samples of materials and/or elements of the Work required as test specimens and shall provide incidental labor and facilities at the site reasonably required in support of such services.



9.7.6 The cost of testing services required solely for the convenience of the Contractor in his scheduling and performance of the Work shall be borne by the Contractor.

9.7.7 The cost of testing services related to remedial operations performed to correct deficiencies in the Work shall be borne by the Contractor.

9.7.8 If, during the course of the performance of any testing, inspection, control, balancing, adjusting, or similar work by the Contractor or an agent of the Contractor, it is the opinion of the A/E that the Contractor or said agent has failed to perform such work in a satisfactory manner, the Contractor shall, at his own expense, retain the services of a service organization which is satisfactory to the A/E for the performance of such work.

## 9.8 Litigation.

9.8.1 Unless otherwise specifically provided in this Agreement, all claims, counter-claims, disputes or other matters in question between the Owner and the Contractor arising out of, or relating to this Agreement, or the breach thereof, will be decided by direct negotiations, by non-binding mediation if the parties mutually agree, or in a circuit court of competent jurisdiction within the State of South Dakota. Notice of a request for mediation shall be sent in writing to the other party to this Agreement within a reasonable time after the claim, dispute, or other matter in question has arisen. If the party receiving notice of request does not agree to mediation in writing within 10 calendar days, it will be deemed that the parties do not mutually agree to mediate the matter. If the parties agree to mediate, a mediator to hear the dispute will be agreed upon by the parties. If agreement on a mediator cannot be reached, the State shall select the mediator.

9.8.2 The Contractor shall carry on the Work and maintain its progress during any dispute or litigation proceedings, and the Owner shall continue to make payments to the Contractor to the extent required by the Contract Documents and South Dakota Law.

**Article 10**  
**TIME**

10.1 Definitions.

10.1.1 The Contract Time is the period of time allotted in the Construction Contract for Substantial Completion of the Work as defined in Sub-Article 10.1.3, including authorized adjustments thereto.

10.1.2 The date of commencement of the Work is the date established in the Notice to Proceed.

10.1.3 The date of Substantial Completion of the Work is the date certified by the A/E when construction is sufficiently completed in accordance with the Contract Documents so that the Owner can occupy and utilize the Project for the use for which it is intended, and such Work is fully completed in accordance with the Contract Documents except for minor items, adjustments or corrections which have no material effect upon the utilization, function or intrinsic values of the entire Project, including all of its mechanical, electrical and other systems and facilities.

10.1.4 The term "day" as used in the Contract Documents shall mean calendar day unless otherwise specifically designated.

10.2 Progress and Completion.

10.2.1 All time limits stated in the Contract Documents, including the Construction Completion Schedule, are of the essence of the Contract.

10.2.2 The Contractor shall begin the Work on the date of commencement as defined in Sub-Article 10.1.2. He shall carry the Work forward expeditiously with adequate forces and shall achieve Substantial Completion within the Contract Time.

10.3 Delays and Extensions of Time.

10.3.1 If the Contractor is delayed at any time in the progress of the Work by any act or neglect of the Owner or the A/E, or by any employee of either, or by changes in the Construction Completion Schedule required by the Owner, or by any separate contractor employed by the Owner, or by changes ordered in the Work, or by labor disputes not caused by the labor practices of the Contractor or any Subcontractor in contravention of applicable labor practices, fire, unusual delay in transportation, severe and unusual weather conditions not reasonably anticipatable, unavoidable casualties, or any other causes beyond the Contractor's control and not occurring due to the fault or neglect of the Contractor, any Subcontractor or any other person for whose acts the Contractor is responsible, then the Contract Time shall be extended by Change Order for such reasonable time as the Owner shall determine, or the Owner may elect to require the Contractor to accelerate the Work, in which case the Contract Sum shall be increased by a Change Order in the amount of the direct cost to the Contractor (exclusive of overhead and profit of necessary over-time labor).

10.3.2 Any claim for extension of time shall be made in writing to the Owner with a copy to A/E not more than 10 days after the commencement of the delay; otherwise it shall be waived. In the case of continuing delay only one claim is necessary. The Contractor shall provide an estimate of the probable effect on such delay on the progress of the Work.

10.3.2.1 Such claims shall set forth in detail the nature of the circumstances which form the basis for each such claim, the date upon which each such alleged cause of delay began, or began to affect the timely prosecution of the Work, and ended, or ceased to have an adverse effect upon the timely prosecution of the Work, and the number of days extension of time requested as a consequence of each such alleged cause of delay. The Contractor shall provide such supporting documentation as the Owner may require, including, where appropriate, a revised Construction Completion Schedule indicating all of the activities affected by the circumstances which form the basis for the claim.

10.3.2.2 The Contractor shall not be entitled to a separate extension of time as a consequence of each one of a number of causes of delay which may have a concurrent or interrelated effect on the progress of the Work.

10.3.2.3 The Owner shall have the right to defer his decision or decisions with reference to any claim or claims for an extension of time made pursuant to the provisions of this Article until the facts or circumstances which form the basis for such claim or claims may be fully assessed to the Owner's reasonable satisfaction.

10.3.2.4 Notwithstanding the provisions of Sub-Article 10.3.2, claims for an extension of time arising out of authorized changes in the Work shall be made in writing prior to or concurrent with the submission of the Contractor's proposal pursuant to such change. No extension of time arising out of changes in the Work will be granted subsequent to the date upon which the Contractor is authorized to proceed with such change or changes in the Work unless specific provisions governing a subsequent determination of an extension of time have been incorporated in such authorization to proceed with such change or changes in the Work. No claim for damages or separate compensation for delay arising from such change in the Work shall be recognized or be deemed valid, it being understood that any additional cost to the Contractor arising from such change shall be included in the amended Contract Sum set forth in such Change Order.

10.3.2.5 Time extensions will not be granted for rain, wind, snow, or other natural phenomena of normal intensity for the locality where work is performed. Determinations of the extent of delay attributable to unusual weather phenomena shall be made by comparing the weather for the contract period involved with the average of the preceding five (5) year climactic range during the same period on the calendar. National Oceanic and Atmospheric Administration National Weather Service statistics for the locality or area where the work is performed shall be used to determine the five (5) year average weather conditions. Time extensions for weather delays do not entitle the Contractor to "extended overhead" recovery.

10.3.3 If no agreement is made stating the dates upon which interpretations as provided in Sub-Article 4.13 shall be furnished, then no claim for delay shall be allowed on account of failure to furnish such interpretations until 15 days after written request is made for them, and not then unless such claim is reasonable.

10.3.4 Should the contractor fail to substantially complete the work within the time agreed upon in the contract documents, or within such extra time as may have been allowed by increases in the contract or by formally approved extensions granted by the owner, the contractor and the contractor's surety shall be liable for and shall pay the owner the sums stipulated in the agreement for construction as liquidated damages for each calendar day of delay until the work is substantially complete. This sum is not a penalty but is liquidated damages due the owner from the contractor by reason of inconvenience to the public, added cost of engineering and supervision, and other items which have caused an expenditure of public funds resulting from the contractor's failure to complete the work within the time specified in the contract. In addition to liquidated damages, if any delay on the part of the contractor, any subcontractor or sub-subcontractor, anyone directly or indirectly employed by any of them, or anyone for whose acts any of them may be liable results in any claim by third parties against the owner or the A/E arising out of such delay, the contractor shall pay, satisfy, and discharge all losses, damages and expenses arising out of such claims, including attorneys' fees, and shall indemnify and hold harmless the owner and the A/E and their agents and employees from and against all costs, fees, losses, damages, and expenses arising out of such claims enforced against the owner or the A/E.

10.3.5 No extension of time will be granted to the Contractor for any delay other than those described in Sub-Article 10.3.1.

10.3.5.1 Should the Contractor fail, refuse or neglect to supply a sufficiency of workmen or to deliver the materials with such promptness as to prevent delay in the progress of the Work, or fail in any material respect diligently to commence and prosecute the Work and to proceed in accordance with the approved construction schedule, or if the different parts thereof are not commenced, prosecuted, finished, delivered or installed in such manner as will insure substantial completion in accordance with the approved Construction Completion Schedule, or if the Contractor shall fail in the performance of any of his obligations under this Contract in any material respect, the Owner shall have the right to direct the Contractor, upon 3 days notice at the Contractor's cost and expense, to furnish such additional labor and to expedite deliveries of materials (or the Owner may furnish such labor and expedite such deliveries at the cost of the Contractor), which labor or expediting shall, in the Owner's opinion, be sufficient to speed up and complete the Work in accordance with the Construction Completion Schedule.

10.3.5.2 If such additional labor shall not be available, the Owner shall have the right to direct the Contractor at the latter's own cost and expense, to work overtime to such an extent as will be sufficient, in the Owner's opinion, to speed up and complete the Work as herein provided.

10.3.6 The Contractor's right to make a claim or claims for an extension of time, as provided in Sub-Article 10.3.1, shall not preclude the Contractor's right to make a claim for delay damages arising out of the Owner's significant interference, by action or inaction, with the Contractor's Work.

#### 10.4 Beneficial Occupancy.

10.4.1 The Owner shall have the privilege of Beneficial Occupancy and the use and benefit of designated areas, subdivisions or portions of the Project prior to completion and acceptance of the entire Project, provided that such Beneficial Occupancy shall not unduly interfere with the Contractor's operations nor unduly delay him in completing the entire Work. Such occupancy and use shall be further subject to the provisions set forth herein and the provisions of SDCL § 5-18B-13.

10.4.2 In the event that the Owner desires to exercise the privilege of Beneficial Occupancy, he shall give reasonable notice to the A/E and the Contractor. If the A/E determines that such proposed occupancy is reasonable and proper, the Contractor shall cooperate with the Owner in providing services and facilities reasonably required for the health, safety and comfort of the occupants and other parties lawfully present and/or entering or leaving the premises. Mutually acceptable arrangements shall be made between the Owner and the Contractor with regard to procedures, terms and conditions governing the operation and maintenance of such services and facilities as may be utilized for the benefit of the Owner. The Owner will assume proportionate and reasonable responsibility for operation of systems, equipment and/or utilities required to provide such services, in part or in total, including proportionate and reasonable expenses of operation incidental thereto. No such Beneficial Occupancy shall accelerate the commencement of any warranty period on any system but only on the particular components being utilized.

10.4.3 The Owner's Beneficial Occupancy or use of such designated areas, subdivisions, or portion of the Work shall not constitute acceptance of systems, materials, or elements of the Work which are not in accordance with the requirements of the Contract Documents; nor relieve the Contractor from his obligations to complete the Work; nor for responsibility for loss or damage due to or arising out of defects in, or malfunctioning of, systems, materials, equipment, or elements of the Work; nor from other unfulfilled obligations or responsibilities of the Contractor under the Contract. If, however, damage results solely from any act of the Owner, the Owner will assume its proportionate responsibility for such damage.

**Article 11**  
**PAYMENTS AND COMPLETION**

11.1 Contract Sum: The Contract Sum is stated in the Agreement for Construction.

11.2 Schedule of Values: Before the first Application for Payment, the Contractor shall submit to the Owner and A/E a schedule of values allocated to the various portions of the Work, prepared in such form and supported by such data to substantiate its accuracy as the Owner and A/E may require. The format and number of copies of such Applications for Payment shall be as directed by the Owner and the A/E. This schedule, unless objected to by the Owner, shall be used as a basis for the Contractor's Applications for Payment.

11.3 Monthly Application for Payment.

11.3.1 No later than the 5th day of each month the Contractor shall submit to the A/E his monthly itemized application for Payment. The Contractor shall not submit more than one pay application per month. The monthly Application for Payment shall be on AIA Document G702 and supported by such data substantiating the Contractor's right to partial payment as the Owner or A/E may require; including but not limited to receipts, releases, and waivers of liens.

11.3.1.1 In applying for payment, the Contractor shall submit his monthly payment estimate based upon the approved schedule of work for the project, itemized in such form and supported by such evidence as will show his right to the payment claimed. Claims made on account of materials delivered and suitably stored at the site, but not incorporated in the work, shall be conditioned upon submission by the Contractor of Bills of Sale or such other procedure as will establish the Owner's title to such material or otherwise adequately protect the Owner's interest.

11.3.1.2 If the Contractor chooses to apply for payment for materials which cannot be incorporated into the Work, and cannot be stored on the site, he may do so provided the following conditions are met:

Unless otherwise agreed to by the Owner, the material shall be stored in a bonded or insured commercial warehouse within a geographic radius of 15 miles of the construction site, with the Owner being listed on the bond or insurance certificate as the sole beneficiary in the case of loss or damage to the stored materials. The Contractor shall be responsible for all storage, insurance or transportation costs associated with the materials. Conditions of insurance will apply to applicable portions of Sub-Article 11.3.1.2. Contractor shall provide the Owner with bills of sale or such other documents as will establish the ownership of the materials.

11.3.2 The Contractor warrants that title to all Work, materials and equipment covered by an Application for Payment will pass to the Owner either by incorporation in the construction or upon the receipt of payment by the Contractor, whichever occurs first, free and clear of all liens, claims, security interests or encumbrances, hereinafter referred to in this Article as "liens"; and that no Work, materials or equipment covered by an Application for Payment will have been acquired by the Contractor, or by any other person performing Work at the site or furnishing materials and equipment for the Project, subject to an agreement under which an interest therein or an encumbrance thereon is retained by the seller or otherwise imposed by the Contractor or such other person.

11.3.3 Monthly applications received after the 5th day of the month will be treated as if submitted on the 5th day of the following month.

11.4 Recommendation for Payment.

11.4.1 By the 15th of each month, the A/E will review the Contractors Monthly Application for Payment and make his certification to the Owner with a copy to the Contractor, for such amount as the A/E believes is properly due, or notify the Contractor in writing his reasons for withholding a Certificate as provided in Sub-Article 11.6.1.

11.4.2 The issuance of a Certification for Payment will constitute a representation by the A/E to the Owner, based on his observations at the site as provided in Sub-Article 4.3 and the data comprising the Monthly Application for Payment, that the Work has progressed to the point indicated; that, to the best of his knowledge, information and belief, the quality of the Work is in accordance with the Contract Documents (subject to an evaluation of the Work for conformance with the Contract Documents upon Substantial Completion, to the result of any subsequent tests required by or performed under the Contract Documents, to minor deviations from the Contract Documents correctable prior to completion, and to any specific qualifications stated in his Certificate); and that the A/E believes that the Contractor is entitled to payment in the amount recommended. However, by issuing a Certification for Payment, the A/E shall not thereby be deemed to represent that he has made exhaustive or continuous on-site inspections to check the quality or quantity of the Work or that he has reviewed the construction means, methods, techniques, sequences or procedures, or that he has made any examination to ascertain how or for what purpose the Contractor has used the moneys previously paid on account of the Contract Sum. The Owner will not be bound by the amount stated in the A/E's Certification for Payment in making determinations of amounts properly payable to the Contractor.

## 11.5 Progress Payments.

11.5.1 Based upon his review of the Monthly Application for Payment, and the A/Es Certification, the Owner shall make progress payments to the Contractor in such amounts as the Owner reasonably determines are properly due less the aggregate of previous payments in each case. Payment of amounts determined to be due by the Owner under each Monthly Application for Payment shall be due to the Contractor 20 days after the 15th of each month. unless the A/E's certification was delayed by following the procedures of Article 11.6.1. In such case, payment shall be 25 days after the 15th of each month. The Owner shall at all times retain an amount sufficient to complete the Work pursuant to SDCL §§ 5-18B-11 and 5-18B-13. If the Owner retains any portion of a certified progress payment that is properly due and undisputed beyond the time for payment specified herein and for reasons other than those required by statute, the Owner shall owe and pay the Contractor four percent (4%) interest compounded annually on the retained amount starting from the date payment first becomes due under this article.

11.5.2 The Contractor shall promptly pay each Subcontractor, upon receipt of payment from the Owner, out of the amount paid to the Contractor on account of such Subcontractor's Work, the amount to which said Subcontractor is entitled reflecting any amounts actually withheld, if any, from payments to the Contractor on account of such Subcontractor's Work. The Contractor shall not withhold retainage from its Subcontractors unless retainage is withheld from the Contractor by the Owner. The Contractor shall, by an appropriate agreement with each Subcontractor, require each Subcontractor to make payments to his Sub-subcontractors in similar manner.

11.5.3 The Owner shall, on request, furnish to any Subcontractor, if practicable, information regarding the percentages of completion or the amounts applied for by the Contractor and the action taken thereon by the Owner on account of Work done by such Subcontractor.

11.5.4 Neither the Owner nor the A/E shall have any obligation to pay or to see to the payment of any moneys to any Subcontractor except as may otherwise be required by law.

11.5.5 No Certification for Payment, nor any progress payment, nor any partial or entire use or occupancy of the Project by the Owner, shall constitute acceptance or approval of any Work not in accordance with the Contract Documents.

## 11.6 Payments Withheld.

11.6.1 The A/E may decline to certify the full payment of the amount requested by the Contractor in his monthly application to the extent necessary to reasonably protect the Owner. If the A/E is unable to certify payment in the amount of the Application, he will, within 10 days after receipt of the monthly application, notify the Contractor in writing the reasons he cannot make such a certification. If the Contractor and the A/E cannot agree on a revised amount within five days of A/E sending written notice, the A/E will promptly issue a Certification for Payment for the amount for which he is able to certify to the Owner pursuant to Sub-Article 11.4.2. The A/E may also decline to certify payment because of subsequently discovered evidence or subsequent observations, he may nullify the whole or any part of any Certification for Payment previously issued, and the Owner may withhold payment of all or any part of an Application for Payment, to such extent as may be necessary to protect the Owner from loss because of:

11.6.1.1 Defective work not remedied;

11.6.1.2 Third party claims filed or reasonable evidence indicating probable filing of such claims;

11.6.1.3 Failure of the Contractor to make payments properly to subcontractors or for labor, materials or equipment;

11.6.1.4 Reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;

11.6.1.5 Damage to the Owner or another contractor;

11.6.1.6 Reasonable evidence that the Work will not be completed within the Contract Time;

11.6.1.7 Failure to carry out the Work in accordance with the Contract Documents;

11.6.1.8 A lien or attachment is filed and such lien is not discharged within 5 days of demand from the Owner;

11.6.1.9 Failure of the Contractor and/or of the Mechanical or Electrical Subcontractors to comply with the mandatory requirements for maintaining "up-to-date" Record Drawings;

11.6.1.10 Incomplete or otherwise inadequate Application for Payment; or

11.6.1.11 Reasonable evidence that the Contractor is in material breach of his obligations under the Contract.

11.6.2 When the above grounds in Sub Article 11.6.1 are removed, payment shall be made for amounts withheld because of them.

## 11.7 Substantial Completion.



11.7.1 When the Contractor considers that the Work, or a designated portion thereof which is acceptable to the Owner, is Substantially Complete as defined in Sub Article 10.1.3 the Contractor shall prepare for submission to the A/E and Owner a list of items to be completed or corrected. The failure to include any item on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents. When the A/E and Owner on the basis of an inspection determines that the Work or designated portion thereof is Substantially Complete, the A/E will then prepare a Certificate of Substantial Completion which shall establish the Date of Substantial Completion, shall state the responsibilities of the Owner and the Contractor for security, maintenance, heat, utilities and damage to the Work, and shall fix the time within which the Contractor shall complete the items listed therein. Warranties and Guarantees required by the Contract Documents shall commence on the Date of Substantial Completion of the Work or designated portion thereof unless otherwise provided in the Certificate of Substantial Completion. The Certificate of Substantial Completion shall be submitted to the Owner and the Contractor for their written acceptance of the responsibilities assigned to them in such Certificate.

11.7.2 Upon Substantial Completion of the Work or designated portion thereof and upon application by the Contractor and certification by the A/E, the Owner shall make payment, reflecting adjustment for defective or incomplete work, if any, for such Work or portion thereof, as provided in the Contract Documents. Double the amount necessary to complete the Work shall be retained by the Owner pursuant to SDCL § 5-18B-13.

## 11.8 Final Completion and Final Payment.

11.8.1 Upon receipt of written notice that the Work is ready for final inspection and acceptance and upon receipt of a final Application for Payment, the A/E and Owner will promptly make such inspection and, when they find the Work acceptable under the Contract Documents and the Contract fully performed, the A/E will promptly issue a final Certificate for payment stating that to the best of his observations and inspections, the Work has been completed in accordance with the terms and conditions of the Contract Documents and that the entire balance found to be due the Contractor and noted in said final Certificate, is due and payable. The A/E's Final Certificate for Payment will constitute a further representation that the conditions precedent to the Contractor's being entitled to final payment as set forth in Sub-Article 11.8.2 have been fulfilled.

11.8.2 The final payment shall not become due until the Contractor submits to the A/E and Owner (1) an affidavit that all payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or his property might in any way be responsible, have been paid or otherwise satisfied, (2) consent of surety to final payment, (3) if required by the Owner, other data establishing payment or satisfaction of all such obligation, such as receipts, releases and waivers of liens arising out of the Contract, to the extent and in such form as may be designated by the Owner, (4) an Unemployment Compensation Contribution Certificate from the South Dakota Department of Labor, and (5) a full and complete release of the Owner from all liability under the Contract and otherwise, except to the extent provided in Sub-Article 11.8.4. If the Contractor fails to furnish such releases or waivers of liens as the Owner reasonably requires to determine that there are no outstanding liens, the Owner may require that Contractor, as a condition of final payment to furnish a bond satisfactory to the Owner to indemnify the Owner against any such liens. Cost of such bond shall be borne by the Contractor. If any such lien remains unsatisfied after all payments are made, the Contractor shall refund to the Owner all moneys that the latter may be compelled to pay in discharging such lien, including all costs and reasonable attorneys' fees.

11.8.3 Owner shall make final payment of all sums due to the Contractor 30 days after the completion and acceptance of the project by the Owner and Contractor's compliance with Article 11.8.2 above. If the Owner fails to make final payment to the Contractor within the time specified herein, the Owner shall pay the Contractor interest at the rate of four percent (4%) compounded annually on the amount retained starting from the date final payment first becomes due.

11.8.4 The acceptance of final payment by the Contractor shall constitute a complete and unconditional waiver and release of any and all claims by the Contractor of whatever nature, and regardless whether they are then known or unknown, and a complete and unconditional release of the Owner and every person for whom the Owner is responsible for any and all matters related to the Contract or otherwise, except those claims which have been made in writing and identified by the Contractor as not having been settled at that time.

**Article 12**  
**PROTECTION OF PERSONS AND PROPERTY**

12.1 Safety Precautions and Programs: The Contractor shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the Work, and for safeguarding all adjacent properties and facilities.

12.2 Safety of Persons and Property.

12.2.1 The Contractor shall take all reasonable precautions for the safety of, and shall provide all reasonable protection to prevent damage, injury or loss to:

12.2.1.1 All employees on the Work and all other persons who may be affected thereby;

12.2.1.2 All the Work and all materials and equipment to be incorporated therein, whether in storage or off the site, under the care, custody or control of the Contractor and any of his Subcontractors or Sub-subcontractors; and

12.2.1.3 Other property at the site or adjacent thereto, including but not limited to, work of the Owner or of separate contractors, trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation or replacement in the course of construction.

12.2.2 The Contractor shall give all notices and comply with all applicable laws, ordinances, rules, regulations and lawful orders of any public authority bearing on the safety of persons or property or their protection from damage, injury or loss, and shall indemnify the Owner and the A/E and save them harmless against all claims, penalties, actions and proceedings relating thereto or the Contractor's failure so to comply.

12.2.3 The Contractor shall erect and maintain, as required by existing conditions and progress of the Work, all reasonable safeguards for safety and protection, including posting danger signs and other warnings against hazards, promulgating safety regulations and notifying owners and users of adjacent utilities.

12.2.4 When the use or storage of any hazardous materials or equipment is necessary for the execution of the Work, the Contractor shall exercise the utmost care and shall carry on such activities under the supervision of properly qualified personnel.

12.2.5 The Contractor shall promptly remedy all damage or loss to any property referred to in Sub-Articles 12.2.1.2 and 12.2.1.3 caused in whole or in part by the Contractor, any Subcontractor, any Sub-subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable and for which the Contractor is responsible under Sub-Articles 12.2.1.2 and 12.2.1.3, except damage or loss attributable to the acts or omissions of the Owner or A/E or anyone directly or indirectly employed by either of them, or by anyone for whose acts either of them may be liable, and not attributable to the fault or negligence of the Contractor. The foregoing obligations of the Contractor are in addition to his obligations under Sub-Article 6.16.

12.2.6 The Contractor shall designate a responsible member of his organization at the Site whose duty shall be the prevention of accidents. This person shall be qualified as a safety supervisor by experience, training, or education and shall have the responsibility to insure and enforce safety requirements on behalf of the Contractor and shall be designated by the Contractor in writing to the Owner and the A/E.

12.2.7 The Contractor shall issue weekly safety reports to the Owner and the A/E attesting to conditions on the Site relating to safety and to actions taken.

12.2.8 The Contractor shall not load or permit any part of the Work to be loaded so as to endanger its safety.

12.2.9 The structure of the Project is designed to support the loads of the finished building. No provision is included for stresses or loads imposed by construction operations. If the Contractor desires to place such loads in excess of the design load shown on drawings, he shall submit drawings and calculations prepared by, and bearing the seal of a professional structural engineer of the proposed method for supporting such loads for the A/E's review and approval. No loading of any kind in excess of design loads shall be placed on any part of the building structure prior to the A/E's approval of submitted drawings and calculations. The costs of the A/E's review shall be borne by the Contractor.

12.2.10 The Contractor shall prepare a written report setting forth the circumstances and details related to any accident or occurrences involving death, bodily injury, sickness, disease, personal injury, and/or loss or injury to or destruction of tangible property. Such reports shall be forwarded promptly to the insurance carriers, the A/E and the Owner.

12.3 Emergencies: In any emergency affecting the safety of persons or property, the Contractor shall act, at his discretion, to prevent threatened damage, injury or loss and shall as promptly as conditions permit notify the insurance carriers, Owner, and A/E of the nature of the emergency and circumstances related thereto. Immediately thereafter, the Contractor shall prepare a written report setting forth in detail the action taken and describing in detail all circumstance and conditions which are related to such action.

## Article 13 INSURANCE

13.1. At all times during the term of this Agreement, Contractor shall obtain and maintain in force insurance coverage of the types and with the limits as follows:

13.1.1. Commercial General Liability Insurance:

equivalent form of coverage **with a limit of not less than one million dollars (\$1,000,000) for each occurrence.** If such insurance contains a general aggregate limit it shall apply separately to this Agreement or be no less than two (2) times the occurrence limit. The insurance policy shall name the State of South Dakota, its officers and employees, as additional insureds, but liability coverage is limited to claims not barred by sovereign immunity. The State of South Dakota, its officers and employees do not hereby waive sovereign immunity for discretionary conduct as provided by law.

13.1.2. Business Automobile Liability Insurance:

Contractor shall maintain business automobile liability insurance or equivalent form **with a limit of not less than one million dollars (\$1,000,000) for each accident.** This insurance shall include coverage for owned, hired and non-owned vehicles.

13.1.3. Worker's Compensation Insurance:

Contractor shall procure and maintain workers' compensation and employers' liability insurance **as required by South Dakota or Federal law.**

13.1.4. Builder's Risk Insurance:

Contractor shall maintain builder's risk insurance **with a limit of not less than the full value of this Agreement** upon any building, structure, equipment and appliance in the process of construction or installation under state contract and upon all materials on site, until such time as the building, structure, equipment and appliances have been finally accepted by the Owner and the contract completed. This insurance shall include the interest of the Owner, Contractor, Subcontractors, and Sub-subcontractors in the Work and shall insure against loss by physical damage including, without duplication of coverage, fire, flood, extended coverage, theft, vandalism, malicious mischief, and collapse.

13.1.5. Installation Floater Insurance:

Contractor shall maintain installation floater insurance **with a limit of not less than the full value of Specialized Equipment and Material** upon specialized equipment and material not covered under the Builder's Risk Insurance in the process of construction or installation under state contract and upon all materials on site, until such time as the building, structure, equipment and appliances have been finally accepted by the Owner and the contract completed. This insurance shall include the interest of the Owner, Contractor, Subcontractors, and Sub-subcontractors in the Work and shall insure against loss by physical damage including, without duplication of coverage, fire, flood, extended coverage, theft, vandalism, malicious mischief, and collapse.

Before beginning work under this Agreement, Contractor shall submit insurance policies to the State Engineer for review and approval, and shall furnish the State with properly executed Certificates of Insurance which shall clearly evidence all insurance required in this Agreement including naming the State, its officers and employees, as additional insureds, as set forth above. In the event of a substantial change in insurance, issuance of a new policy, cancellation or nonrenewal of the policy, Contractor agrees to provide immediate notice to the State and provide a new certificate of insurance showing continuous coverage in the amounts required. Contractor shall furnish copies of any changed or new insurance policies if requested by the State.

**Article 14**  
**CHANGES IN THE WORK**

14.1 Change Orders: A Change Order is a written order to the Contractor signed by the Owner, issued after execution of the Contract, authorizing a change in the Work or an adjustment in the Contract Sum or the Contract Time. The Contract Sum and the Contract Time may be changed only by Change Order. A Change Order signed by the Contractor indicates his agreement therewith, including the adjustment in the Contract Sum or the Contract Time.

14.2 The Owner, without invalidating the Contract, may order changes in the Work within the general scope of the Contract consisting of additions, deletions, or other revisions, the Contract Sum and the Contract Time being adjusted accordingly. All such changes in the Work shall be authorized by Change Order, and shall be performed under the applicable conditions of the Contract Documents. No later than the 5th day of each month, the A/E will process a written change order to include all outstanding RFPs.

14.3 The cost or credit to the Owner resulting from a change in the Work shall be determined in one or more of the following ways:

14.3.1 By mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation. Such lump sum proposals shall be supported by a completely detailed analysis of the proposed change subdivided into the Work of the Contractor and/or the Work of each Subcontractor and/or Sub-subcontractors involved in the proposed change, as applicable, with each such subdivision further broken down into the following elements:

14.3.1.1 Number of man-hours of labor to be performed by each trade, craft or classification of employee involved in the proposed change.

14.3.1.2 The hourly rate for each such trade, craft or classification of employee, including the appropriate wage supplement for social security, old age and unemployment contributions, and such other employee benefits as may be established by statute or by written agreement negotiated by and between organizations representing such crafts or trades and representatives of their employers.

14.3.1.3 The estimated quantity of each item or element of material and/or equipment entering into the proposed change.

14.3.1.4 The unit cost of each such item or element of material and/or equipment.

14.3.1.5 Rental of items or units of construction plant and equipment with a schedule of the period or periods of use of such item or unit in connection with the proposed change.

14.3.1.6 Rental terms and rates for each such item or unit of construction plant and equipment. Rental for equipment shall be based on the following:

14.3.1.6.1 Hourly rental rates shall be based on 80% of the applicable rates for equipment listed in the 'Green Book', latest edition, (published by the Associated Equipment Distributors, 615 West 22nd Street, Oakbrook, Illinois, 60523).

14.3.1.6.2 Hourly rental rates for equipment not listed in the 'Green Book' shall be based on 100% of the applicable rates for equipment listed in the 'Blue Book', latest edition (published by Dataquest, 1290 Ridder Park Drive, San Jose, California, 95131).

14.3.1.6.3 Hourly rental rates determined from the 'Green Book' or 'Blue Book' includes all items of cost and expense to the Contractor, including gas, oil, maintenance, repairs, insurance, and transportation to and from construction site.

14.3.1.7 Power and/or other utilities entering into the proposed change.

14.3.1.8 Rates and terms applicable to such power and/or other utilities.

14.3.1.9 Additional premiums, if applicable, for the extension of insurance and bond coverages as required herein to the proposed change.

14.3.1.10 Applicable federal, state and local taxes.

14.3.1.11 Indirect Cost and Fee computed as a percentage override applied to net cost in accordance with the provisions of this Article.

14.3.2 By unit prices stated in the Contract Documents or subsequently agreed upon;

14.3.3 By cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee;

14.3.4 By the method provided in Sub-Article 14.3.12.

14.3.5 The Contractor shall require that the itemized analysis of each portion of the proposed change to be performed by a Subcontractor and/or Sub-subcontractor be prepared by each such Subcontractor and/or Sub-subcontractor in accordance with the format established herein. Copies of all such itemized analysis shall be appended to the Contractor's itemized analysis of the proposed change in the Work.

14.3.6 For purposes of calculating Indirect Cost and Fee in relation to Change Orders, the net cost of a proposed change in the Work shall include, and unless otherwise agreed in writing prior to the performance of the proposed change, shall be limited to the fair and reasonable estimated cost of the total of all of the individual items, elements, or components involved in proposed change in the Work (including adds and deducts) as set forth in Sub-Articles 14.3.1.1 through 14.3.1.8.

14.3.7 For each portion of a proposed net additive change in the Work to be performed directly by the Contractor, the cost to Owner shall include an increment for the Indirect Cost and Fee of the Contractor associated with such portion of proposed change of 8% of the net cost of the Work.

14.3.8 For each portion of a proposed net additive change in the Work to be performed directly by a Subcontractor, in addition to an increment or increments for Subcontractor's Indirect Cost and profit associated therewith of 8%, the cost to the Owner shall include a supplementary increment or increments for Contractor's Indirect Cost and Fee associated therewith of 6% of the net cost of the Work.

14.3.9 In computing Indirect Cost and Fee, the percentage for Indirect Cost and Fee shall be taken on basic wage only. No percentage override shall be taken on Social Security, Old Age and Unemployment contributions, contributions to Industry funds, education, and Training Funds and/or similar wage supplements, contributions or benefits.

14.3.10 Items, elements or components of changes in the Work or proposed changes which shall be classified as Indirect Cost and excluded from net cost shall include, but shall not necessarily be limited to:

14.3.10.1 All classifications of administrative, supervisory, and clerical personnel not engaged manually in the performance of the Work, including timekeepers, clerks, watchmen, and security personnel.

14.3.10.2 Miscellaneous expense, job burden, and/or other generalized categories of cost or expense.

14.3.10.3 Use of small tools and miscellaneous materials.

14.3.10.4 Insurance other than insurance coverage required herein.

14.3.11 In changes in the Work involving both additions to and deductions in the Work, or any portion or element thereof, or the relocation or rearrangement of items, portions or elements thereof, or the substitution of any items, portions or elements thereof, such additions and deductions shall be balanced, and the Contractor's Fee computed on the same basis for deductions as well as additions. If at the request of the A/E and/or the Owner a number of unrelated changes in the Work are set forth individually, summarized and totaled in a single Change Order for reasons of administrative convenience, the amount or amounts of individual deductive changes in the Work set forth therein shall, in any event, be balanced against the amount or amounts of individual additive changes in computing the Contractor's Fee for the purpose of adding and deducting.

14.3.12 If none of the methods set forth in Sub-Articles 14.3.1, .3.2 or .3.3 is agreed upon, the Contractor, provided he receives a written order signed by the Owner, shall promptly proceed with the Work involved. The cost of such Work shall then be determined by the Owner on the basis of the reasonable expenditures and savings of those performing the Work attributable to the change, including, in the case of an increase in the Contract Sum, a reasonable allowance for the Contractor's Fee. In such case, and also under Sub-Articles 14.3.3 and .3.4 above, the Contractor shall keep and present, in such form as the Owner may prescribe, an itemized accounting together with appropriate supporting data for inclusion in a Change Order, at the end of each day, and will submit to the Owner or his designated representative: (a) daily time slips showing the name of each workman employed on such work, the number of hours which he is employed thereon, the character of his duties, and the wages and benefits to be paid to him and on his behalf, and (b) a memorandum of the equipment used in the performance of such Work, together with the rental claimed therefor. Unless otherwise provided in the Contract Documents, cost shall be limited to the following: cost of materials, including sales tax and cost of delivery; cost of labor, including social security, old age and unemployment insurance, and fringe benefits required by agreement or custom; worker's or workmen's compensation insurance; bond premiums; rental value of equipment and machinery; and the additional costs of supervision and field office personnel directly attributable to the change. Pending final determination of cost to the Owner, payments on account shall be made on the basis of amounts reasonably estimated by the Owner. The amount of credit to be allowed by the Contractor to the Owner for any deletion or change which results in a net decrease in the Contract sum will be the amount of the actual net cost as confirmed by the A/E and agreed to by the Owner. When both additions and credits covering related Work or substitutions are involved in any one change, the allowance or credit for the Contractor's Fee shall be figured on the basis of the net increase, or decrease, if any, with respect to that change.

#### 14.4 Differing Site Conditions



14.4.1 The Contractor shall promptly, and before the conditions are disturbed, give a written notice to the A/E of (1) subsurface or latent physical conditions at the site which differ materially from those indicated in this contract, or (2) unknown physical conditions at the site, of an unusual nature, which differ materially from those ordinarily encountered and generally recognized as inhering in work of the character provided for in the contract.

14.4.2 The A/E shall investigate the site conditions promptly after receiving the notice. If the conditions do materially so differ and cause an increase or decrease in the Contractor's cost of, or the time required for, performing any part of the work under this contract, whether or not changed as a result of the conditions, the Contract Sum shall be adjusted as provided in this Article, provided that the work has been ordered in writing by Owner and A/E as provided in Sub-Article 14.1 above. There shall be included in the adjustment to the Contract Sum under the preceding sentence a reasonable allowance for any extraordinary increase in Indirect Cost borne by the Contractor because of such additional work.

#### 14.5 Claims for Additional Cost.

14.5.1 If the Contractor wishes to make a claim for an increase in the Contract Sum, he shall give the A/E and Owner a written notice thereof within 10 days after the occurrence of the event giving rise to such claim except where claim is made in connection with deviations in Shop Drawing or Sample submittals, in which case claim shall be made in writing to the A/E concurrently with such submittals. This notice shall be given by the Contractor before proceeding to execute the work, except in an emergency endangering life or property in which case the Contractor shall proceed in accordance with Sub-Article 12.3. No such claim shall be valid unless so made. Any change in the Contract Sum resulting from such claim shall be authorized by Change Order.

14.5.2 If the Contractor claims that additional cost is involved because of, but not limited to, (1) any written interpretation pursuant to Sub-Article 4.13, (2) any order by the Owner to stop the Work pursuant to Sub-Article 5.2 where the Contractor was not at fault, (3) any written order for a minor change in the Work issued pursuant to Sub-Article 14.6, or (4) any deviation in Shop Drawing or Sample submittals from the requirements of the Contract Documents, the Contractor shall make such claim as provided in Sub-Article 14.5.1.

14.6 Minor Changes in the Work: The A/E will have authority to order minor changes in the Work not involving an adjustment in the Contact Sum or an extension of the Contract Time and not inconsistent with the intent of the Contract Documents. Such changes shall be effected by written order, and shall be binding on the Owner and the Contractor. The Contractor shall carry out such written orders promptly.

**Article 15**  
**UNCOVERING AND CORRECTION OF WORK**

15.1 Uncovering of Work.

15.1.1 If any portion of the Work should be covered contrary to the request of the A/E or the Owner, or the requirements specifically expressed in the Contract Documents, it must, if required in writing by the A/E or the Owner, be uncovered for his observation and shall be replaced at the Contractor's expense.

15.1.2 If any other portion of the Work has been covered which the A/E or the Owner has not specifically required to observe prior to being covered, the A/E or the Owner may request to see such Work and it shall be uncovered by the Contractor. If such work be found in accordance with the Construction Documents, the cost of uncovering and replacement shall, by appropriate Change Order, be charged to the Owner. If such work be found not in accordance with the Construction Documents, the Contractor shall pay such costs unless it be found that this condition was caused by the Owner or a separate contractor as provided in Article 8, in which event the Owner shall be responsible for the payment of such costs.

15.2 Correction of Work.

15.2.1 The Contractor shall promptly correct all Work rejected by the A/E as defective or as failing to conform to the Construction Documents whether observed before or after Substantial Completion and whether or not fabricated, installed or completed. The Contractor shall bear all costs of correcting such rejected Work, including compensation for the A/E's additional services and the Office of the State Engineer fees made necessary thereby.

15.2.2 If, at any time after the Owner's acceptance of the fully completed Project any of the Work is found not to have been provided in conformance with the Construction Documents, or, if within one year after such acceptance any of the Work is otherwise found to be faulty or defective, the Contractor shall correct it promptly after receipt of a written notice from the Owner to do so. The Contractor shall also repair or replace any part of the Work which is damaged by the defective condition or the remedial Work. This obligation shall survive termination of the Contract, subject to the terms of any applicable statute of limitations. The Owner shall give such notice promptly after discovery of the condition.

15.2.3 The Contractor shall remove from the Site all portions of the Work which are defective or non-conforming and which have not been corrected under Sub-Articles 6.4.1, 15.2.1 and 15.2.2, unless removal is waived by the Owner.

15.2.4 If the Contractor fails to correct defective or non-conforming Work as provided in Sub-Articles 6.4.1, 15.2.1 and 15.2.2, the Owner may correct it in accordance with Sub-Article 5.3.

15.2.5 If the Contractor does not proceed with the correction of such defective or non-conforming Work within a reasonable time fixed by written notice from the A/E, the Owner may remove it and may store the materials or equipment at the expense of the Contractor. If the Contractor does not pay the cost of such removal and storage within 10 days thereafter, the Owner may upon 10 additional days written notice sell such Work at auction or a private sale and shall account for the net proceeds thereof, after deducting all the costs that should have been borne by the Contractor, including compensation for the A/E's additional services made necessary thereby. If such proceeds of sale do not cover all costs which the Contractor should have borne, the difference shall be charged to the Contractor and an appropriate Change Order shall be issued. If the payments then or thereafter due to the Contractor are not sufficient to cover such amount, the Contractor shall pay the difference to the Owner upon demand.

15.2.6 The Contractor shall bear the cost of making good all work of the Owner or separate contractors destroyed or damaged by such correction removal.

15.2.7 Nothing contained in this Article shall be construed to establish a period of limitation with respect to any other obligation which the Contractor might have under the Contract Documents, including Sub-Article 6.4 hereof. The establishment of any time period prescribed by the terms of any warranty required by the Contract Documents relates only to the specific obligation of the Contractor to correct the Work, and has no relationship to the time within which his obligation to comply with the Contract Documents may be sought to be enforced, nor the time within which proceedings may be commenced to establish the Contractor liability with respect to his obligations other than specifically to correct the Work.

15.3 Acceptance of Defective or Non-Conforming Work: If the Owner prefers to accept defective or non-conforming Work, he may do so instead of requiring its removal and correction, in which case a Change Order will be issued to reflect a reduction in the Contract Sum where appropriate and equitable. Such adjustment shall be effected whether or not final payment has been made.

**Article 16**  
**TERMINATION OF THE CONTRACT**

16.1 Termination by the Contractor: If the Work is stopped for a period of 90 days under an order of any court or any public authority having jurisdiction, or as a result of an act of government, such as a declaration of a national emergency making materials unavailable, through no act or fault of the Contractor or Subcontractor or their agents or employees or any other persons performing any of the Work under a contract with the Contractor, then the Contractor may, upon 7 additional days written notice to the Owner and the A/E, terminate the Contract and recover from the Owner payment for all Work executed to the termination date, together with reasonable demobilization costs. The Contractor shall have no other right to terminate the Contract for any reason.

16.2 Termination by the Owner.

16.2.1 If the Contractor is in default under the Contract Documents, the Owner may, without prejudice to any other right or remedy and upon written notice to the Contractor, terminate the contract.

Prior to termination of the Contract, the Owner shall give the Contractor and his surety 10 calendar days written notice, during which the Contractor and/or his surety may rectify the cause of the termination. If rectified to the satisfaction of the Owner within said 10 days, the Owner may rescind its notice of termination. If not rectified, the termination for cause shall become effective at the end of the 10 day notice period. In the alternative, the Owner may postpone the effective date of the termination notice, at its sole discretion, if it should receive reassurances from the Contractor and its surety that the causes of termination will be remedied in a time and manner which the Owner finds acceptable. If at any time more than 10 days after the notice of termination, the Owner determines that the Contractor or its surety has not or is not likely to rectify the causes of termination in an acceptable manner or within the time allowed, then the Owner may immediately terminate the Contract for cause by giving written notice to the Contractor and its surety. In no event shall termination for cause terminate the obligations of the Contractor's surety on its payment and performance bonds.

Notice of termination, whether initial or given after a period of postponement, may be served upon the Contractor and the surety by mail or any other means at their last known places of business in South Dakota or elsewhere, by delivery to any officer or management/supervisory employee of either wherever they may be found, or, if no such officer, employee or place of business is known or can be found by reasonable inquiry within 3 days, by posting the notice at the job site. Failure to accept or pick up registered or certified mail addressed to the last known address shall be deemed to be delivery.

Upon termination of the Contract, the Owner shall take possession of the premises and of all materials, tools, appliances, equipment, and other facilities on the Project, wherever stored, and may finish the Work by whatever method he may deem expedient. The Contractor shall assign Subcontracts to the Owner or to a designated substitute contractor promptly upon request. In such case the Contractor shall not be entitled to receive any further payment until the Work is finished and the Owner has determined its damages owing to the Contractor's default.

16.2.2 If the costs of finishing the Work, including compensation for the A/E's and Office of the State Engineer's additional services made necessary by the Contractor's default, and all other damages suffered by the Owner on account of the Contractor's default, exceed the unpaid balance of the Contract Sum, the Contractor shall pay the difference to the Owner, and this obligation for payment shall survive the termination of the Contract. If the costs of finishing the Work are less than the unpaid portion of the contract Sum, the Owner shall pay the unpaid balance of any amount properly owing to the Contractor for all Work executed to the date of termination, less actual damages. The Owner will not be obligated to pay any further amount on account of Direct Cost, Indirect Cost or Fee.

16.2.3 If it should be judicially determined that the Owner improperly terminated this Contract for cause, then the termination shall be deemed to be a termination for the convenience of the Owner.

### 16.3 Termination for Convenience.

16.3.1 The Owner may terminate this Contract at any time without cause, in whole or in part, upon giving the Contractor notice of such termination. Upon such termination, the Contractor shall immediately cease Work and remove from the project site all of its labor forces and such of its materials as Owner elects not to purchase or to assume in the manner hereinafter provided. Upon such termination, the Contractor shall take such steps as Owner may require to assign to the Owner the Contractor's interest in all Subcontracts and purchase orders designated by Owner. After all such steps have been taken to Owner's satisfaction, the Contractor shall receive as full compensation for termination and assignment the following:

- (1) All amounts then otherwise due under the terms of this Contract,
- (2) Amounts due for work performed subsequent to the latest Request for Payment through the date of termination,
- (3) Reasonable compensation for the actual cost of demobilization incurred by the Contractor as a direct result of such termination. The Contractor shall not be entitled to any compensation for lost profits or for any other type of contractual compensation or damage other than those provided by the preceding sentence. Upon payment of the foregoing, Owner shall have no further obligations to Contractor of any nature.

16.3.2 In no event shall termination for the convenience of the Owner terminate the obligations of the Contractor's surety on its payment and performance bonds.

## ARPA Supplemental Conditions

**This project may be partially funded using American Rescue Plan Act (ARPA) funds. As a condition of the ARPA funding guidelines, the Contractor shall meet the following minimum requirements:**

By signing this contract, Contractor and/or consultant(s) confirm they meet the legal requirements relating to nondiscrimination. This includes that they do not deny benefits, services, or otherwise discriminate on the basis of race, color, national origin (including limited English proficiency), disability, age, or sex (including sexual orientation and gender identity), in accordance with the following authorities: Title VI of the Civil Rights Act of 1964 (Title VI) Public Law 88-352, 42 U.S.C. 2000d-1 et seq., and the Department's implementing regulations, 31 CFR part 22; Section 504 of the Rehabilitation Act of 1973 (Section 504), Public Law 93-112, as amended by Public Law 93-516, 29 U.S.C. 794; Title IX of the Education Amendments of 1972 (Title IX), 20 U.S.C. 1681 et seq., and the Department's implementing regulations, 31 CFR part 28; Age Discrimination Act of 1975, Public 6 See flexibility provided in [https://www.whitehouse.gov/wp-content/uploads/2021/03/M\\_21\\_20.pdf](https://www.whitehouse.gov/wp-content/uploads/2021/03/M_21_20.pdf). 7

**This project may be partially funded using Coronavirus Capital Projects Fund (CPF) established by Section 604 of the Social Security Act. As a condition of the CPF funding guidelines, the Contractor shall meet the following minimum requirements:**

- 1) A recipient may provide a certification that, for the relevant project, all laborers and mechanics employed by contractors and subcontractors in the performance of such project are paid wages at rates not less than those prevailing, as determined by the U.S. Secretary of Labor in accordance with subchapter IV of chapter 31 of title 40, United States Code (commonly known as the "Davis-Bacon Act"), for the corresponding classes of laborers and mechanics employed on projects of a character similar to the contract work in the civil subdivision of the State (or the District of Columbia) in which the work is to be performed, or by the appropriate State entity pursuant to a corollary State prevailing-wage-in-construction law (commonly known as "baby Davis-Bacon Acts"). If such certification is not provided, a recipient must provide a project employment and local impact report detailing:
  - a. The number of employees of contractors and sub-contractors working on the project;
  - b. The number of employees on the project hired directly and hired through a third party;
  - c. The wages and benefits of workers on the project by classification; and
  - d. Whether those wages are at rates less than those prevailing.
- 2) Recipient may provide a certification that a project includes a project labor agreement, meaning a pre-hire collective bargaining agreement consistent with section 8(f) of the National Labor Relations Act (29 U.S.C. 158(f)). If the recipient does not provide such certification, the recipient must provide a project workforce continuity plan, detailing:
  - a. How the recipient will ensure the project has ready access to a sufficient supply of appropriately skilled and unskilled labor to ensure high-quality construction throughout the life of the project, including a description of any required professional certifications and/or in-house training;
  - b. How the recipient will minimize risks of labor disputes and disruptions that would jeopardize timeliness and cost-effectiveness of the project;

- c. How the recipient will provide a safe and healthy workplace that avoids delays and costs associated with workplace illnesses, injuries, and fatalities, including descriptions of safety training, certification, and/or licensure requirements for all relevant workers (e.g., OSHA 10, OSHA 30);
  - d. Whether workers on the project will receive wages and benefits that will secure an appropriately skilled workforce in the context of the local or regional labor market; and
  - e. Whether the project has completed a project labor agreement.
- 3) Whether the project prioritizes local hires.
- 4) Whether the project has a Community Benefit Agreement, with a description of any such agreement.

## **Appendix II to Part 200 - Contract Provisions for Non-Federal Entity Contracts Under Federal Awards**

In addition to other provisions required by the Federal agency or non-Federal entity, all contracts made by the non-Federal entity under the Federal award must contain provisions covering the following, as applicable.

(A) Contracts for more than the simplified acquisition threshold, which is the inflation adjusted amount determined by the Civilian Agency Acquisition Council and the Defense Acquisition Regulations Council (Councils) as authorized by 41 U.S.C. 1908, must address administrative, contractual, or legal remedies in instances where contractors violate or breach contract terms, and provide for such sanctions and penalties as appropriate.

(B) All contracts in excess of \$10,000 must address termination for cause and for convenience by the non-Federal entity including the manner by which it will be effected and the basis for settlement.

(C) Equal Employment Opportunity. Except as otherwise provided under 41 CFR Part 60, all contracts that meet the definition of "federally assisted construction contract" in 41 CFR Part 60-1.3 must include the equal opportunity clause provided under 41 CFR 60-1.4(b), in accordance with Executive Order 11246, "Equal Employment Opportunity" (30 FR 12319, 12935, 3 CFR Part, 1964-1965 Comp., p. 339), as amended by Executive Order 11375, "Amending Executive Order 11246 Relating to Equal Employment Opportunity," and implementing regulations at 41 CFR part 60, "Office of Federal Contract Compliance Programs, Equal Employment Opportunity, Department of Labor."

(D) ~~Davis-Bacon Act, as amended (40 U.S.C. 3141-3148).~~

(E) Contract Work Hours and Safety Standards Act (40 U.S.C. 3701-3708). Where applicable, all contracts awarded by the non-Federal entity in excess of \$100,000 that involve the employment of mechanics or laborers must include a provision for compliance with 40 U.S.C. 3702 and 3704, as supplemented by Department of Labor regulations (29 CFR Part 5). Under 40 U.S.C. 3702 of the Act, each contractor must be required to compute the wages of every mechanic and laborer on the basis of a standard work week of 40 hours. Work in excess of the standard work week is permissible provided that the worker is compensated at a rate of not less than one and a half times the basic rate of pay for all hours worked in excess of 40 hours in the work week. The requirements of 40 U.S.C. 3704 are applicable to construction work and provide that no laborer or mechanic must be required to

work in surroundings or under working conditions which are unsanitary, hazardous or dangerous. These requirements do not apply to the purchases of supplies or materials or articles ordinarily available on the open market, or contracts for transportation or transmission of intelligence.

(F) Rights to Inventions Made Under a Contract or Agreement. If the Federal award meets the definition of “funding agreement” under 37 CFR § 401.2 (a) and the recipient or subrecipient wishes to enter into a contract with a small business firm or nonprofit organization regarding the substitution of parties, assignment or performance of experimental, developmental, or research work under that “funding agreement,” the recipient or subrecipient must comply with the requirements of 37 CFR Part 401, “Rights to Inventions Made by Nonprofit Organizations and Small Business Firms Under Government Grants, Contracts and Cooperative Agreements,” and any implementing regulations issued by the awarding agency.

(G) Clean Air Act (42 U.S.C. 7401-7671q.) and the Federal Water Pollution Control Act (33 U.S.C. 1251-1387), as amended - Contracts and subgrants of amounts in excess of \$150,000 must contain a provision that requires the non-Federal award to agree to comply with all applicable standards, orders or regulations issued pursuant to the Clean Air Act (42 U.S.C. 7401-7671q) and the Federal Water Pollution Control Act as amended (33 U.S.C. 1251-1387). Violations must be reported to the Federal awarding agency and the Regional Office of the Environmental Protection Agency (EPA).

(H) Debarment and Suspension (Executive Orders 12549 and 12689) - A contract award (see 2 CFR 180.220) must not be made to parties listed on the governmentwide exclusions in the System for Award Management (SAM), in accordance with the OMB guidelines at 2 CFR 180 that implement Executive Orders 12549 (3 CFR part 1986 Comp., p. 189) and 12689 (3 CFR part 1989 Comp., p. 235), “Debarment and Suspension.” SAM Exclusions contains the names of parties debarred, suspended, or otherwise excluded by agencies, as well as parties declared ineligible under statutory or regulatory authority other than Executive Order 12549.

(I) Byrd Anti-Lobbying Amendment (31 U.S.C. 1352) - Contractors that apply or bid for an award exceeding \$100,000 must file the required certification. Each tier certifies to the tier above that it will not and has not used Federal appropriated funds to pay any person or organization for influencing or attempting to influence an officer or employee of any agency, a member of Congress, officer or employee of Congress, or an employee of a member of Congress in connection with obtaining any Federal contract, grant or any other award covered by 31 U.S.C. 1352. Each tier must also disclose any lobbying with non-Federal funds that takes place in connection with obtaining any Federal award. Such disclosures are forwarded from tier to tier up to the non-Federal award.

(J) See § 200.323. (attached)

(K) See § 200.216. (attached)

(L) See § 200.322. (attached)

§ 200.323 Procurement of recovered materials.



A non-Federal entity that is a state agency or agency of a political subdivision of a state and its contractors must comply with section 6002 of the Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act. The requirements of Section 6002 include procuring only items designated in guidelines of the Environmental Protection Agency (EPA) at 40 CFR part 247 that contain the highest percentage of recovered materials practicable, consistent with maintaining a satisfactory level of competition, where the purchase price of the item exceeds \$10,000 or the value of the quantity acquired during the preceding fiscal year exceeded \$10,000; procuring solid waste management services in a manner that maximizes energy and resource recovery; and establishing an affirmative procurement program for procurement of recovered materials identified in the EPA guidelines.

§ 200.216 Prohibition on certain telecommunications and video surveillance services or equipment.

(a) Recipients and subrecipients are prohibited from obligating or expending loan or grant funds to:

(1) Procure or obtain;

(2) Extend or renew a contract to procure or obtain; or

(3) Enter into a contract (or extend or renew a contract) to procure or obtain equipment, services, or systems that uses covered telecommunications equipment or services as a substantial or essential component of any system, or as critical technology as part of any system. As described in Public Law 115-232, section 889, covered telecommunications equipment is telecommunications equipment produced by Huawei Technologies Company or ZTE Corporation (or any subsidiary or affiliate of such entities).

(i) For the purpose of public safety, security of government facilities, physical security surveillance of critical infrastructure, and other national security purposes, video surveillance and telecommunications equipment produced by Hytera Communications Corporation, Hangzhou Hikvision Digital Technology Company, or Dahua Technology Company (or any subsidiary or affiliate of such entities).

(ii) Telecommunications or video surveillance services provided by such entities or using such equipment.

(iii) Telecommunications or video surveillance equipment or services produced or provided by an entity that the Secretary of Defense, in consultation with the Director of the National Intelligence or the Director of the Federal Bureau of Investigation, reasonably believes to be an entity owned or controlled by, or otherwise connected to, the government of a covered foreign country.

(b) In implementing the prohibition under Public Law 115-232, section 889, subsection (f), paragraph (1), heads of executive agencies administering loan, grant, or subsidy programs shall prioritize available funding and technical support to assist affected businesses, institutions and organizations as is reasonably necessary for those affected entities to transition from covered communications equipment and services, to procure replacement equipment and services, and to ensure that communications service to users and customers is sustained.

§ 200.322 Domestic preferences for procurements.

(a) As appropriate and to the extent consistent with law, the non-Federal entity should, to the greatest extent practicable under a Federal award, provide a preference for the purchase, acquisition, or use of goods, products, or materials produced in the United States (including but not limited to iron, aluminum, steel, cement, and other manufactured products). The requirements of this section must be included in all subawards including all contracts and purchase orders for work or products under this award.

(b) For purposes of this section:

(1) “Produced in the United States” means, for iron and steel products, that all manufacturing processes, from the initial melting stage through the application of coatings, occurred in the United States.

(2) “Manufactured products” means items and construction materials composed in whole or in part of non-ferrous metals such as aluminum; plastics and polymer-based products such as polyvinyl chloride pipe; aggregates such as concrete; glass, including optical fiber; and lumber.

# **PROJECT MANUAL**

**Lincoln Hall Business & Nursing School**

**Northern State University**

**Aberdeen, SD**

**Issue Date: 4/9/2024**

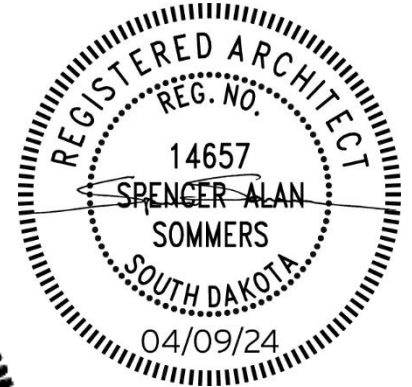
**OSE #R0122-05X**

**CO-OP PROJECT NO. 2160**

**LINCOLN HALL  
NORTHERN STATE UNIVERSITY  
ABERDEEN, SD**

OSE #R0122--05X  
AMD 21-261 / CO-OP 2160  
April 9, 2024, 2024  
Project Contacts:

Architect: CO-OP Architecture  
Mr. Spencer Sommers, AIA  
1108 S Main St #102  
Aberdeen, SD 57401  
Ph: 605-725-4852



Landscape Architect: Confluence  
Mr. Lyle Pudwill, ASLA, PLA  
524 N Main Ave #201  
Sioux Falls, SD 57104  
Ph: 605-339-1205



Civil Engineer: Helm & Associates  
Mr. Lucas Hoover, PE  
221 Highway 19  
Aberdeen, SD 57401  
Ph: 605-225-1212



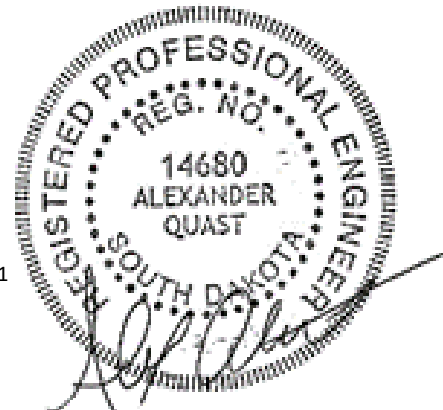
Structural Engineer: RISE, Inc.  
Mr. Jesse Munsterman, P.E.  
1405 Prairie Parkway E  
West Fargo, ND 58078  
Ph: 701-318-1782



Mechanical Engineer: Sichmeller Engineering  
Mr. Travis Sichmeller, P.E.  
801 Railroad Ave. SE  
Aberdeen, SD 57401  
Ph: 605-225-4344



Electrical Engineer: IMEG  
Mr. Alex Quast, P.E.  
3001 Broadway Street NE #601  
Minneapolis, MN 55413  
Ph: 612-540-5033



## TABLE OF CONTENTS

### DIVISION 00 – OFFICE OF THE STATE ENGINEER STATE SPECIFICATION

000001	INDEX
000002	INVITATION TO BID
000003	BIDDER'S CHECKLIST
000004	ASBESTOS CONTAINING MATERIALS STATEMENT
000005	INSTRUCTIONS TO BIDDERS
000005A	BID FORM AND/OR EXPLANATION OF UNIT PRICES & ALTERNATES
000005B	ELECTRONIC BIDDING INSTRUCTIONS
000005C	BID BOND
000005D	PERFORMANCE & PAYMENT BOND WITH ACKNOWLEDGMENT OF SURETY
000005E	NON-RESIDENT BIDDER AFFIDAVIT
000005F	CONTRACTOR'S STATEMENT OF SKILLS & CAPABILITIES
000005G	RESIDENT SUBCONTRACTOR CERTIFICATION
000006	AGREEMENT FOR CONSTRUCTION
000007	GENERAL INDEX AND GENERAL CONDITIONS
000008	ARPA SUPPLEMENTAL CONDITIONS
000009	SPECIAL INDEX AND SPECIAL CONDITIONS
000010	TECHNICAL INDEX AND TECHNICAL SPECIFICATIONS
000011	PLAN INDEX AND PLANS

### DIVISION 01 - GENERAL REQUIREMENTS

011000	SUMMARY
012000	PRICE & PAYMENT PROCEDURES
012200	UNIT PRICES
012300	ALTERNATES
012500	SUBSTITUTION PROCEDURES
012510	SUBSTITUTION REQUEST FORM
013000	ADMINISTRATIVE REQUIRMENTS
013216	CONSTRUCTION PROGRESS SCHEDULE
013329.03	SUSTAINABLE DESIGN REPORTING - GREEN GLOBES
013566.06	PROJECT SUSTAINABILITY GOAL POINT SUMMARY - GREEN GLOBES
013566.13	SUSTAINABILITY CERTIFICATION PROJECT PROCEDURES - GREEN GLOBES
014000	QUALITY REQUIRMENTS
014100	REGULATORY REQUIREMENTS
015000	TEMPORARY FACILITIES & CONTROLS
016000	PRODUCT REQUIRMENTS
017000	EXECUTION AND CLOSEOUT REQUIREMENTS
017800	CLOSEOUT SUBMITTALS
017900	DEMONSTRATION AND TRAINING
019113	GENERAL COMMISSIONING REQUIREMENTS
019119	COMMISSIONING OF BUILDING ENCLOSURE (BECx)

## **DIVISION 02 - EXISTING CONDITIONS**

020100 MAINTENANCE OF EXISTING CONDITIONS  
024100 DEMOLITION

## **DIVISION 03 - CONCRETE**

030505 UNDERSLAB VAPOR BARRIER  
033000 CAST-IN-PLACE CONCRETE  
033511 CONCRETE FLOOR FINISHES

## **DIVISION 04 – MASONRY**

042000 UNIT MASONRY

## **DIVISION 05 - METALS**

051200 STRUCTURAL STEEL FRAMING  
051213 ARCHITECTURALLY EXPOSED STRUCTURAL STEEL FRAMING  
052100 STEEL JOIST FRAMING  
053100 STEEL DECKING  
054000 COLD-FORMED METAL FRAMING  
055000 METAL FABRICATIONS  
055100 METAL STAIRS  
055213 PIPE AND TUBE RAILINGS

## **DIVISION 06 - WOOD, PLASTICS, AND COMPOSITES**

061000 ROUGH CARPENTRY  
062000 FINISH CARPENTRY  
064100 ARCHITECTURAL WOOD CASEWORK

## **DIVISION 07 - THERMAL AND MOISTURE PROTECTION**

071300 SHEET WATERPROOFING  
071200 THERMAL INSULATION  
072119 FOAMED-IN-PLACE INSULATION  
072400 EXTERIOR INSULATION AND FINISH SYSTEM  
072500 FLUID-APPLIED MEMBRANE AIR BARRIERS  
073116 METAL SHINGLES  
074213 METAL WALL PANELS  
075400 THERMOPLASTIC MEMBRANE ROOFING  
076200 SHEET METAL FLASHING AND TRIM  
077200 ROOF ACCESSORIES  
078400 FIRESTOPPING  
079200 JOINT SEALANTS  
079513 EXPANSION JOINT COVER ASSEMBLIES

## **DIVISION 08 - OPENINGS**

081113	HOLLOW METAL DOORS & FRAMES
081416	FLUSH WOOD DOORS
083100	ACCESS DOORS AND PANELS
083323	COILING OVERHEAD DOORS
084126	ALL-GLASS ENTRANCES AND STOREFRONTS
084313	ALUMINUM-FRAMED STOREFRONTS
084413	GLAZED ALUMINUM CURTAIN WALLS
087100	DOOR HARDWARE
088000	GLAZING

## **DIVISION 09 – FINISHES**

092116	GYPSUM BOARD ASSEMBLIES
092216	NON-STRUCTURAL METAL FRAMING
093000	TILING
095100	ACOUSTICAL CEILINGS
095426	SUSPENDED WOOD CEILINGS
096500	RESILIENT FLOORING
096813	TILE CARPETING
097800	INTERIOR WALL PANELING
098430	SOUND-ABSORBING WALL AND CEILING UNITS
099000	PAINTING AND COATING
099600	HIGH-PERFORMANCE COATINGS

## **DIVISION 10 - SPECIALTIES**

101101	VISUAL DISPLAY BOARDS
101400	SIGNAGE
102113.17	PHENOLIC TOILET COMPARTMENTS
102123	CUBICLE CURTAINS AND TRACK
102241	OPERABLE GLASS PARTITIONS
102250	VERTICAL OPERABLE PARTITION
102600	WALL AND DOOR PROTECTION
102800	TOILET, BATH, & LAUNDRY ACCESSORIES
104400	FIRE PROTECTION SPECIALTIES
105129	PHENOLIC LOCKERS

## **DIVISION 11 - EQUIPMENT**

117311	PATIENT LIFTS
--------	---------------

## **DIVISION 12 - FURNISHINGS**

122400	WINDOW SHADES
123600	COUNTERTOPS

## **DIVISION 14 – CONVEYING EQUIPMENT**

142400        HYDRAULIC ELEVATORS

## **DIVISION 21 – FIRE PROTECTION**

21 1000        FIRE SUPPRESSION SYSTEMS

## **DIVISION 22 – PLUMBING**

22 0500        GENERAL PLUMBING REQUIREMENTS  
22 0510        BASIC PLUMBING MATERIALS AND METHODS  
22 0700        PLUMBING SYSTEMS INSULATION  
22 4000        PLUMBING

## **DIVISION 23 – HEATING, VENTILATION AND AIR CONDITIONING**

23 0500        GENERAL HVAC REQUIREMENTS  
23 0510        BASIC HVAC MATERIALS AND METHODS  
23 0593        TESTING, ADJUSTING, & BALANCING (AIR AND WATER)  
23 0700        HVAC SYSTEMS INSULATION  
23 0900        CONTROLS & CONTROL SEQUENCES  
23 2113        HYDRONIC PIPING SYSTEMS  
23 2123        HVAC HYDRONIC PUMPS  
23 7000        VENTILATION AND AIR CONDITIONING

## **DIVISION 26 - ELECTRICAL**

26 05 00        BASIC ELECTRICAL REQUIREMENTS  
26 05 03        THROUGH PENETRATION FIRESTOPPING  
26 05 05        ELECTRICAL DEMOLITION FOR REMODELING  
26 05 13        WIRE AND CABLE  
26 05 17        ELECTRIC HEAT TRACE AND SNOW MELT  
26 05 26        GROUNDING AND BONDING  
26 05 27        SUPPORTING DEVICES  
26 05 33        CONDUIT AND BOXES  
26 05 53        ELECTRICAL IDENTIFICATION  
26 05 73        POWER SYSTEM STUDY  
26 09 33        LIGHTING CONTROL SYSTEMS  
26 20 00        SERVICE ENTRANCE  
26 24 13        SWITCHBOARDS  
26 24 16        PANELBOARDS  
26 27 26        WIRING DEVICES  
26 27 74        ELECTRIC HEATERS  
26 28 16        DISCONNECT SWITCHES  
26 43 00        SURGE PROTECTION DEVICES  
26 51 19        LED LIGHTING  
26 52 15        EMERGENCY LIGHTING INVERTER



## **DIVISION 27 - COMMUNICATIONS**

27 05 00	BASIC COMMUNICATIONS SYSTEMS REQUIREMENTS
27 05 03	THROUGH PENETRATION FIRESTOPPING
27 05 26	COMMUNICATIONS BONDING
27 05 28	INTERIOR COMMUNICATION PATHWAYS
27 05 43	EXTERIOR COMMUNICATION PATHWAYS
27 05 53	IDENTIFICATION AND ADMINISTRATION
27 11 00	COMMUNICATION EQUIPMENT ROOMS (CER)
27 13 00	BACKBONE CABLING REQUIREMENTS
27 15 00	HORIZONTAL CABLING REQUIREMENTS
27 17 10	TESTING
27 17 20	STRUCTURED CABLING SYSTEM WARRANTY
27 41 00	PROFESSIONAL AUDIO-VIDEO SYSTEM

## **DIVISION 28 – ELECTRONIC SAFETY AND SECURITY**

28 05 00	BASIC ELECTRONIC SAFETY & SECURITY SYSTEM REQUIREMENTS
28 05 03	THROUGH PENETRATION FIRESTOPPING
28 13 00	ELECTRONIC ACCESS CONTROL
28 31 01	FIRE ALARM AND DETECTION SYSTEMS ADDRESSABLE

## **DIVISION 01 – CIVIL GENERAL REQUIREMENTS**

013223	SURVEY AND LAYOUT DATA
017329	CUTTING AND PATCHING

## **DIVISION 02 – CIVIL EXISTING CONDITIONS**

021000	MAINTENANCE OF EXISTING CONDITIONS
023000	SUBSURFACE INVESTIGATION

## **DIVISION 03 – CIVIL CONCRETE**

031100	CONCRETE FORMWORK
031500	CONCRETE JOINTS AND WATERSTOPS
032000	CONCRETE REINFORCEMENT
033000	CAST-IN-PLACE CONCRETE

## **DIVISION 31 – EARTHWORK**

312300	EXCAVATION AND FILL
312311	WATERING FOR EMBANKMENTS
312314	SHEETING, SHORING, AND BRACING
312333	TRENCHING, BACKFILLING, AND COMPACTING

**DIVISION 32 – EXTERIOR IMPROVEMENTS**

321123	AGGREGATE MATERIAL
321213.13	BITUMINOUS TACK COAT
321216	ASPHALT CONCRETE SURFACING
321600	CURBS, GUTTERS, SIDEWALKS, AND DRIVEWAYS
328423	UNDERGROUND SPRINKLERS
329219	SEEDING
329300	PLANTS

**DIVISION 33 – UTILITIES**

330100	EXISTING UNDERGROUND UTILITIES
331100	WATER UTILITY PIPING AND FITTINGS
331216	WATER UTILITY DISTRIBUTION VALVES
331300	DISINFECTING OF WATER UTILITY DISTRIBUTION
331301	TESTING OF WATER UTILITY DISTRIBUTION
333100	SANITARY SEWER PIPING AND FITTINGS
333913	MANHOLES AND CASTINGS
334100	STORM UTILITY DRAINAGE PIPING

## INDEX OF DRAWINGS

### **COVER & CODE**

G-000 COVER SHEET  
G-100 INDEX & ABBREVIATIONS  
G-101 CODE SITE PLAN & CODE ANALYSIS  
G-102 CODE PLANS  
G-103 GREEN GLOBES PRELIMINARY CHECKLIST

### **CIVIL**

C-100 EXISTING SITE CONDITIONS TOPOGRAPHIC SURVEY  
C-101 DEMOLITION PLAN  
C-102 BASE BID SITE GRADING PLAN  
C-103 ALTERNATE SITE GRADING PLAN  
C-104 SITE UTILITY PLAN  
C-105 DETAILS  
C-106 DETAILS

### **LANDSCAPE**

L-201 SITE FEATURES PLAN  
L-301 PLANTING PLAN  
L-302 IRRIGATION PLAN  
L-501 SITE DETAILS  
L-502 SITE DETAILS  
L-503 IRRIGATION SCHEDULES AND DETAILS

### **STRUCTURAL**

S001 STRUCTURAL NOTES & SCHEDULES  
S002 STRUCTURAL SCHEDULES  
S101 FOOTING & FOUNDATION PLAN  
S201 SECOND FLOOR FRAMING PLAN  
S202 MECHANICAL PENTHOUSE FLOOR FRAMING PLAN  
S301 ROOF FRAMING PLAN  
S401 OPERABLE PARTITION FRAMING – ALT #9  
S402 SOUTH CONNECTOR PLANS - ALT#13  
S403 SOUTH CONNECTOR PLANS - ALT#14  
S501 ENLARGED FRAMING PLANS  
S601 STRUCTURAL DETAILS  
S602 STRUCTURAL DETAILS  
S603 STRUCTURAL DETAILS  
S604 STRUCTURAL DETAILS  
S605 STRUCTURAL DETAILS  
S606 STRUCTURAL DETAILS  
S607 STRUCTURAL DETAILS  
S608 STRUCTURAL DETAILS  
S609 STRUCTURAL DETIALS  
S610 STRUCTURAL DETIALS

**ARCHITECTURAL**

AD-100 SITE DEMO PLAN  
A-101 LEVEL 1 FLOOR PLAN  
A-102 LEVEL 2 FLOOR PLAN  
A-103 MECHANICAL PENTHOUSE FLOOR PLAN & CONFERENCE ROOM ROOF PLAN  
A-104 TOWER & CHIMNEY FLOOR PLAN  
A-105 ROOF PLAN  
A-106 "SOUTH CONNECTOR PLANS, ELEVATIONS, SECTIONS - ALTERNATE #13"  
A-107 "SOUTH CONNECTOR PLANS, ELEVATIONS, SECTIONS - ALTERNATE #14"  
A-108 GRAHAM HALL - DEMO PLANS  
A-109 GRAHAM HALL - FLOOR PLANS & CEILING PLANS  
A-111 LEVEL 1 REFLECTED CEILING PLAN  
A-112 LEVEL 2 REFLECTED CEILING PLAN  
A-121 LEVEL 1 FINISH PLAN  
A-122 LEVEL 2 FINISH PLAN  
A-201 SOUTH & WEST ELEVATIONS  
A-202 NORTH & EAST ELEVATIONS  
A-205 BUILDING SECTIONS  
A-206 BUILDING SECTIONS  
A-207 BUILDING SECTIONS  
A-403 ENLARGED NORTH STAIR PLANS AND SECTIONS  
A-404 ENLARGED SOUTH STAIR PLANS AND SECTIONS  
A-405 ENLARGED NORTH ELEVATOR PLANS AND SECTIONS  
A-406 ENLARGED SOUTH CONNECTOR STAIR AND ELEVATOR - ALT #14  
A-411 ENLARGED RESTROOM PLANS  
A-412 ENLARGED RESTROOM PLANS  
A-421 INTERIOR ELEVATIONS - LOBBY / COMMONS  
A-422 INTERIOR ELEVATIONS - CORRIDORS LEVEL 1  
A-423 INTERIOR ELEVATIONS - LEVEL 1  
A-424 INTERIOR ELEVATIONS - LEVEL 2  
A-425 ENLARGED PLAN & ELEVATIONS - ACTIVE LEARNING 101 & 102  
A-426 ENLARGED PLAN & ELEVATIONS - NORTHERN INNOVATION STARTUP CENTER  
A-427 ENLARGED PLAN & ELEVATIONS - LEVEL 1 & 2 ADMIN & FACULTY ROOMS  
A-428 ENLARGED PLAN & ELEVATIONS - CLASSROOMS 201 & 202  
A-429A ENLARGED PLAN & ELEVATIONS - CLASSROOM LARGE 212  
A-429B ENLARGED PLAN & ELEVATIONS - CLASSROOM LARGE 212 – ALTERNATE #9  
A-430 ENLARGED PLAN & ELEVATIONS - SKILLS LAB 213  
A-431 ENLARGED PLAN & ELEVATIONS - SIMULATION SUITE  
A-432 ENLARGED ELEVATIONS - SIMULATION SUITE  
A-433 ENLARGED PLAN & ELEVATIONS - LEVEL 2 ADMIN & FACULTY ROOMS  
A-501 FINISH LEGEND & EQUIPMENT SCHEDULE  
A-502 DOOR SCHEDULE AND DETAILS  
A-503 EXTERIOR WINDOW SCHEDULE  
A-504 INTERIOR WINDOW SCHEDULE  
A-505 CASEWORK SCHEDULE  
A-601 EXTERIOR WALL & ROOF ASSEMBLIES  
A-602 PARTITION TYPES  
A-611 WALL SECTIONS  
A-612 WALL SECTIONS  
A-613 WALL SECTIONS

A-614 WALL SECTIONS  
A-615 WALL SECTIONS  
A-616 WALL SECTIONS - SOUTH CONNECTOR  
A-621 EXTERIOR DETAILS  
A-622 EXTERIOR DETAILS  
A-623 EXTERIOR DETAILS  
A-624 EXTERIOR DETAILS  
A-625 EXTERIOR DETAILS  
A-701 CEILING DETAILS  
A-702 MILLWORK DETAILS  
A-703 FLOOR TRANSITION DETAILS  
A-704 INTERIOR DETAILS - STAIR AND GUARDRAIL  
A-705 INTERIOR WINDOW DETAILS

**MECHANICAL**

M100 MOTOR SCHEDULE, LEGEND & SHEET INDEX  
M200 MECHANICAL SITE PLAN  
M201 MECHANICAL ROOF PLAN  
M300 LEVEL 1 - BELOW GRADE PLUMBING & HYDRONICS PLAN  
M301 LEVEL 1 - ABOVE GRADE PLUMBING & HYDRONICS PLAN  
M302 LEVEL 2 - ABOVE GRADE PLUMBING & HYDRONICS PLAN  
M303 PENTHOUSE LEVEL - ABOVE GRADE PLUMBING & HYDRONICS PLAN  
M400 FIRE PROTECTION - LEGENDS & DETAILS  
M401 LEVEL 1 - FIRE PROTECTION PLAN  
M402 LEVEL 2 - FIRE PROTECTION PLAN  
M403 PENTHOUSE LEVEL - FIRE PROTECTION PLAN  
M500 LEVEL 1 - HVAC PLAN  
M501 LEVEL 2 - HVAC PLAN  
M502 PENTHOUSE LEVEL - HVAC PLAN  
M503 HVAC TEMPERATURE CONTROL ZONE PLAN  
M600 WASTE VENT RISER DIAGRAM  
M601 WATER RISER DIAGRAM  
M602 HYDRONIC PIPING RISER DIAGRAM  
M603 PLUMBING FIXTURE SCHEDULE  
M700 MECHANICAL DETAILS  
M701 MECHANICAL DETAILS  
M702 MECHANICAL DETAILS  
M703 MECHANICAL DETAILS  
M800 MECHANICAL SECTIONS  
M801 MECHANICAL SECTIONS CONTINUED  
M900 MECHANICAL SCHEDULES  
M100A "GRAHAM/STUDENT CENTER MOTOR SCHEDULE, LEGEND & SHEET INDEX"  
M200A GRAHAM HALL - BASEMENT MECHANICAL DEMOLITION PLAN  
M300A GRAHAM HALL - BASEMENT MECHANICAL DEMOLITION PLAN  
M301A GRAHAM HALL - LEVEL 1 MECHANICAL PROPOSED PLAN  
M302A GRAHAM HALL - LEVEL 2 MECHANICAL PROPOSED PLAN  
M400A STUDENT CENTER - LOWER LEVEL MECH & FIRE PROTECTION DEMO & PROPOSED PLAN  
M500A GRAHAM/STUDENT CENTER MECHANICAL DETAILS  
M501A GRAHAM/STUDENT CENTER MECHANICAL SECTIONS  
M502A GRAHAM/STUDENT CENTER MECHANICAL SCHEDULES

**ELECTRICAL**

E000 ELECTRICAL COVERSHEET  
E001 ELECTRICAL SYSTEMS COVERSHEET  
E100 SITE DEMOLITION PLAN - ELECTRICAL  
E101 SITE REMODEL PLAN - ELECTRICAL  
E200 LEVEL 1 PLAN - LIGHTING  
E201 LEVEL 2 PLAN - LIGHTING  
E210 LEVEL 1 PLAN - POWER AND SYSTEMS  
E211 LEVEL 2 PLAN - POWER AND SYSTEMS  
E220 PENTHOUSE PLAN - ELECTRICAL  
E300 ELECTRICAL DETAILS  
E400 ELECTRICAL RISER DIAGRAMS - LINCOLN HALL  
E500 ELECTRICAL SCHEDULES  
E600 ELECTRICAL PANEL SCHEDULES  
E601 ELECTRICAL PANEL SCHEDULES  
E602 ELECTRICAL PANEL SCHEDULES  
E603 ELECTRICAL PANEL SCHEDULES  
E000A ELECTRICAL COVERSHEET  
E100A ELECTRICAL SITE PLAN  
E200A LINCOLN & GRAHAM HALL - ELECTRICAL DEMOLITION PLAN  
E300A LINCOLN & GRAHAM HALL - LOWER LEVEL ELECTRICAL  
E400A ELECTRICAL DETAILS AND SCHEDULES  
E500A ELECTRICAL DIAGRAMS  
E600A ELECTRICAL SCHEDULES

**TECHNOLOGY**

T000 TECHNOLOGY COVERSHEET  
T101 LEVEL 01 PLAN – PATHWAY & SECURITY  
T200 LEVEL 02 PLAN - TECHNOLOGY  
T201 LEVEL 02 PLAN – PATHWAY & SECURITY  
T300 TECHNOLOGY ENLARGEMENT  
T301 TECHNOLOGY ENLARGEMENT  
T400 TECHNOLOGY DETAILS AND DIAGRAMS  
T401 TECHNOLOGY DETAILS AND DIAGRAMS  
T402 TECHNOLOGY DIAGRAMS  
T403 TECHNOLOGY DIAGRAMS  
T404 TECHNOLOGY DIAGRAMS  
T405 TECHNOLOGY DIAGRAMS  
T500 TECHNOLOGY SCHEDULE

# Soil Technologies, Inc.

28822 124<sup>th</sup> Street – Mobridge, SD 57601 – (605) 762-3406

[www.soil-technologies.com](http://www.soil-technologies.com)

*“Building Your Success On A Solid Foundation”*

December 12, 2023

## Office of the State Engineer

Joe Foss Building  
523 East Capitol  
Pierre, SD 57501



Subj: Soil Exploration  
**Proposed Lincoln Hall Construction**  
(School of Business & Nursing Program)  
Northern State University  
Aberdeen, SD  
STI #23-1847

This report presents the findings of the Soil Exploration for the above referenced project. The exploration program was performed in accordance with your authorization of our proposal to OSE dated September 21, 2023 via OSE Service Agreement #R0122—5X. An electronic file copy is being sent to you.

Soil Technologies, Inc. (STI) is dedicated to providing our clients with the most complete Soil Exploration and Geotechnical Engineering services. To accomplish this, a Geotechnical Engineer from Soil Technologies, Inc. should be retained to monitor the earthwork operations during construction. The Geotechnical Engineer will observe the soil conditions at the project site and judge when the excavations are satisfactorily completed. The Geotechnical Engineer's observations will help affirm that the earthwork is performed according to the recommendations of this report.

Thank you for the opportunity to perform these services for you on this project. If you have any questions regarding the contents of this report, or if we can be of further service to you, please feel free to contact us.

SOIL TECHNOLOGIES, INC.

  
Mr. Kim E. Stoecker, PE 6394  
President  


**OFFICE OF THE STATE  
ENGINEER  
PIERRE, SD**

**SOIL EXPLORATION  
PROPOSED LINCOLN HALL CONSTRUCTION  
NORTHERN STATE UNIVERSITY  
ABERDEEN, SD**

**STI #23-1847**

**December 12, 2023**



**TABLE OF CONTENTS**

**STI #23-1847**

1.0 INTRODUCTION .....	1
1.1 Project Information .....	1
2.0 ENGINEERING REVIEW .....	1
2.1 Discussion .....	2
2.2 Site Preparations .....	3
2.3 Foundations.....	11
2.4 Lateral Earth Pressures .....	12
2.5 Exterior Backfill.....	14
2.6 Site Drainage.....	16
3.0 CONSTRUCTION AND DESIGN CONSIDERATIONS .....	17
3.1 Site Excavation .....	17
3.2 Concrete .....	19
4.0 EXCAVATION OBERVATION AND TESTING .....	19
5.0 GENERAL EXPLORATION INFORMATION .....	20
5.1 Scope of Exploration .....	20
5.2 Site Surface Conditions .....	20
5.3 Site Subsurface Conditions .....	21
5.4 Water Levels .....	21
5.5 Laboratory Test Program.....	21
6.0 LIMITATIONS, REVIEW, USE, AND PURPOSE OF REPORT .....	22
7.0 STANDARD OF CARE.....	23
Attachments:	
Boring Location Drawing	
Borings Logs	
Field Exploration Procedures & “Descriptions”	
Symbols and Terminology	
Precautions...During Cold Weather	
Construction Observation and Testing	
Important Information about Your Geotechnical Report	

# **SOIL EXPLORATION**

## **PROPOSED LINCOLN HALL CONSTRUCTION**

### **NORTHERN STATE UNIVERSITY**

#### **ABERDEEN, SD**

#### **STI #23-1847**

### **1.0 INTRODUCTION**

#### **1.1 Project Information**

We understand the project will consist of the construction of a new building on the NSU Campus in Aberdeen. The proposed building will house the School of Business and the Nursing Program. It will consist of a two-story, slab-on-grade heated structure and will have overall dimensions of about 90 x 260 feet. A connecting link to Graham Hall will be constructed at the south end of the building. The building will be supported on shallow spread footing foundations. The existing entrance elevation of Briscoe/Lincoln is  $\pm 1300.8$ .

#### **• Conditions:**

- The finished floor elevation of the proposed building will be at 1301.5 feet.\*
- The perimeter frost footings of the proposed building will rest 4.5 to 6 feet below the finished floor and be at an elevation between 1295.5 to 1297.0 feet.\*
- The new perimeter finished grades immediately surrounding the proposed building will be below the main level (ground level) finished floor elevation.
- Column loads will be a maximum of 300 kips (total dead and live loads) with continuous footing loads less than 7 kips/ft (total dead and live loads).
- Uniform floor slab loadings exerted on the underlying soils will be a maximum 500 pounds per square foot (psf).

*\*Elevations based on survey data provided by Helms & Assoc.*

### **2.0 ENGINEERING REVIEW**

The engineering recommendations provided in this report are based on the soil information obtained under this Soil Exploration Program along with the information and conditions of the project as described above. The recommendations are valid for the specific information and conditions listed. If there are additions, corrections, or changes to the above information or conditions, it is necessary that we be notified so that we can determine whether the new information or conditions affect our recommendations.

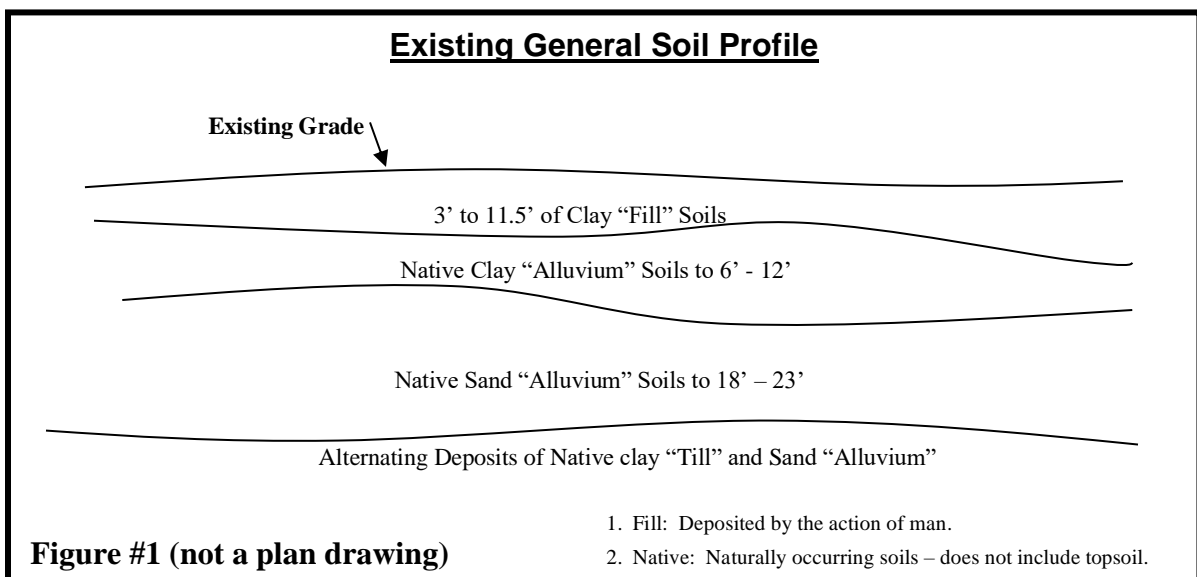
Our design assumptions include a minimum theoretical safety factor of 3 with respect to shearing or base failure of the foundations. We assume an allowable total settlement of 1 inch and a differential settlement of up to ½ inch over a length of 30 feet.

The recommendations in this report assume the location of the proposed building is within 50 feet of the boring locations as shown on the attached sketch. If the location of the proposed building is changed so as not to be within this distance for each of the respective borings, the opinions and recommendation of this report may not be applicable, and we must be contacted for additional review and potentially additional borings.

## 2.1 Discussion

- **Soil Profile**

The boring logs suggest that the general soil profile in the area of the proposed structure consists of about 3 to 11.5 feet of clay “fill” soils overlying native clay “alluvium” (water deposited soils) to depths of about 6 to 12 feet below the existing grades. The native clay “alluvium” is underlain by native sand “alluvium” to depths of 18 to 23 feet below the existing grades followed by alternating deposits of native clay “till” (glacial deposited soils) and sand “alluvium” which extend to the termination depths of the borings at 21 and 36 feet below the existing grades. Please refer to Figure #1 below and the attached boring logs.



Note: The existing “fill” soils are assumed to be “undocumented” and thus, they are considered uncontrolled fill that were not monitored nor tested for quality and compaction during placement.



- **General**

Based on the subsurface conditions encountered at the boring locations, it is our opinion that the native soils at the site will support the proposed structure on shallow spread footing foundations, provided the recommendations in this report are performed and the estimated settlements are acceptable. Listed below are some of the more prominent site conditions.

- **FOOTING AREAS:** Based on the boring logs, “fill” soils exist at the site and extend from the surface to depths of about 3 to 11.5 feet below the existing grades. In our opinion, the “fill” soils are not suitable for support of the footings and should be removed from the footing areas. Also, native clay “alluvium” soils exist below the “fill” soils to depths of 6 to 12 feet and, in some areas, are weak relative to support of the proposed building. However, the underlying sand soils are generally strong relative to support of the proposed building. Thus, to help limit differential foundation settlement, maximize the soil bearing pressure, and provide for uniform excavations, it is our opinion that the footings of the proposed structure should rest on the native sand “alluvium” soils that exist below the native clay “alluvium” soils or on engineered fill placed above the native sand “alluvium” soils.
- **FLOOR AREA:** As mentioned above, “fill” soils were encountered at the site and extend from the surface to depths of about 3 to 11.5 feet below the existing grades. Similar to the footing areas, the existing “fill” soils are not suitable for support of the floor and should be removed from the floor areas. However, the underlying native clay “alluvium” soils can be used for support of the uniform floor loadings of the proposed building.

## **2.2 Site Preparations**

**FOOTINGS (Interior, Exterior, & Thickened Edged):** In our opinion, the existing “fill” soils and the native clay “alluvium” soils should not be used for support of the footings. Thus, site preparations in the footing areas should consist of the excavation of the existing “fill” soils and the native clay “alluvium” soils to expose the underlying native sand “alluvium” soils. The native sand soils were encountered at depths of about 6 to 12 feet below the existing grades at the boring locations.

During the footing area excavations, the exposed native sand “alluvium” soils at the bottom of the excavations should be observed by STI’s on-site Geotechnical Engineer. The Geotechnical Engineer should perform shallow hand auger borings. Soft, sheared, disturbed, loose, or otherwise weak soils should be excavated as directed by the Geotechnical Engineer.



Upon the Geotechnical Engineer’s observation and approval of the exposed native sand soils, the footings can then be constructed to rest on the competent native sand soils, or on engineered fill soils (soils that have been compacted and tested to a specified density) placed above the native clay sand soils to meet the design footing grade elevation. Refer to “Engineered Fill” recommendations on pages 9-10.

The approximate minimum recommended footing area excavation depths and corresponding elevations at each boring location are shown in Table 1 below. They are also noted on each of the attached boring logs. Also, refer to Figure #2 on page 6 showing “Typical Building Site Preparations.” Keep in mind that the required footing excavation depths may be significantly different at other locations at the site, and the on-site Geotechnical Engineer may require the footing excavation depths to be significantly different at those other locations.

NOTE: The existing rubble, loose soils, utilities, etc. of the existing building demolition must be completely removed from the footing areas. Tree roots should be removed to their full depth. These might require deeper excavations than listed in Table 1 below. We strongly recommend that a Geotechnical Engineer or geotechnical representative be on-site full time during the final removal of the existing building foundation components, loose soil, utilities tree roots, etc.

**TABLE 1 – FOOTING AREA EXCAVATIONS**

Boring #	<u>FOOTING EXCAVATION DEPTHS</u>	<u>FOOTING EXCAVATION ELEVATIONS</u>
	Minimum Depths of Excavation Below Existing Grade (Feet)	Corresponding Minimum Excavation Elevations (Feet)*
1	10.5	1289.7
2	9	1290.2
3	11.5	1287.4
4	6	1293.3
5	6.5	1293.3
6	9	1291.3
7	7	1291.3
8	9	1290.1
9	9	1289.8
10	8.5	1291.6



11	7	1293.2
12	7	1293.3
13	6	1294.4
14	12	1288.0

*\*Elevations based on survey data provided by Helms & Assoc.*

**FLOOR SLAB:** It is our opinion that the existing “fill” soils should not be used for support of the floor slab. However, if the existing native soils are not disturbed, they can be used for support of the floor slab. Therefore, we recommend that site preparations for the floor slab area consist of excavating the existing “fill” soils to expose the underlying native clay “alluvium” soils or the existing native sand “alluvium” soils. However, to help limit differential movement of the floor, at least 3.5 feet of engineered fill should be placed below the new floor such that the new floor is resting on at least 3.5 feet of engineered fill.

During the floor area excavations, the exposed soils at the bottom of the excavations should be observed by STI’s on-site Geotechnical Engineer. The Geotechnical Engineer should perform shallow hand auger borings into the exposed soils. Soft, sheared, disturbed, loose, or otherwise weak soils should be excavated and replaced with engineered fill as directed by the Geotechnical Engineer. Upon the Geotechnical Engineer’s observation and approval of the exposed soils, engineered fill should be placed above the exposed native soils to meet the design floor grade elevation. Refer to the “Engineered Fill” recommendations listed on pages 9-10.

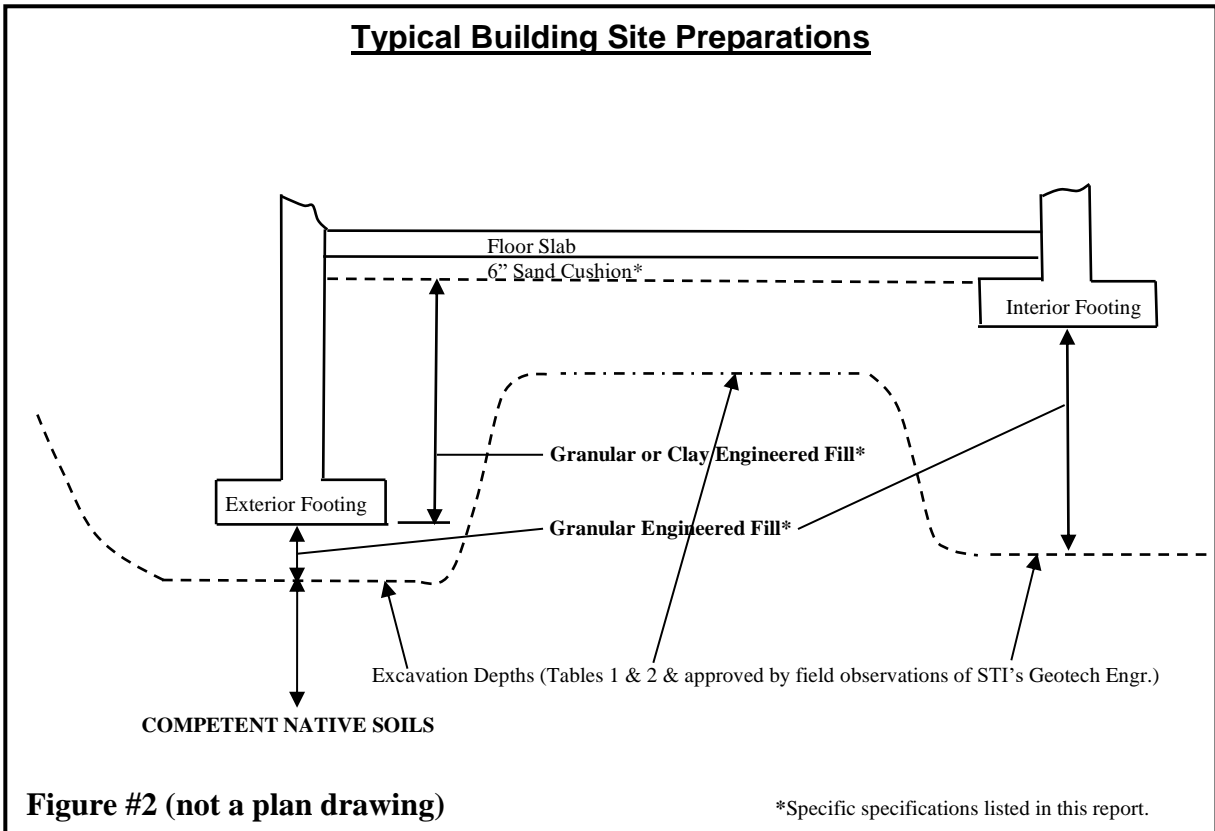
The approximate minimum recommended floor area excavation depths and corresponding elevations at each boring location are shown in Table 2 on page 6. They are also noted on each of the attached boring logs. Also, refer to Figure #2 on page 6 showing “Typical Building Site Preparations.” Keep in mind that the required floor excavation depths may be significantly different at other locations at the site, and the on-site Geotechnical Engineer may require the floor excavation depths to be significantly at those other locations.

**NOTE:** The existing rubble, loose soils, utilities, etc. of the existing building demolition must be completely removed from the floor areas. Tree roots should be removed to their full depth. These might require deeper excavations than listed in Table 2 below. We strongly recommend that a Geotechnical Engineer or geotechnical representative be on-site full time during the final removal of the existing building foundation components, floors, loose soil, utilities, tree roots, etc.

**TABLE 2 – FLOOR AREA EXCAVATIONS**

Boring #	<u>FLOOR EXCAVATION DEPTHS</u>	<u>FLOOR EXCAVATION ELEVATIONS</u>
	Minimum Depths of Excavation Below Existing Grade (Feet)	Corresponding Minimum Excavation Elevations (Feet)*
1	7	1293.2
2	4	1295.2
3	11.5	1287.4
4	6	1293.3
5	6.5	1293.3
6	6.5	1293.8
7	4.5	1293.8
8	6.5	1292.6
9	4	1294.8
10	4.5	1295.6
11	4	1296.2
12	4	1296.3
13	3	1297.4
14	3	1297.0

\*Elevations based on survey data provided by Helms & Assoc.





- **Geotechnical Engineer's Observations**

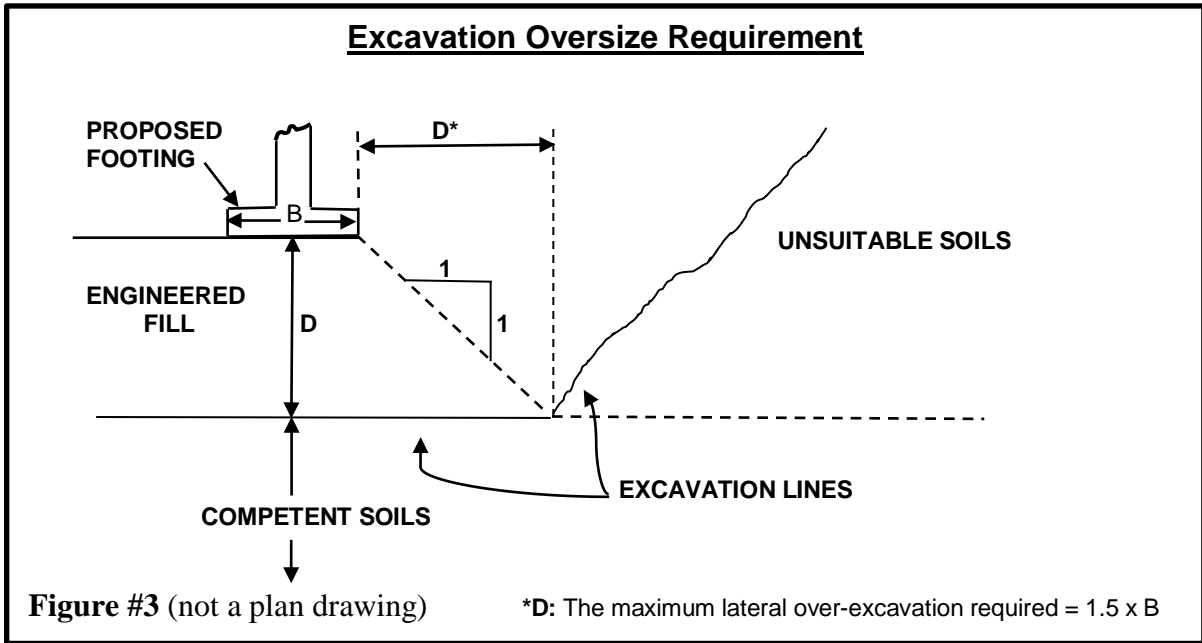
Soil types and strengths can sometimes vary around and in-between the borings. Some soils may not be as competent for support of the proposed building as those encountered in the borings. Therefore, we recommend that the soils exposed in the final footing and floor area excavations of the proposed structure(s) be observed in the field by a Geotechnical Engineer from Soil Technologies, Inc (STI). The Geotechnical Engineer will compare the exposed soils with the soils listed on the boring logs of this report to determine if they are the correct soil types and strengths. Once the type and strength of the soils exposed in the excavations are judged competent by STI's Geotechnical Engineer, the engineered fill, concrete footings, and floors can be placed as needed. STI's Geotechnical Engineer will provide a written report detailing the observations of the exposed soils in the footing and floor slab areas. **The general contractor or owner's representative should contact STI's Geotechnical Engineer to perform these field observations prior to the earthwork phase of the project.**

**Note: This report and its recommendations are a two-step process.** The first step is the implementation of the recommendations of this report during the design of the project. The second step is the implementation of these recommendations during construction. **The second step is critical to the success of the project, and it must include the field observations of the soils by STI's Geotechnical Engineer during the earthwork phase of the project.** It has been our experience that the lack of field observations by the Geotechnical Engineer during the earthwork phase of the project can result in oversight, in part or in whole, of the recommendations of the soils report. Therefore, the absence of our field observations of the soils during the earthwork phase, especially during the footing and floor area excavations, shall relieve us of the liability of the work performed during that phase of the project and its effect on related components. Also, refer to IBC Chapter 17, "Special Inspections" Table 1705.6.

- **Excavation Oversize Requirements**

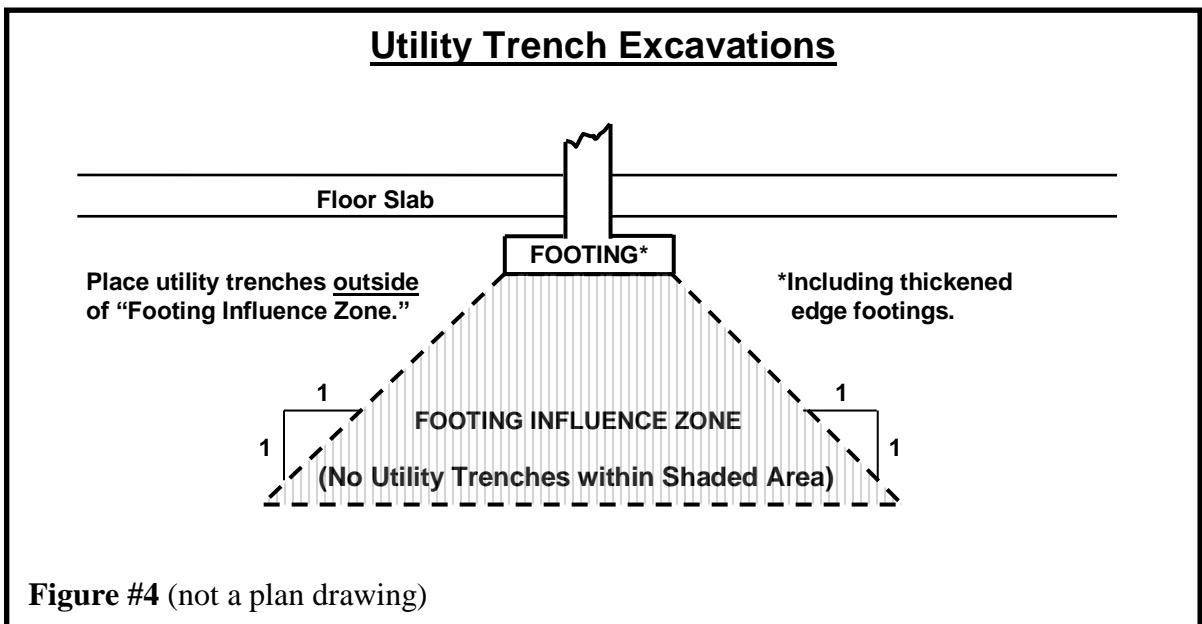
Engineered fill placed below the footings should be oversized one foot laterally for each foot of engineered fill placed below the footings (extend the excavation outwards from the outer edges of the footings a distance of 1 foot for every 1 foot of engineered fill placed below the footings). The maximum lateral over-excavation required is 1.5 times the width of the footing. Please see Figure #3 below illustrating the 1:1 excavation oversize requirement.





- **Utility Trenches**

Utility trenches within the building footprint (and in structural areas outside the building footprint) should be refilled with engineered fill. The engineered fill should be compacted and tested to the specified density listed on page 10. In addition, utility trenches should not be placed within the influence zone of the footings, including the influence zone of thickened edge footings. Please refer to Figure #4 below. If it is necessary to install a utility by crossing beneath an existing footing (new or old), that portion of the utility trench below the existing footing should be refilled with a lean concrete mix (flowable fill).





We recommend that consideration be given to placing a polyethylene vapor membrane (retarder) beneath the floor slab, especially if there are areas where moisture sensitive floor coverings are planned. If used, consideration should be given to the potential of curling of the concrete floor due to the presence of the membrane. Placing the membrane at least 2 inches beneath the surface of the sand cushion can help to minimize the potential for curling of the concrete floor. The use and placement of the membrane should be decided by the architect or structural engineer of record. The slab designer should refer to ACI 302 and/or ACI 360 for procedures and cautions regarding the use and placement of a vapor retarder.

- **Subgrade Modulus**

Placement of engineered fill soils from the bottom of the excavation to the design slab elevation will generally increase the overall modulus. The amount of increase is dependent on the type and depth of engineered fill placed. A granular engineered fill would generally provide a higher modulus than clay engineered fill. For design purposes, we have provided estimated subgrade modulus (“K”) values as listed below in Table 3. The subgrade modulus values are assumed to be at the surface of the described soil type compacted to at least 97% of the Standard Proctor density (ASTM: D698). Please note that these values are only estimates based on soil types and densities. “Plate Load Tests” should be performed to provide specific “K” values.

**TABLE 3**

<u>Soil Type</u> (Minimum 95% Compaction) and/or approved by the on-site Geotechnical Engineer)	<u>Depth of Engineered Sand Soils</u>	<u>Estimated Subgrade Modulus (pci)*</u>
Engineered Sand Soils over Lean Clay Soils	6” to 9”	130
Engineered Sand Soils over Lean Clay Soils	9” to 12”	170
Engineered Sand Soils over Lean Clay Soils	15” to 18”	200
Engineered Sand Soils over Lean Clay Soils	More than 20”	230

\*Values should be reduced (up to 40%) for exterior pavements or slabs exposed to freeze thaw cycles.

- **Engineered Fill - Foundation and Floor Areas**

We recommend the following types of engineered fill and compaction of engineered fill.

*NOTE: Soils are classified as sand if more than 50% (by weight) is retained above the #200 sieve.*

<p><b>Below the footings:</b></p>	<p><b><u>If moist to dry soil conditions exist in the excavation:</u></b> Use a granular engineered fill such as a pit run or processed sand or sand with gravel (SP, SW, SM, and SC). The pit run and processed sand should have a maximum gravel/cobble size of 3 inches, at least 13% passing the #40 sieve, and less than 15% passing the #200 sieve.</p> <p><b><u>If wet or saturated soil conditions exist in the excavation:</u></b> A clean and medium to coarse grained sand or sand with gravel (SP or SW) will likely be required until at least 2 feet above the wet or saturated soil level in order to achieve the required compaction. The clean sand should have a maximum gravel/cobble size of 2 inches, 13% to 40% passing the #40 sieve, and less than 5% passing the #200 sieve. A 6 to 8-inch layer of 3/8" or less rock can be placed at the bottom of the excavation for stabilization purposes.</p>	
<p><b>Above the footings and more than 6 inches below the bottom of the floor slab (including utility trenches):</b></p>	<p><b><u>If moist to dry soil conditions exist in the excavation:</u></b> Use either a pit run or processed sand or sand with gravel (SP, SW, SM, and SC) or a non-organic and non-expansive lean clay (CL). The pit run and processed sand should have a maximum gravel/cobble size of 3 inches and at least 13% passing the #40 sieve. The clay should have a liquid limit of less than 45.</p> <p><b><u>NOTE the following:</u></b></p> <ul style="list-style-type: none"> <li>- The on-site, non-organic lean clay soils (brown) are acceptable as CL engineered fill.</li> <li>- Organic soils (topsoil) should not be used for engineered fill.</li> <li>- Fat clay soil (CH) should not be used for engineered fill.</li> </ul>	
<p><b>6-inch or more sand cushion below floor slab (capillary break):</b></p>	<p>The final 6" or more of engineered fill (fill placed directly beneath the floor slab) should consist of free draining sand (SP or SW) having a maximum gravel size of 1" and with less than <b>10%</b> passing the #200 sieve by weight. The purpose of the sand cushion is to provide a working surface for the placement of concrete and also to serve as a capillary barrier.</p>	
<p><b>Compaction of engineered fill: (Less than 6 feet total thickness):</b></p>	<ul style="list-style-type: none"> <li>- Below Footings <u>and in the footing influence zone (pg. 8):</u></li> <li>- Below Floor Slabs:</li> <li>- Utility Trenches (inside &amp; within 10' outside of the building):</li> </ul>	<p><b><u>Minimum % Compaction</u></b></p> <ul style="list-style-type: none"> <li>➤ 97% of the ASTM: D698*</li> <li>➤ 97% of the ASTM: D698*</li> <li>➤ Same as "Below Floor Slabs"</li> </ul> <p><small>*Standard Proctor Density</small></p>

• **Compaction Equipment and Placement of Engineered Fill**

Engineered fill should be compacted in maximum 12-inch loose lifts using heavy, self-propelled compaction equipment, or maximum 6-inch loose lifts using hand-operated compaction equipment. Smooth-faced, vibratory compaction equipment should be used for compaction of



granular engineered fill (sand). Clay engineered fill should be placed at a moisture content ranging from -4% to +2% of the optimum moisture content as determined by the Standard Proctor (ASTM: D698). The moisture content of granular engineered fill should be such to achieve the specified compaction. The moisture content of the clay soils should be maintained until placement of the footings and floor slabs. The engineered fill should be free of frost and should not be placed on frozen soils. Please refer to the attached “Precautions...During Cold Weather.”

### 2.3 Foundations

- **Allowable Soil Bearing Pressure**

In our opinion, the proposed structure can be supported on a shallow spread footing foundation system (column pads and/or strip footings). We recommend that the spread footings be designed using **an allowable soil bearing pressure of up to 3500 psf.**

The allowable soil bearing pressure listed above assumes that the site is prepared as recommended in section 2.2 Site Preparations and that the project is constructed as per the information and conditions listed in section 1.1 Project Information. **If the project information or conditions are changed, STI must be notified in writing for additional review and possibly revised recommendations.**

The allowable soil bearing pressure is based on our judgment of the soil conditions at the boring locations along with recommended compaction levels and our experience with similar soil conditions. The allowable soil bearing pressure is a net pressure and can be increased 30% for short-term loadings such as wind loads.

- **Foundation Settlement**

The recommendations in this report should provide a theoretical safety factor of at least 3.0 against localized shear failure of the footings. Long term total settlements of the building are estimated to be less than 1 inch with estimated differential settlements less than ½ inch over a 30-foot length.

The above estimated settlements are based on the above recommended soil bearing pressure, the site being prepared as recommended in section 2.2 Site Preparations, and the project being constructed as per the information and conditions listed in section 1.1 Project Information: ... **the finished floor elevations will be at 1301.5 feet, column loads will be a maximum of 300 kips**



**(total dead and live loads) with continuous footing loads less than 7 kips/ft (total dead and live loads), etc.**

Please note that the total and differential settlement of the footings (and floor) could be significantly greater than the above estimates if improper construction practices are used. These practices may include but are not limited to: allowing snow or ice to be incorporated into the engineered fill soils, allowing the soils below the footings or floor to be saturated or freeze prior to or after their placement, inadequate compaction of engineered fill soils, supporting the footings or floor on expansive soils such as fat clay (CH) or on soils that were inadvertently loosened during construction, etc.

- **Soil/Concrete Sliding Friction**

For horizontal loads, we recommend a soil-concrete friction factor of 0.35. The frictional factor should be applied only to the base (bottom) of the concrete foundation units and only the net downward vertical load should be used to determine the friction. An appropriate safety factor should be applied to the calculated lateral values.

- **Frost Depth**

To avoid frost related movement of heated structures during their entire life, the exterior footings should be placed at or below a frost depth as per city code, or a minimum 4½ feet below finished grade. Interior footings of heated buildings can be placed at shallower depths provided they are protected from frost during and after construction. To avoid frost related movement of unheated structures, canopies, etc., both the exterior and interior footings should be placed at least 5½ feet below the finished exterior grade or the floor slab, as appropriate.

## **2.4 Lateral Earth Pressures**

For below grade retaining walls (including basement, tunnel, or lower level walls) they should be designed to resist the lateral pressures of retained backfill soils. For calculation of lateral earth pressures, we recommend the estimated ultimate pressure values (no safety factor included) listed in the tables below. An appropriate safety factor should be applied to the calculated design values. The pressure values are equivalent to that generated by a fluid. For active earth pressure, the retaining wall must rotate about the base. For passive pressures, the wall must move horizontally to mobilize resistance.

**TABLE 4**  
**Equivalent Fluid Pressures (Above Groundwater – Drained Condition)**

Soil Type	Active Pressure (pcf)*	At Rest Pressure (pcf)*	Passive Pressure (pcf)*
Free Draining Sands (SP, SW, SP-SM, SW-SM)	35	55	330
Silty Sands & Clayey Sands (SM & SC)	41	63	350
Lean Clay & Sandy Lean Clay (CL)	42	65	300

\*pcf = pounds per cubic foot    \*Passive pressure values should be reduced at least 40% due to loss of strength if soil is exposed to freeze-thaw cycles.

**TABLE 5**  
**Equivalent Fluid Pressures (Submerged Conditions)**

Soil Type	Active Pressure (pcf)*	At Rest Pressure (pcf)*	Passive Pressure (pcf)*
Free Draining Sands (SP, SW, SP-SM, SW-SM)	78	87	190
Silty Sands and Clayey Sands (SM & SC)	82	92	220
Lean Clay & Sandy Lean Clay (CL)	85	95	180

\*pcf = pounds per cubic foot    \*Passive pressure values should be reduced at least 40% due to loss of strength if soil is exposed to freeze-thaw cycles.

The above values are not applicable to dynamic loading conditions, loading from heavy compaction equipment, or the weight of an adjacent foundation. or overburden pressure. If overburden weight exists above the retaining structure, such as would exist for a below grade tunnel, an overburden factor equal to the coefficient of the active pressure or at rest pressure times the overburden weight should be added to the “active” and “at rest” fluid pressures listed in the tables above. We recommend using a coefficient of at-rest lateral earth pressure of 0.45 for sand backfill and 0.5 for the native lean clay backfill. Additionally, the stated parameters for the submerged conditions should be used according to high ground water records.

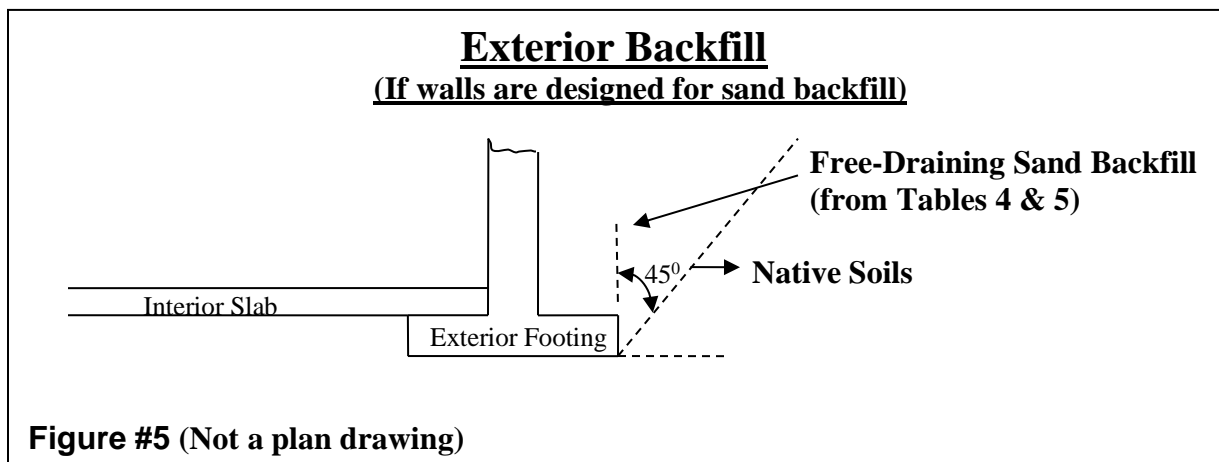
The above values assume that the on-site soils adjacent to the retaining structure are in their undisturbed state or, if laterally over-excavated and backfilled, compacted to a density of 95% to 102% of the Standard Proctor density.

The below grade structures should be waterproofed if possible. Drain tile systems should be incorporated in the design for below grade structures. The drain tile lines should be sloped to provide positive gravity drainage to daylight or to a sump pit and pump. Rigid PCV lines may be required to achieve continuous positive drainage. Also, design considerations should be given to

buoyancy factors in the case that dewatering is interrupted during the life of the structure. Unit weights of 110 pcf and 20 pcf can be used for compacted soil above and below the groundwater level, respectively.

Please note that if the equivalent fluid pressures listed for the free-draining sands (SP), (SW), (SP-SM) or (SW-SM) are used in the design, we suggest that full time on-site observations and soil tests of the backfill be performed to ensure that only free-draining sands are actually used for all the retaining wall backfill. If there is some doubt that the observations and testing is going to be performed, we suggest that the more conservative pressures listed for the (CL) be used in design.

If the walls are designed using the equivalent fluid pressures for a “free-draining sand” (SP, SW, SP-SM, SW-SM), the free-draining sand backfill soils around the perimeter of the structure and related components should extend outward at a 45° (or greater) “wedge” angle. Please see figure #5 below. The placement of the free-draining sand backfill should be verified in the field by the geotechnical engineer. Also, based on the design of the retaining wall(s), the structural engineer should specify on the structural plans the type of soil(s) that can be used for exterior backfill of the retaining walls (SP, SW, SP-SM, SW-SM, SM, SC, or CL) and if a 45° “wedge” is required.



### **2.5 Exterior Backfill**

- **Soil Type**

Unless retaining structures are specifically designed for lateral pressures of a “free-draining sand” (SP, SW, SP-SM, SW-SM), it is our opinion that the on-site or imported non-organic and non-expansive sand (SP, SW, SM, or SC), or the lean clay (CL), or silt (ML) soils should be used for exterior backfill soils (fill soils placed outside the exterior foundation walls and adjacent areas).



Fat clay soils (CH) can also be used but are not desired; and the Geotechnical Engineer should approve their use and placement. Utility trenches or other excavations leading to the building foundations or floor areas should also be backfilled with the on-site or imported non-organic and non-expansive sand, clay, or silt soils. However, if circumstances require that sand or silt backfill is used within 10 feet of the proposed structure, an 18-inch compacted clay cap or an asphalt or concrete pavement should be placed at the surface of the backfill to help minimize surface water from reaching the foundation soils. (Please refer to Figure #6 on page 16.)

Organic soils (usually black colored) should not be used for exterior backfill, except for cover material. Also, soils that can expand, such as fat clay (CH), should not be used for backfill against retaining type structures or below slabs, sidewalks, driveways, etc.

- **Compaction and Placement of Exterior Backfill**

Exterior backfill soils placed along foundation walls and in adjacent areas such as beneath lawns, sidewalks, traffic areas, or in utility line trenches, should be compacted to the following minimum percent densities as listed in Table 6 below. Note: Exterior backfill soils placed within the “influence zone” below the footings should be compacted to the minimum densities listed for footings on page 10.

**TABLE 6**

<b><u>Compaction of Exterior Backfill</u></b>	Light Traffic Areas (autos, driveways, sidewalks, etc. - below granular base):	95% of the ASTM: D698*
	Heavy Truck Traffic Areas (below granular base):	97% of the ASTM: D698*
	Utility lines and other backfill within 10 feet of the proposed structure(s) except in traffic areas use above %.	95% of the ASTM: D698*
	Non- Traffic Areas (lawns, landscaping areas, etc.) greater than 10 feet of the proposed structure(s)	92% of the ASTM: D698*

\*Standard Proctor Density

Exterior backfill soils should be compacted in maximum 12-inch loose lifts using heavy, self-propelled compaction equipment, or maximum 6-inch loose lifts using hand-operated compaction equipment. Clay exterior backfill soils should be placed at a moisture content ranging from -4% to +2% of the optimum moisture content as determined by the Standard Proctor. The moisture content of granular exterior backfill soils (sand) should be such to achieve the specified compaction. Smooth-faced, vibratory compaction equipment should be used for compaction of granular backfill soils. The backfill material should be free of frost and should not be placed on frozen soils. Please refer to the “Precautions...During Cold Weather” attached to this report.



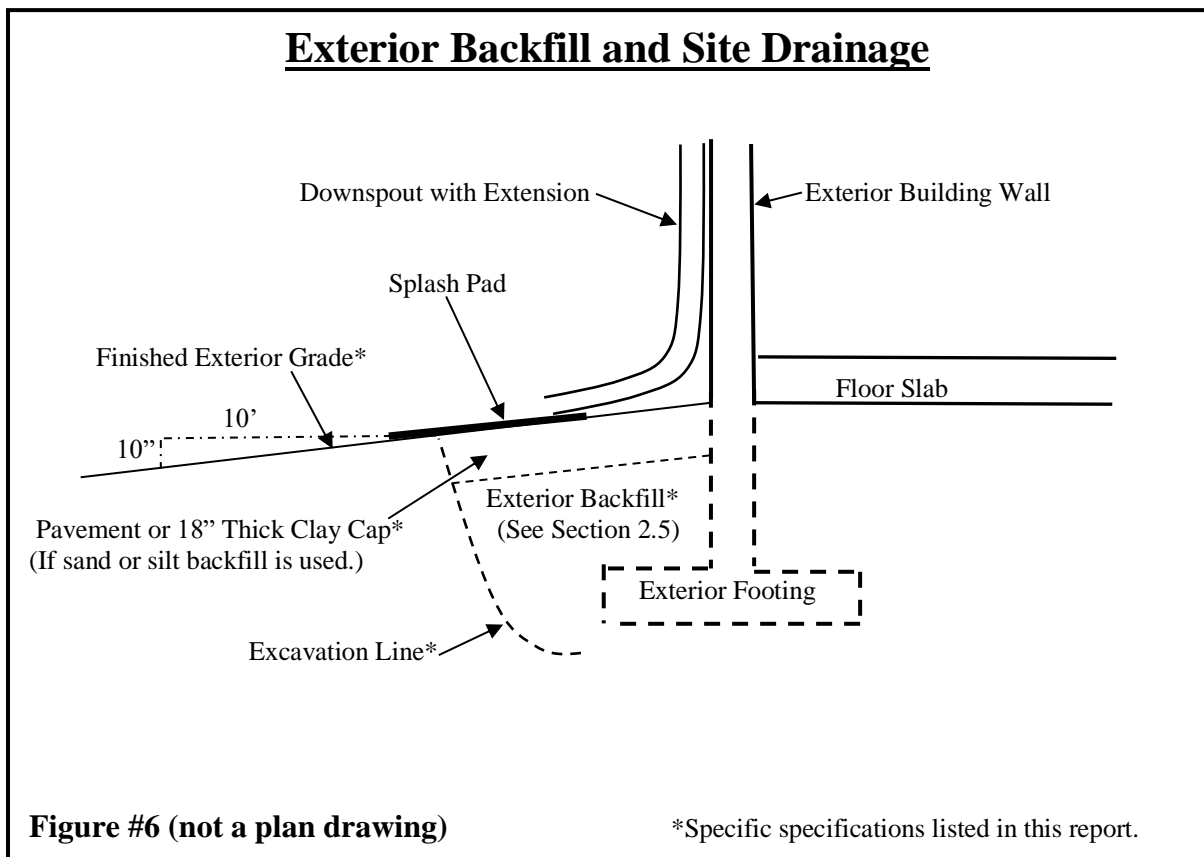
**2. 6 Site Drainage**

• **Site Grading**

Proper drainage should be maintained during and after construction. General site grading should not allow water to pond in the building areas or in the excavations. Any ponded water should be removed immediately. Finished grades around the perimeter of the structure should be sloped away from the structure with a minimum slope of 1 inch per foot for at least 10 feet beyond the excavation lines. (Please refer to Figure #6 below.) The slope can be reduced to ¼ inch per foot in areas that are completely surfaced and properly sealed with asphalt or concrete. The slope and proper drainage should be maintained throughout the life of the structure.

• **Roof Runoff**

Roof runoff water should be controlled by a system of downspouts and gutters with proper extensions to remove the runoff water away from the structure. The gutters and downspouts, as well as splash pads and extensions, should be maintained so that leakage does not occur adjacent to the structure. (Please refer to Figure #6 below.)





### **3.0 CONSTRUCTION AND DESIGN CONSIDERATIONS**

#### **3.1 Site Excavation**

- **Soil Disturbance & Moisture Changes**

The native clay soils encountered at the site are sensitive to disturbance and may experience strength loss under the influence of construction traffic and/or additional moisture. Construction traffic in areas where these soils are used for structural or floor support should be limited. If self-propelled compaction equipment is used, extra care should be taken so as not to disturb (weaken) the native soils due to excess weight and/or vibration of the equipment. If the soil used for structural, floor, or wheel traffic support becomes frozen, desiccated, saturated, or is disturbed, the affected soil should be removed; or if the disturbance is shallow, recompacted in-place prior to placement of additional fill or structural units.

Also, the site preparations should include complete removal of all remnants of previously existing structures, structural units, utilities, tree roots, etc. Excavations to remove these items, or intrusions (accidental, deliberate, or otherwise) should be backfilled with engineered fill and compacted to the specified density listed on page 10. As previously noted, we strongly recommend that a Geotechnical Engineer or geotechnical representative be on-site full time during the final removal of the existing building foundation components, loose soil, utilities, etc. Excess settlements of the proposed building may develop if residual components of the building demolition are left in-place.

The excavations should be left open a minimal amount of time to prevent strength loss of these soils by sluffing of soils, ponding of water, or changes in their in-situ moisture content. In addition, surface drainage away from the excavations should be provided during construction. Also, the excavations should be done with an excavation bucket having a smooth cutting edge.

- **Dewatering**

We do not anticipate that the footing or floor excavations will extend below the groundwater level, and thus, dewatering techniques for proper placement of engineered fill and/or the footings/floor slab system are not anticipated, but they should not be ruled out. Please refer to the groundwater measurements listed at the bottom of the attached boring logs.



If groundwater is encountered, the excavations and dewatering must be such as to provide for physical access and observations of the soils at the bottom of the excavations, and for proper compaction of the engineered fill soils at the bottom of excavations. Also, the excavations should remain dewatered until placement of the engineered fill, foundations, and lower portions of the exterior backfill are completed.

- **Seismic Category**

Based on IBC 2021, the subsurface conditions encountered at the site, and our experience with other general geologic conditions for this area, it is our opinion that Site Class D should be used to determine site coefficients and seismic design category.

- **Expansion Joint and Structural Movement Considerations**

We recommend the placement of an expansion joint between the proposed building and an existing structure or its corridors to accommodate any differential movement that may occur. Underground piping between the structures should be designed with flexible couplings, and the utility knockouts in foundation walls should be oversized so deflections in alignment do not result in breakage or distress.

- **Existing Structure**

If the foundations for the proposed building are placed next to an existing structure, care should be taken not to undermine the foundations of the existing structure. Also, to prevent additional loading on the existing foundations, the new foundations should rest at or below the depth of the existing foundations. If the new foundations rest within a 45° envelope below the existing foundations, the new foundations may need to be designed for increased loading caused by the overlying pressures of the existing footings. Please contact us if this situation develops in the design.

- **Moisture or Frost Related Movement**

Exterior architectural features, slabs, and utilities can experience moisture or frost related movement which can result in distress. The existing clay soils likely have a moderate to high susceptibility of frost related movement. The risk of this potential movement and subsequent distress can be reduced (but not necessarily eliminated) by:

1. The use of control joints.
2. The use of self-adjusting utility connections.
3. Allowing for movement for exterior features attached to structural elements.



4. The use of significant depths of clean granular fill beneath slabs-on-grade (floors), driveways, sidewalk, etc.
5. Proper drainage away from exterior slabs-on-grade.
6. Placement of rigid insulation sheeting under at least 10 inches of free draining granular fill.

If limited frost movement is desired below movement sensitive surfaces, such as unheated interior or exterior slabs, sidewalks, driveways, etc., significant depths (at least 36") of free-draining granular fill having less than 12% passing the #200 sieve should be placed for their support.

- **OSHA**

Excavations must comply with the requirements of local, state, federal and other prescribed safety regulations, e.g., OSHA Part 1926, Subpart P, "Excavations." Reference to these requirements should be included in the project specifications.

### **3.2 Concrete**

The concrete used for the project should be composed of a quality mix that has proven success, or a mix design should be established for proper proportions of aggregate, cement, water, and any admixtures. The concrete should be handled, placed, and cured according to the recommendations in the current **ACI** manual. Improper mix designs, placement methods, saw joints, curing methods, temperatures, etc. could result in the concrete experiencing excessive shrinkage, cracking, curling, pop-outs, and other distress. These items should be monitored by a qualified engineer during construction. Also, floor covering should not be placed on the slab until it is nearly fully cured. Typically, flooring manufactures require 3 to 4 weeks or more of curing time at room temperature (60° F or more) prior to placement of flooring.

### **4.0 EXCAVATION OBERVATION AND TESTING**

The recommendations contained in this report are based on the subsurface conditions found at the boring locations. It is possible that there are soil conditions on the site that were not represented by the borings. Consequently, on-site observation by a qualified Geotechnical Engineer during construction is considered integral to the successful implementation of the recommendations.

We recommend that a Geotechnical Engineer from Soil Technologies, Inc. be on-site during the excavation operations. The engineer will judge if the soils exposed at the bottom and along the



sidewalls of the excavations are adequate for support of the floor slab and for the foundations designed with the allowable soil bearing pressure recommended in this report. The Geotechnical Engineer should also be on-site immediately prior to placement of the sand cushion and reinforcing steel of floor slab to verify that the floor area soils are not frozen, rutted, desiccated, saturated and/or otherwise disturbed. In addition, we recommend that density testing be performed within the sequence of the engineered fill.

## **5.0 GENERAL EXPLORATION INFORMATION**

### **5.1 Scope of Exploration**

We have conducted a soil exploration program for the proposed project. The scope of our services under this exploration is limited to the following:

1. To perform soil borings to explore the subsurface soil and groundwater conditions.
2. To perform nominal laboratory tests to aid in judging the soil properties.
3. To provide a geotechnical engineering report including the results of the field and laboratory tests as well as geotechnical engineering opinions and recommendations that are relative to the project.

Fourteen standard penetration test borings were performed at the site on November 28 & 29, 2023. The borings were performed at the locations shown on the attached sketch. Some settlement of the soils used to fill the open bore holes should be anticipated and closure of the holes is the responsibility of the client or property owner.

### **5.2 Site Surface Conditions**

The site of the proposed construction is located at the existing Briscoe & Lincoln halls, just north of the Graham Hall and the Student Center at Northern State University in Aberdeen, SD. The site is bordered on the north by 12<sup>th</sup> Ave and on the west by S. Washington Street. The site surface at the time of our soil borings consisted of mostly grass. The overall general topography of the site is relatively level. The ground elevations at the boring locations were provided by Helms and Assoc. of Aberdeen. The elevations are listed at the top of the attached boring logs.



### **5.3 Site Subsurface Conditions**

The subsurface conditions encountered at each boring location are illustrated on the boring logs attached to this report. The logs also indicate the possible geologic origin of the materials encountered (alluvium, till, lacustrine etc.). A description of the general soil profile is also provided in section **2.1 Discussion**. We wish to point out that the subsurface conditions at other times and locations at this site may differ from those found at our boring locations. If different subsurface conditions are encountered during construction, it is necessary that you contact us so that our recommendations can be reviewed.

### **5.4 Water Levels**

Observations for subsurface groundwater were made at the boring locations during our field operations. Groundwater was encountered at the boring locations during our sampling operations. Specific information relative to the groundwater observations is shown at the bottom of the boring logs.

The absence or present level of groundwater in the borings may not represent the actual static groundwater levels. In order to accurately determine the static groundwater level, observations over an extended period are usually required. Such periods of observation are normally not available in a typical soil exploration program. Seasonal and annual fluctuations of the groundwater levels should be expected to occur. It is possible that the subsurface groundwater levels during or after construction could be significantly different than at the time the borings were performed.

### **5.5 Laboratory Test Program**

Soil samples were selected for laboratory tests to determine the engineering and index properties. Where applicable, the tests were performed in accordance with the American Society for Testing and Materials (ASTM) procedures. The test results are shown on the boring logs opposite the samples upon which the tests were made or, they are attached.



## **6.0 LIMITATIONS, REVIEW, USE, AND PURPOSE OF REPORT**

- **Limitations**

The data obtained from the sampling and testing of the soils encountered at the boring locations are the basis of the recommendations submitted in this report. However, variations can occur between these borings and between the samples. Thus, no exploration program can totally reveal the exact subsurface conditions for the entire site. If the subsurface conditions encountered at the time of construction differ from those represented by our borings, it is necessary to contact us so that our opinions and recommendations can be reviewed. Differing subsurface conditions may result in altering our recommendations which may affect construction costs. It is suggested that a contingency be provided for this purpose.

- **Review of Report**

This report is founded on the information and conditions listed in this report for design of the proposed structure(s). We recommend that we be retained to briefly review the geotechnical aspects of the final design and specifications to determine whether any changes in design may have had an effect on the validity of the recommendations contained in this report, and whether our recommendations have been correctly communicated so that their intent has been implemented in the design and specifications. Divergence from our recommendations by the design, specifications, or field applications shall relieve us of the responsibility of that portion of the project and its effect on related components unless our written agreement with such divergence has been obtained. Also, we recommend that this report is provided to the owner(s) along with the architect(s), engineer(s), contractor(s), etc. chosen for design and construction of the project.

- **Use of Report**

This report is intended for the Client's sole use and benefit and solely for the Client's use in the design and construction of the proposed project described herein and in preparation of construction documents. The data, analysis, and recommendations in this report may not be appropriate for extensions of the proposed project or for other projects or purposes. Thus, this report shall not be used or relied on by persons or entities for extensions of the proposed project or for other projects or purposes. Parties contemplating extensions of the proposed project or for other projects or purposes must contact us for additional review. In the absence of our written review and approval, we make no representation and assume no responsibility for extensions of the proposed project or for other projects or purposes. Also, this report is not a bidding document



and is only an aid in the design and construction of the proposed project. Contractors and others involved in the project must draw their own conclusions regarding the site conditions and construction methods.

- **Purpose of Report**

The purpose of this report is to present the results of our field and laboratory tests as well as our geotechnical engineering review and recommendations for the project. Our work is intended for geotechnical purposes only and not to verify the presence or extent of any contamination at the site. If environmental information is desired, an environmental assessment should be conducted.

### **7.0 STANDARD OF CARE**

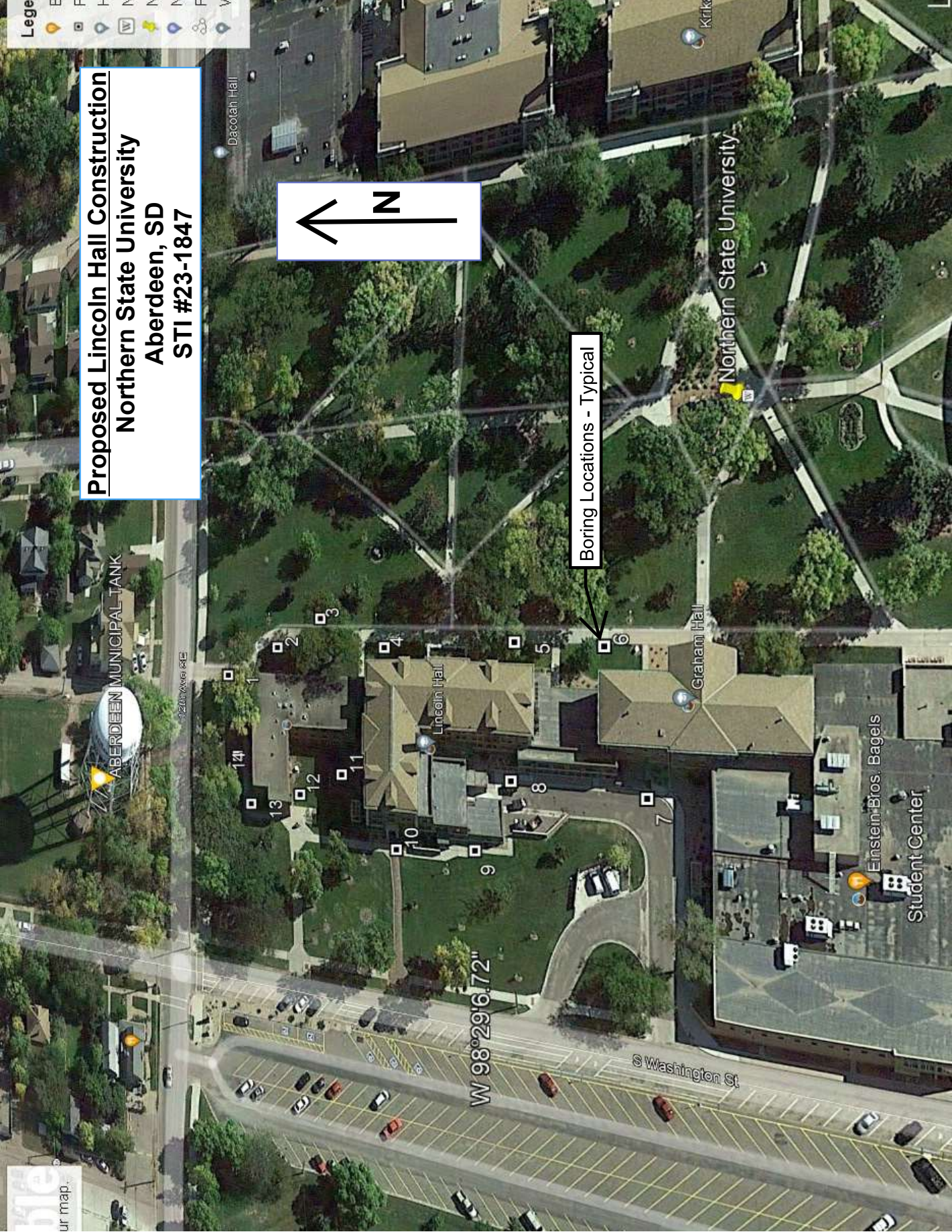
The recommendations contained in this report represent our professional opinions. These opinions were arrived at in accordance with currently accepted engineering procedures at this time and location. Other than this, no other representation, guarantee, or warranty, either expressed or implied, is made.

This report was prepared by:

A handwritten signature in black ink, appearing to read 'Kim E. Stoecker', is written over a horizontal line.

Kim E. Stoecker, PE  
President





**Proposed Lincoln Hall Construction**  
**Northern State University**  
**Aberdeen, SD**  
**STI #23-1847**

Boring Locations - Typical

W 98°29'6.72"

S Washington St

ABERDEEN MUNICIPAL TANK

120th Ave SE

Dacotah Hall

Lincoln Hall

Graham Hall

Northern State University

Einstein Bros. Bagels

Student Center

- Legend
- E
- F
- F
- N
- N
- N
- F
- V

# BORING LOG

**STI JOB #:** 23-1847      **Project:** Lincoln Hall Construction      **BORING #:** 1  
**Location:** NSU - Aberdeen, SD      Sheet 1 of 2

Latitude (North)=      Longitude (West)=      **SURFACE ELEVATION =** 1300.2

Depth (ft.)	Elev. (ft.)	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	Water Level	N. Value	SAMPLE		LABORATORY TESTS							
						Sample No.	Sample Type	Moisture (%)	Dry Density (pcf)	Pocket Pen (tsf)	Qu (psf)	Liquid Limit	Plastic Limit	200 Sieve (%)	
7	1293.2	Fill, Lean Clay, dark brown and black, moist, some Organics	FILL		9	1	SPT								
						6	SPT								
						4	SPT	<b>For Floors:</b> Excavate the Clay "Fill" soils to expose competent native Clay "Alluvium" soils at a depth of at least 7' below existing grade. Final excavation depths shall be determined by STI's on-site Geotechnical Engineer.							
6	SPT														
10.5	1289.7	Lean Clay, brown mottled and gray, moist, firm to stiff (CL)	FINE ALLUVIUM		6	4	SPT								
						4A	3TW	35	84		1950				
						10	SPT	<b>For Footings:</b> Excavate the Clay "Fill" soils and Clay "Alluvium" soils to expose competent native Sand "Alluvium" soils at a depth of at least 10.5' below existing grade. Final excavation depths shall be determined by STI's on-site Geotechnical Engineer.							
12	1288.2	Sand, fine grained, brown, dry, a lens of Clay above 12' (SP)	COARSE ALLUVIUM												
12	1288.2	Silty Sand, fine grained, brown and dark brown, moist to waterbearing, loose to medium dense (SM)	MIXED ALLUVIUM		10	6	SPT	26							13
18	1282.2	Sandy Lean Clay, a little Gravel, dark gray, moist, a lens of waterbearing Sand above 20' and at 30', hard (CL)	TILL	▼											

WATER LEVEL MEASUREMENTS						▼					
						Boring Started: 11/29/2023 at Boring Completed: 11/29/2023 at 12:05					
DATE:	TIME:	SAMPLED TO:	CAVE IN:	CASING:	DEPTH:	Drilling Method: to					
11/29/2023	12:05	31'	20.5'		15'	Drilling Method: 3 1/4" HSA 0' to 29.5'					
						Jet with Drilling Mud: to					
						Hammer Type: Auto Hammer (140 lb.)					
						Crew Chief: R.H.      Logged By:					
						Backfill Method:					

**SOIL TECHNOLOGIES, INC**      28822 124TH ST., MOBRIDGE, SD  
 TELEPHONE: (605) 762-3406

Electronic File Copy 12-12-2023

# BORING LOG

**STI JOB #:** 23-1847      **Project:** Lincoln Hall Construction      **BORING #:** 1  
**Location:** NSU - Aberdeen, SD      Sheet 2 of 2

Latitude (North)= \_\_\_\_\_ Longitude (West)= \_\_\_\_\_ **SURFACE ELEVATION =** \_\_\_\_\_

Depth (ft.)	Elev. (ft.)	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	Water Level	N. Value	SAMPLE		LABORATORY TESTS									
						Sample No.	Sample Type	Moisture (%)	Dry Density (pcf)	Pocket Pen (tsf)	Qu (psf)	Liquid Limit	Plastic Limit	200 Sieve (%)			
		(Continued from Sheet 1)															
31	1269.2	END OF BORING			33	9	SPT										
					35	10	SPT										

<b>WATER LEVEL MEASUREMENTS</b> ▼						<b>Boring Started:</b> See sheet 1 at _____	
						<b>Boring Completed:</b> See sheet 1 at _____	
<b>DATE:</b>	<b>TIME:</b>	<b>SAMPLED TO:</b>	<b>CAVE IN:</b>	<b>CASING:</b>	<b>DEPTH:</b>	<b>Drilling Method:</b> See sheet 1 to _____	
( SEE SHEET 1 )						<b>Drilling Method:</b> See sheet 1 to _____	
						<b>Jet with Drilling Mud:</b> See sheet 1 to _____	
						<b>Hammer Type:</b> Auto Hammer (140 lb.)	
						<b>Crew Chief:</b> See sheet 1 <b>Logged By:</b> See sheet 1	
						<b>Backfill Method:</b> See sheet 1	

**SOIL TECHNOLOGIES, INC**      28822 124TH ST., MOBRIDGE, SD  
 TELEPHONE: (605) 762-3406      FAX: 888-518-2157

Electronic File Copy 12-12-2023

# BORING LOG

STI JOB #: 23-1847		Project: Lincoln Hall Construction		BORING #: 2											
Location: NSU - Aberdeen, SD		Sheet 1 of 1													
Latitude (North)=		Longitude (West)=		SURFACE ELEVATION = 1299.2											
Depth (ft.)	Elev. (ft.)	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	Water Level	N. Value	SAMPLE		LABORATORY TESTS							
						Sample No.	Sample Type	Moisture (%)	Dry Density (pcf)	Pocket Pen (tsf)	Qu (psf)	Liquid Limit	Plastic Limit	200 Sieve (%)	
4	1295.2	Fill, Lean Clay, a trace of Gravel, black and dark brown, moist, some Organics	FILL			7	1	SPT							
						8	2	SPT							
6.5	1292.7	Lean Clay, brown mottled and gray, moist, firm (CL)	FINE ALLUVIUM			7	3	SPT							
		Fat Clay, brown mottled and gray, moist, stiff (CH)				10	4	SPT							
9	1290.2	Clayey Sand, fine grained, brown, moist, loose (SC)	MIXED ALLUVIUM			9	5	SPT							
						9	6	SPT	20						44
14	1285.2	Lean Clay with Sand, brown, moist, lenses of Sand, stiff (CL)				10	7	SPT	25	103	1.8				
		Lean Clay with Sand, a little Gravel, dark gray, moist, very stiff (CL)				22	8	SPT							
21	1278.2	END OF BORING													
<b>WATER LEVEL MEASUREMENTS</b>				▼		Boring Started: 11/29/2023 at Boring Completed: 11/29/2023 at 12:50									
DATE:	TIME:	SAMPLED TO:	CAVE IN:	CASING:	DEPTH:	Drilling Method: to									
11/29/2023	12:50	21'	18.5'		16'	Drilling Method: 3 1/4" HSA 0' to 19.5'									
						Jet with Drilling Mud: to									
						Hammer Type: Auto Hammer (140 lb)									
						Crew Chief: R.H.      Logged By:									
						Backfill Method:									
<b>SOIL TECHNOLOGIES, INC</b>						28822 124TH ST., MOBRIDGE, SD TELEPHONE: (605) 762-3406									

**For Floors:** Excavate the Clay "Fill" soils to expose competent native Clay "Alluvium" soils at a depth of at least 4' below existing grade. Final excavation depths shall be determined by STI's on-site Geotechnical Engineer.

**For Footings:** Excavate the Clay "Fill" soils and Clay "Alluvium" soils to expose competent native Sand "Alluvium" soils at a depth of at least 9' below existing grade. Final excavation depths shall be determined by STI's on-site Geotechnical Engineer.

Electronic File Copy 12-12-2023

# BORING LOG

<b>STI JOB #:</b> 23-1847		<b>Project:</b> Lincoln Hall Construction		<b>BORING #:</b> 3																																
		<b>Location:</b> NSU - Aberdeen, SD		Sheet 1 of 2																																
Latitude (North)=		Longitude (West)=		<b>SURFACE ELEVATION =</b> 1298.9																																
Depth (ft.)	Elev. (ft.)	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	Water Level	N. Value	SAMPLE		LABORATORY TESTS																												
						Sample No.	Sample Type	Moisture (%)	Dry Density (pcf)	Pocket Pen (tsf)	Qu (psf)	Liquid Limit	Plastic Limit	200 Sieve (%)																						
11.5	1287.4	Fill, Lean Clay and Sandy Lean Clay, a little Gravel, brown and black, moist, some Organics	FILL		9	1	SPT																													
								18	1280.9	Lean Clay with Sand, a little Gravel, dark gray, moist, very stiff (CL)	TILL		26	8	SPT																					
																11.5	1287.4	Clayey Sand, fine grained, brown and gray, dry to 14' then waterbearing, loose (SC)	MIXED ALLUVIUM		6	6	SPT													
																								11.5	1287.4	Clayey Sand, fine grained, brown and gray, dry to 14' then waterbearing, loose (SC)	MIXED ALLUVIUM		7	7	SPT					
																																11.5	1287.4	Clayey Sand, fine grained, brown and gray, dry to 14' then waterbearing, loose (SC)	MIXED ALLUVIUM	
11.5	1287.4	Clayey Sand, fine grained, brown and gray, dry to 14' then waterbearing, loose (SC)	MIXED ALLUVIUM		6	6	SPT																													

**For Footings and Floors:** Excavate the Clay "Fill" soils and Clay "Alluvium" soils to expose competent native Sand "Alluvium" soils at a depth of at least 11.5' below existing grade. Final excavation depths shall be determined by STI's on-site Geotechnical Engineer.

<b>WATER LEVEL MEASUREMENTS</b>						Boring Started: 11/29/2023 at	
						Boring Completed: 11/29/2023 at 13:45	
<b>DATE:</b>	<b>TIME:</b>	<b>SAMPLED TO:</b>	<b>CAVE IN:</b>	<b>CASING:</b>	<b>DEPTH:</b>	<b>Drilling Method:</b> to	
11/29/2023	13:45	31'	19'		14.5'	Drilling Method: 3 1/4" HSA 0' to 29.5'	
						Jet with Drilling Mud: to	
						Hammer Type: Auto Hammer (140 lb)	
						Crew Chief: R.H. Logged By:	
						Backfill Method:	

**SOIL TECHNOLOGIES, INC**

28822 124TH ST., MOBRIDGE, SD  
TELEPHONE: (605) 762-3406

Electronic File Copy 12-12-2023

# BORING LOG

<b>STI JOB #:</b> 23-1847		<b>Project:</b> Lincoln Hall Construction		<b>BORING #:</b> 3											
		<b>Location:</b> NSU - Aberdeen, SD		Sheet 2 of 2											
Latitude (North)=		Longitude (West)=		<b>SURFACE ELEVATION =</b>											
Depth (ft.)	Elev. (ft.)	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	Water Level	N. Value	SAMPLE		LABORATORY TESTS							
						Sample No.	Sample Type	Moisture (%)	Dry Density (pcf)	Pocket Pen (tsf)	Qu (psf)	Liquid Limit	Plastic Limit	200 Sieve (%)	
		(Continued from Sheet 1)													
23	1275.9	Sand, fine to medium grained, gray, waterbearing, very dense (SP)	COARSE ALLUVIUM		57	9	SPT								
31	1267.9	END OF BORING			57	10	SPT								
<b>WATER LEVEL MEASUREMENTS</b>				▼		Boring Started: See sheet 1 at									
						Boring Completed: See sheet 1 at									
DATE:	TIME:	SAMPLED TO:	CAVE IN:	CASING:	DEPTH:	Drilling Method: See sheet 1 to									
( SEE SHEET 1 )						Drilling Method: See sheet 1 to									
						Jet with Drilling Mud: See sheet 1 to									
						Hammer Type: Auto Hammer (140 lb)									
						Crew Chief: See sheet 1    Logged By: See sheet 1									
						Backfill Method: See sheet 1									
<b>SOIL TECHNOLOGIES, INC</b>				28822 124TH ST., MOBRIDGE, SD TELEPHONE: (605) 762-3406    FAX: 888-518-2157											

Electronic File Copy 12-12-2023

# BORING LOG

<b>STI JOB #:</b> 23-1847		<b>Project:</b> Lincoln Hall Construction		<b>BORING #:</b> 4												
		<b>Location:</b> NSU - Aberdeen, SD		Sheet 1 of 1												
Latitude (North)=		Longitude (West)=		<b>SURFACE ELEVATION =</b> 1299.3												
Depth (ft.)	Elev. (ft.)	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	Water Level	N. Value	SAMPLE		LABORATORY TESTS								
						Sample No.	Sample Type	Moisture (%)	Dry Density (pcf)	Pocket Pen (tsf)	Qu (psf)	Liquid Limit	Plastic Limit	200 Sieve (%)		
6	1293.3	Fill, Lean Clay, dark brown and black, moist, some Organics	FILL		6	1	SPT									
					5	2	SPT									
					8	3	SPT									
				Clayey Sand, fine grained, brown and gray, moist to 14' then waterbearing, loose to very loose (SC)	MIXED ALLUVIUM		10	4	SPT							
							6	5	SPT	27						38
							5	6	SPT							
						▼	4	7	SPT							
18	1281.3	Lean Clay with Sand, a little Gravel, dark gray, moist, hard (CL)	TILL													
21	1278.3	<b>END OF BORING</b>														
<b>WATER LEVEL MEASUREMENTS</b>				▼	<b>Boring Started:</b> 11/29/2023 at											
					<b>Boring Completed:</b> 11/29/2023 at 14:45											
<b>DATE:</b>	<b>TIME:</b>	<b>SAMPLED TO:</b>	<b>CAVE IN:</b>	<b>CASING:</b>	<b>DEPTH:</b>	<b>Drilling Method:</b>										
11/29/2023	14:45	21'	16'		14.5'	<b>Drilling Method:</b> 3 1/4" HSA		0' to 19.5'								
						<b>Jet with Drilling Mud:</b>		to								
						<b>Hammer Type:</b> Auto Hammer (140 lb)										
						<b>Crew Chief:</b> R.H.		<b>Logged By:</b>								
						<b>Backfill Method:</b>										
<b>SOIL TECHNOLOGIES, INC</b>					28822 124TH ST., MOBRIDGE, SD TELEPHONE: (605) 762-3406											

**For Footings and Floors:** Excavate the Clay "Fill" soils and Clay "Alluvium" soils to expose competent native Sand "Alluvium" soils at a depth of at least 6' below existing grade. Final excavation depths shall be determined by STI's on-site Geotechnical Engineer.

Electronic File Copy 12-12-2023

# BORING LOG

<b>STI JOB #:</b> 23-1847		<b>Project:</b> Lincoln Hall Construction		<b>BORING #:</b> 5										
		<b>Location:</b> NSU - Aberdeen, SD		Sheet 1 of 2										
Latitude (North)=		Longitude (West)=		SURFACE ELEVATION = 1299.8										
Depth (ft.)	Elev. (ft.)	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	Water Level	N. Value	SAMPLE		LABORATORY TESTS						
						Sample No.	Sample Type	Moisture (%)	Dry Density (pcf)	Pocket Pen. (tsf)	Qu (psf)	Liquid Limit	Plastic Limit	200 Sieve (%)
6.5 9.5 18	1293.3	Fill, Lean Clay, a trace of construction debris and Gravel, brown and black, moist	FILL		9	1	SPT							
					9	2	SPT							
					8	3	SPT							
	1290.3	Clayey Sand, fine grained, brown and gray, dry, medium dense (SC)	MIXED ALLUVIUM		12	4	SPT							
					8	5	SPT							
					5	6	SPT							
					4	7	SPT							
	1281.8	Sand with Silt, fine grained, brown, dry to 14' then waterbearing, loose to very loose (SP-SM)	COARSE ALLUVIUM		13	8	SPT							
		Sand, fine to medium grained, a trace of Gravel, waterbearing, medium dense (SP)												
<b>WATER LEVEL MEASUREMENTS</b>				▼	<b>Boring Started:</b> 11/29/2023 at									
					<b>Boring Completed:</b> 11/29/2023 at 15:35									
<b>DATE:</b>	<b>TIME:</b>	<b>SAMPLED TO:</b>	<b>CAVE IN:</b>	<b>CASING:</b>	<b>DEPTH:</b>	<b>Drilling Method:</b>								
11/29/2023	15:35	31'	20.5'		15'	3 1/4" HSA		0' to 29.5'						
						<b>Jet with Drilling Mud:</b>		to						
						<b>Hammer Type:</b>		Auto Hammer (140 lb)						
						<b>Crew Chief:</b> R.H.		<b>Logged By:</b>						
						<b>Backfill Method:</b>								
<b>SOIL TECHNOLOGIES, INC</b>				28822 124TH ST., MOBRIDGE, SD TELEPHONE: (605) 762-3406										

**For Footings and Floors:** Excavate the Clay "Fill" soils and Clay "Alluvium" soils to expose competent native Sand "Alluvium" soils at a depth of at least 6.5' below existing grade. Final excavation depths shall be determined by STI's on-site Geotechnical Engineer.

Electronic File Copy 12-12-2023



# BORING LOG

<b>STI JOB #:</b> 23-1847		<b>Project:</b> Lincoln Hall Construction		<b>BORING #:</b> 5											
		<b>Location:</b> NSU - Aberdeen, SD		Sheet 2 of 2											
Latitude (North)=		Longitude (West)=		<b>SURFACE ELEVATION =</b>											
Depth (ft.)	Elev. (ft.)	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	Water Level	N. Value	SAMPLE		LABORATORY TESTS							
						Sample No.	Sample Type	Moisture (%)	Dry Density (pcf)	Pocket Pen. (tsf)	Qu (psf)	Liquid Limit	Plastic Limit	200 Sieve (%)	
23	1276.8	(Continued from Sheet 1)  <b>Sandy Lean Clay</b> , a little Gravel, dark gray, moist, very stiff (CL)	TILL		18	9	SPT								
31	1268.8	<b>END OF BORING</b>			24	10	SPT								
<b>WATER LEVEL MEASUREMENTS</b>				▼		<b>Boring Started:</b> See sheet 1 at									
						<b>Boring Completed:</b> See sheet 1 at									
<b>DATE:</b>	<b>TIME:</b>	<b>SAMPLED TO:</b>	<b>CAVE IN:</b>	<b>CASING:</b>	<b>DEPTH:</b>	<b>Drilling Method:</b> See sheet 1 to									
( SEE SHEET 1 )						<b>Drilling Method:</b> See sheet 1 to									
						<b>Jet with Drilling Mud:</b> See sheet 1 to									
						<b>Hammer Type:</b> Auto Hammer (140 lb)									
						<b>Crew Chief:</b> See sheet 1 <b>Logged By:</b> See sheet 1									
						<b>Backfill Method:</b> See sheet 1									
<b>SOIL TECHNOLOGIES, INC</b>				28822 124TH ST., MOBRIDGE, SD TELEPHONE: (605) 762-3406 FAX: 888-518-2157											

Electronic File Copy 12-12-2023

# BORING LOG

<b>STI JOB #:</b> 23-1847		<b>Project:</b> Lincoln Hall Construction			<b>BORING #:</b> 6													
		<b>Location:</b> NSU - Aberdeen, SD			Sheet 1 of 1													
Latitude (North)=		Longitude (West)=			SURFACE ELEVATION = 1300.3													
Depth (ft.)	Elev. (ft.)	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	Water Level	N. Value	SAMPLE		LABORATORY TESTS										
						Sample No.	Sample Type	Moisture (%)	Dry Density (pcf)	Pocket Pen (tsf)	Qu (psf)	Liquid Limit	Plastic Limit	200 Sieve (%)				
6.5 9 14 18 21	1293.8         1291.3         1286.3         1282.3         1279.3	Fill, Lean Clay and Sandy Lean Clay, a trace of Gravel, dark brown and black, moist, some Organics	FILL			7	1	SPT										
						6	2	SPT										
						7	3	SPT										
				Lean Clay, brown and gray, moist, a lense of Sand above 8.5', stiff (CL)	FINE ALLUVIUM													
				Sand with Silt, fine grained, brown, dry, loose (SP-SM)	COARSE ALLUVIUM													
				Silty Sand, fine grained, dark brown, waterbearing, loose (SM)	MIXED ALLUVIUM													
				Silty Sand, fine to medium grained, a trace of Gravel, brown, waterbearing, dense (SM)														
				END OF BORING														
<b>WATER LEVEL MEASUREMENTS</b>						Boring Started: 11/29/2023 at												
						Boring Completed: 11/29/2023 at 16:20												
DATE:	TIME:	SAMPLED TO:	CAVE IN:	CASING:	DEPTH:	Drilling Method:		to										
11/29/2023	16:20	21'	15'		14'	Drilling Method:		3 1/4" HSA 0' to 19.5'										
						Jet with Drilling Mud:		to										
						Hammer Type:		Auto Hammer (140 lb)										
						Crew Chief:		R.H. Logged By:										
						Backfill Method:												
<b>SOIL TECHNOLOGIES, INC</b>				28822 124TH ST., MOBRIDGE, SD				TELEPHONE: (605) 762-3406										

**For Floors:** Excavate the Clay "Fill" soils to expose competent native Clay "Alluvium" soils at a depth of at least 6.5' below existing grade. Final excavation depths shall be determined by STI's on-site Geotechnical Engineer.

**For Footings:** Excavate the Clay "Fill" soils and Clay "Alluvium" soils to expose competent native Sand "Alluvium" soils at a depth of at least 9' below existing grade. Final excavation depths shall be determined by STI's on-site Geotechnical Engineer.

Electronic File Copy 12-12-2023

# BORING LOG

STI JOB #: 23-1847		Project: Lincoln Hall Construction		BORING #: 7										
Location: NSU - Aberdeen, SD				Sheet 1 of 1										
Latitude (North)=		Longitude (West)=		SURFACE ELEVATION = 1298.3										
Depth (ft.)	Elev. (ft.)	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	Water Level	N. Value	SAMPLE		LABORATORY TESTS						
						Sample No.	Sample Type	Moisture (%)	Dry Density (pcf)	Pocket Pen (tsf)	Qu (psf)	Liquid Limit	Plastic Limit	200 Sieve (%)
2	1296.3	Fill, Clayey Sand, a little Gravel, brown, moist, a 4.5" of Asphalt at the surface	FILL		6	1	SPT							
		Fill, Lean Clay, black, moist, some Organics		6	2	SPT	<b>For Floors:</b> Excavate the Clay "Fill" soils to expose competent native Clay "Alluvium" soils at a depth of at least 4.5' below existing grade. Final excavation depths shall be determined by STI's on-site Geotechnical Engineer.							
4.5	1293.8	Lean Clay, grayish brown, moist, firm (CL)	FINE ALLUVIUM		7	3							SPT	26
7	1291.3	Sand, fine grained, light tan, dry, loose (SP)	COARSE ALLUVIUM		6	4	SPT	<b>For Footings:</b> Excavate the Clay "Fill" soils and Clay "Alluvium" soils to expose competent native Sand "Alluvium" soils at a depth of at least 7' below existing grade. Final excavation depths shall be determined by STI's on-site Geotechnical Engineer.						
9	1289.3	Sand with Silt, fine grained, light gray, moist, loose (SP-SM)		6	5	SPT	15							
14	1284.3	Silty Sand, fine grained, dark brown, waterbearing, loose (SM)	MIXED ALLUVIUM		6	6	SPT							
		Sand with Silt, fine to medium grained, a little Gravel, brown, waterbearing, medium dense (SP-SM)	COARSE ALLUVIUM		7	7	SPT							
18	1280.3				23	8	SPT							
21	1277.3	END OF BORING												
<b>WATER LEVEL MEASUREMENTS</b>				▼	Boring Started: 11/28/2023 at									
					Boring Completed: 11/28/2023 at									
DATE:	TIME:	SAMPLED TO:	CAVE IN:	CASING:	DEPTH:	Drilling Method: to								
11/28/2023	13:40	21'	13'		12'	Drilling Method: 3 1/4" HSA 0' to 19.5'								
						Jet with Drilling Mud: to								
						Hammer Type: Auto Hammer (140 lb)								
						Crew Chief: R.H. Logged By:								
						Backfill Method:								

Electronic File Copy 12-12-2023

**SOIL TECHNOLOGIES, INC**

 28822 124TH ST., MOBRIDGE, SD  
 TELEPHONE: (605) 762-3406

# BORING LOG

STI JOB #: 23-1847		Project: Lincoln Hall Construction		BORING #: 8												
Location: NSU - Aberdeen, SD				Sheet 1 of 1												
Latitude (North)=		Longitude (West)=		SURFACE ELEVATION = 1299.1												
Depth (ft.)	Elev. (ft.)	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	Water Level	N. Value	SAMPLE		LABORATORY TESTS								
						Sample No.	Sample Type	Moisture (%)	Dry Density (pcf)	Pocket Pen (tsf)	Qu (psf)	Liquid Limit	Plastic Limit	200 Sieve (%)		
1	1298.1	Fill, Clayey Sand, a little Gravel, brown and black, moist, a 4.5" layer of Asphalt at the surface	FILL		7	1	SPT									
		Fill, Lean Clay, a trace of Gravel, brown and black, moist, some Organics, possible Topsoil at 4.5' and 6.5'														
6.5	1292.6	Lean Clay, brown mottled and gray, moist, firm (CL)	FINE ALLUVIUM													
9	1290.1	Sand with Silt, fine grained, light gray, moist to 12' then waterbearing, loose (SP-SM)	COARSE ALLUVIUM	▼												
14.5	1284.6	Silty Sand, fine grained, dark brown, waterbearing, loose (SM)	MIXED ALLUVIUM													
19	1280.1	Sand with Silt, fine grained, brownish gray, waterbearing, a lense of Clay above 21', medium dense (SP-SM)	COARSE ALLUVIUM													
21	1278.1	<b>END OF BORING</b>														
<b>WATER LEVEL MEASUREMENTS</b>				▼	Boring Started: 11/28/2023 at											
					Boring Completed: 11/28/2023 at 12:55											
DATE:	TIME:	SAMPLED TO:	CAVE IN:	CASING:	DEPTH:	Drilling Method:		to								
11/28/2023	12:55	21'	13'		13'	Drilling Method:		3 1/4" HSA 0' to 19.5'								
						Jet with Drilling Mud:		to								
						Hammer Type:		Auto Hammer (140 lb)								
						Crew Chief:		R.H. Logged By:								
						Backfill Method:										

**For Floors:** Excavate the Clay "Fill" soils to expose competent native Clay "Alluvium" soils at a depth of at least 6.5' below existing grade. Final excavation depths shall be determined by STI's on-site Geotechnical Engineer.

**For Footings:** Excavate the Clay "Fill" soils and Clay "Alluvium" soils to expose competent native Sand "Alluvium" soils at a depth of at least 9' below existing grade. Final excavation depths shall be determined by STI's on-site Geotechnical Engineer.

Electronic File Copy 12-12-2023

**SOIL TECHNOLOGIES, INC**

28822 124TH ST., MOBRIDGE, SD  
TELEPHONE: (605) 762-3406

# BORING LOG

STI JOB #: 23-1847		Project: Lincoln Hall Construction		BORING #: 9												
Location: NSU - Aberdeen, SD				Sheet 1 of 2												
Latitude (North)=		Longitude (West)=		SURFACE ELEVATION = 1298.8												
Depth (ft.)	Elev. (ft.)	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	Water Level	N. Value	SAMPLE		LABORATORY TESTS								
						Sample No.	Sample Type	Moisture (%)	Dry Density (pcf)	Pocket Pen (tsf)	Qu (psf)	Liquid Limit	Plastic Limit	200 Sieve (%)		
4	1294.8	Fill, Lean Clay, black, dark brown, and brown, moist, a trace of construction debris	FILL		10	1	SPT									
					8	2	SPT	<div style="border: 1px solid black; padding: 5px;"> <b>For Floors:</b> Excavate the Clay "Fill" soils to expose competent native Clay "Alluvium" soils at a depth of at least 4' below existing grade. Final excavation depths shall be determined by STI's on-site Geotechnical Engineer.                 </div>								
9	1289.8	Lean Clay, brown mottled and gray, moist, soft to firm (CL)	FINE ALLUVIUM		3	3	SPT									
					8	4	SPT	30	94		1300					
9	1289.8	Sand, fine grained, brown, dry to 14' then waterbearing, loose (SP)	COARSE ALLUVIUM		10	5	SPT									
					10	6	SPT	<div style="border: 1px solid black; padding: 5px;"> <b>For Footings:</b> Excavate the Clay "Fill" soils and Clay "Alluvium" soils to expose competent native Sand "Alluvium" soils at a depth of at least 9' below existing grade. Final excavation depths shall be determined by STI's on-site Geotechnical Engineer.                 </div>								
18	1280.8			▼	6	7	SPT									
		Sand, fine to medium grained, gray brown/brown, waterbearing, loose (SP)			5	8	SPT									
<b>WATER LEVEL MEASUREMENTS</b>				▼	Boring Started: 11/29/2023 at											
					Boring Completed: 11/29/2023 at 9:40											
DATE:	TIME:	SAMPLED TO:	CAVE IN:	CASING:	DEPTH:	Drilling Method:		to								
11/29/2023	9:40	36'	20'		14'	Drilling Method:		3 1/4" HSA 0' to 34.5'								
						Jet with Drilling Mud:		to								
						Hammer Type:		Auto Hammer (140 lb)								
						Crew Chief:		R.H. Logged By:								
						Backfill Method:										

Electronic File Copy 12-12-2023

**SOIL TECHNOLOGIES, INC**

 28822 124TH ST., MOBRIDGE, SD  
 TELEPHONE: (605) 762-3406

# BORING LOG

<b>STI JOB #:</b> 23-1847		<b>Project:</b> Lincoln Hall Construction			<b>BORING #:</b> 9									
		<b>Location:</b> NSU - Aberdeen, SD			Sheet 2 of 2									
Latitude (North)=		Longitude (West)=			<b>SURFACE ELEVATION =</b>									
Depth (ft.)	Elev. (ft.)	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	Water Level	N. Value	SAMPLE		LABORATORY TESTS						
						Sample No.	Sample Type	Moisture (%)	Dry Density (pcf)	Pocket Pen (tsf)	Qu (psf)	Liquid Limit	Plastic Limit	200 Sieve (%)
		<b>(Continued from Sheet 1)</b>												
23	1275.8	<b>Lean Clay with Sand</b> , a trace of Gravel, dark gray, moist, firm (CL)	TILL		7	9	SPT							
28	1270.8	<b>Clayey Sand</b> , dark gray, waterbearing, very loose (SC)	MIXED ALLUVIUM		2	10	SPT							
34	1264.8	<b>Lean Clay with Sand</b> , a little Gravel, dark gray, moist, firm (CL)	TILL		8	11	SPT							
36	1262.8	<b>END OF BORING</b>												
<b>WATER LEVEL MEASUREMENTS</b>				▼	<b>Boring Started:</b> See sheet 1 at									
					<b>Boring Completed:</b> See sheet 1 at									
<b>DATE:</b>	<b>TIME:</b>	<b>SAMPLED TO:</b>	<b>CAVE IN:</b>	<b>CASING:</b>	<b>DEPTH:</b>	<b>Drilling Method:</b> See sheet 1 to								
( SEE SHEET 1 )						<b>Drilling Method:</b> See sheet 1 to								
						<b>Jet with Drilling Mud:</b> See sheet 1 to								
						<b>Hammer Type:</b> Auto Hammer (140 lb)								
						<b>Crew Chief:</b> See sheet 1			<b>Logged By:</b> See sheet 1					
						<b>Backfill Method:</b> See sheet 1								
<b>SOIL TECHNOLOGIES, INC</b>					28822 124TH ST., MOBRIDGE, SD TELEPHONE: (605) 762-3406 FAX: 888-518-2157									

Electronic File Copy 12-12-2023

# BORING LOG

STI JOB #: 23-1847		Project: Lincoln Hall Construction		BORING #: 10												
Location: NSU - Aberdeen, SD				Sheet 1 of 1												
Latitude (North)=		Longitude (West)=		SURFACE ELEVATION = 1300.1												
Depth (ft.)	Elev. (ft.)	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	Water Level	N. Value	SAMPLE		LABORATORY TESTS								
						Sample No.	Sample Type	Moisture (%)	Dry Density (pcf)	Pocket Pen (tsf)	Qu (psf)	Liquid Limit	Plastic Limit	200 Sieve (%)		
		Fill, Lean Clay and Sandy Lean Clay, a trace of Gravel, dark brown and black, moist	FILL		11	1	SPT									
4.5	1295.6	Lean Clay, brown, moist, firm (CL)	FINE ALLUVIUM		9	2	SPT									
7	1293.1	Lean Clay, brown mottled and gray, moist, firm (CL)	FINE ALLUVIUM		6	3	SPT									
8.5	1291.6	Sand with Silt, fine grained, light grayish brown, moist, loose (SP-SM)	COARSE ALLUVIUM		7	4	SPT	30	93	1.7						
14	1286.1	Silty Sand, fine grained, dark brown and gray, waterbearing, loose (SM)	MIXED ALLUVIUM		8	5	SPT	18								24
18	1282.1	Sand with Silt, fine to medium grained, a trace of Gravel, brown, waterbearing, medium dense (SP-SM)	COARSE ALLUVIUM		8	6	SPT									
21	1279.1				7	7	SPT									
		<b>END OF BORING</b>														
<b>WATER LEVEL MEASUREMENTS</b>					<b>Boring Started:</b> 11/29/2023 at											
					<b>Boring Completed:</b> 11/29/2023 at 8:25											
<b>DATE:</b>	<b>TIME:</b>	<b>SAMPLED TO:</b>	<b>CAVE IN:</b>	<b>CASING:</b>	<b>DEPTH:</b>	<b>Drilling Method:</b>										
11/29/2023	8:25	21'	14.5'		14.5'	3 1/4" HSA		0' to 19.5'								
						<b>Jet with Drilling Mud:</b>		to								
						<b>Hammer Type:</b>		Auto Hammer (140 lb)								
						<b>Crew Chief:</b>		R.H. <b>Logged By:</b>								
						<b>Backfill Method:</b>										
<b>SOIL TECHNOLOGIES, INC</b>				28822 124TH ST., MOBRIDGE, SD TELEPHONE: (605) 762-3406												

**For Floors:** Excavate the Clay "Fill" soils to expose competent native Clay "Alluvium" soils at a depth of at least 4.5' below existing grade. Final excavation depths shall be determined by STI's on-site Geotechnical Engineer.

**For Footings:** Excavate the Clay "Fill" soils and Clay "Alluvium" soils to expose competent native Sand "Alluvium" soils at a depth of at least 8.5' below existing grade. Final excavation depths shall be determined by STI's on-site Geotechnical Engineer.

Electronic File Copy 12-12-2023

# BORING LOG

<b>STI JOB #:</b> 23-1847		<b>Project:</b> Lincoln Hall Construction		<b>BORING #:</b> 11												
		<b>Location:</b> NSU - Aberdeen, SD		Sheet 1 of 2												
Latitude (North)=		Longitude (West)=		<b>SURFACE ELEVATION =</b> 1300.2												
Depth (ft.)	Elev. (ft.)	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	Water Level	N. Value	SAMPLE		LABORATORY TESTS								
						Sample No.	Sample Type	Moisture (%)	Dry Density (pcf)	Pocket Pen (tsf)	Qu (psf)	Liquid Limit	Plastic Limit	200 Sieve (%)		
4 7 9 14 18	1296.2	Fill, Lean Clay, dark brown and black, moist, a trace of construction debris, some Organics	FILL		9	1	SPT									
					7	2	SPT	<b>For Floors:</b> Excavate the Clay "Fill" soils to expose competent native Clay "Alluvium" soils at a depth of at least 4' below existing grade. Final excavation depths shall be determined by STI's on-site Geotechnical Engineer.								
	1293.2	Lean Clay, light brown, moist, firm (CL)	FINE ALLUVIUM		6	3	SPT	27	0.9							
								<b>For Footings:</b> Excavate the Clay "Fill" soils and Clay "Alluvium" soils to expose competent native Sand "Alluvium" soils at a depth of at least 7' below existing grade. Final excavation depths shall be determined by STI's on-site Geotechnical Engineer.								
	1291.2	Clayey Sand, fine grained, brown, loose (SC)	MIXED ALLUVIUM		6	4	SPT									
			Clayey Sand, fine grained, brown mottled and gray, moist, loose (SC)			8	5	SPT	23							42
							5A	3TW	31	97	850					
1286.2		Clayey Sand, fine grained, dark brown, waterbearing, very loose (SC)			6	6	SPT									
				▼	4	7	SPT									
1282.2		Sandy Lean Clay, a little Gravel, dark gray, moist, a lense of Sand above 20', very stiff (CL)	TILL		23	8	SPT									
<b>WATER LEVEL MEASUREMENTS</b>				▼	<b>Boring Started:</b> 11/28/2023 at											
					<b>Boring Completed:</b> 11/28/2023 at 15:55											
<b>DATE:</b>	<b>TIME:</b>	<b>SAMPLED TO:</b>	<b>CAVE IN:</b>	<b>CASING:</b>	<b>DEPTH:</b>	<b>Drilling Method:</b>		to								
11/28/2023	15:55	31'	14.5'		14.5'	<b>Drilling Method:</b>		3 1/4" HSA 0' to 29.5'								
						<b>Jet with Drilling Mud:</b>		to								
						<b>Hammer Type:</b>		Auto Hammer (140 lb)								
						<b>Crew Chief:</b> R.H.		<b>Logged By:</b>								
						<b>Backfill Method:</b>										
<b>SOIL TECHNOLOGIES, INC</b>				28822 124TH ST., MOBRIDGE, SD TELEPHONE: (605) 762-3406												

Electronic File Copy 12-12-2023



# BORING LOG

<b>STI JOB #:</b> 23-1847		<b>Project:</b> Lincoln Hall Construction		<b>BORING #:</b> 11											
		<b>Location:</b> NSU - Aberdeen, SD		Sheet 2 of 2											
Latitude (North)=		Longitude (West)=		<b>SURFACE ELEVATION =</b>											
Depth (ft.)	Elev. (ft.)	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	Water Level	N. Value	SAMPLE		LABORATORY TESTS							
						Sample No.	Sample Type	Moisture (%)	Dry Density (pcf)	Pocket Pen (tsf)	Qu (psf)	Liquid Limit	Plastic Limit	200 Sieve (%)	
		<b>(Continued from Sheet 1)</b>													
24	1276.2	<b>Silty Sand</b> , fine grained, gray, waterbearing, dense (SM)	MIXED ALLUVIUM		26	9	SPT								
26	1274.2	<b>Sand with Silt</b> , fine to medium grained, a trace of Gravel, gray, waterbearing, dense (SP-SM)	COARSE ALLUVIUM												
31	1269.2	<b>END OF BORING</b>			30	10	SPT								
<b>WATER LEVEL MEASUREMENTS</b>				▼	<b>Boring Started:</b> See sheet 1 at										
					<b>Boring Completed:</b> See sheet 1 at										
<b>DATE:</b>	<b>TIME:</b>	<b>SAMPLED TO:</b>	<b>CAVE IN:</b>	<b>CASING:</b>	<b>DEPTH:</b>	<b>Drilling Method:</b> See sheet 1 to									
( SEE SHEET 1 )						<b>Drilling Method:</b> See sheet 1 to									
						<b>Jet with Drilling Mud:</b> See sheet 1 to									
						<b>Hammer Type:</b> Auto Hammer (140 lb)									
						<b>Crew Chief:</b> See sheet 1		<b>Logged By:</b> See sheet 1							
						<b>Backfill Method:</b> See sheet 1									
<b>SOIL TECHNOLOGIES, INC</b>				28822 124TH ST., MOBRIDGE, SD TELEPHONE: (605) 762-3406 FAX: 888-518-2157											

Electronic File Copy 12-12-2023

# BORING LOG

STI JOB #: 23-1847		Project: Lincoln Hall Construction			BORING #: 12									
Location: NSU - Aberdeen, SD					Sheet 1 of 1									
Latitude (North)=		Longitude (West)=			SURFACE ELEVATION = 1300.3									
Depth (ft.)	Elev. (ft.)	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	Water Level	N. Value	SAMPLE		LABORATORY TESTS						
						Sample No.	Sample Type	Moisture (%)	Dry Density (pcf)	Pocket Pen (tsf)	Qu (psf)	Liquid Limit	Plastic Limit	200 Sieve (%)
4	1296.3	Fill, Organic Lean Clay, black, moist	FILL		6	1	SPT							
					2	2	SPT							
7	1293.3	Lean Clay, light brown, moist, firm (CL)	FINE ALLUVIUM		7	3	SPT							
14	1286.3	Clayey Sand, fine grained, brown, moist, medium dense to loose (SC)	MIXED ALLUVIUM		12	4	SPT							
					12	5	SPT							
21	1279.3	Silty Sand, fine grained, dark brown, waterbearing, loose (SM)		▼	9	6	SPT							
					6	7	SPT							
					7	8	SPT							
		<b>END OF BORING</b>												
<b>WATER LEVEL MEASUREMENTS</b>				▼	<b>Boring Started:</b> 11/28/2023 at									
					<b>Boring Completed:</b> 11/28/2023 at 15:00									
<b>DATE:</b>	<b>TIME:</b>	<b>SAMPLED TO:</b>	<b>CAVE IN:</b>	<b>CASING:</b>	<b>DEPTH:</b>	<b>Drilling Method:</b>								
11/28/2023	15:00	21'	13.5'		13'	Drilling Method: 3 1/4" HSA 0' to 19.5'								
						Jet with Drilling Mud: to								
						Hammer Type: Auto Hammer (140 lb)								
						Crew Chief: R.H. Logged By:								
						Backfill Method:								
<b>SOIL TECHNOLOGIES, INC</b>				28822 124TH ST., MOBRIDGE, SD TELEPHONE: (605) 762-3406										

**For Floors:** Excavate the Clay "Fill" soils to expose competent native Clay "Alluvium" soils at a depth of at least 4' below existing grade. Final excavation depths shall be determined by STI's on-site Geotechnical Engineer.

**For Footings:** Excavate the Clay "Fill" soils and Clay "Alluvium" soils to expose competent native Sand "Alluvium" soils at a depth of at least 7' below existing grade. Final excavation depths shall be determined by STI's on-site Geotechnical Engineer.

Electronic File Copy 12-12-2023

# BORING LOG

STI JOB #: 23-1847		Project: Lincoln Hall Construction		BORING #: 13											
Location: NSU - Aberdeen, SD				Sheet 1 of 2											
Latitude (North)=		Longitude (West)=		SURFACE ELEVATION = 1300.4											
Depth (ft.)	Elev. (ft.)	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	Water Level	N. Value	SAMPLE		LABORATORY TESTS							
						Sample No.	Sample Type	Moisture (%)	Dry Density (pcf)	Pocket Pen (tsf)	Qu (psf)	Liquid Limit	Plastic Limit	200 Sieve (%)	
1	1299.4	Fill, Organic Lean Clay, black, moist	FILL		11	1	SPT								
3	1297.4	Fill, Sandy Lean Clay, brown and black, moist, some Organics			7	2	SPT	<div style="border: 1px solid black; padding: 5px;"> <b>For Floors:</b> Excavate the Clay "Fill" soils to expose competent native Clay "Alluvium" soils at a depth of at least 3' below existing grade. Final excavation depths shall be determined by STI's on-site Geotechnical Engineer.                 </div>							
6	1294.4	Lean Clay, light brown, moist, soft (CL)	FINE ALLUVIUM		4	3	SPT							30	
10.5	1289.9	Sand, fine grained, light brown, dry, loose (SP)	COARSE ALLUVIUM		9	4	SPT								
14	1286.4	Silty Sand, fine grained, brownish gray, moist, loose (SM)	MIXED ALLUVIUM		9	5	SPT								
18	1282.4	Silty Sand, fine grained, dark brown, waterbearing, loose (SM)			8	6	SPT								
		Sandy Lean Clay, a little Gravel, dark gray, moist, hard (CL)	TILL	▼	7	7	SPT								
					32	8	SPT								
<b>WATER LEVEL MEASUREMENTS</b>				▼	<b>Boring Started:</b> 11/28/2023 at										
					<b>Boring Completed:</b> 11/28/2023 at 17:10										
<b>DATE:</b>	<b>TIME:</b>	<b>SAMPLED TO:</b>	<b>CAVE IN:</b>	<b>CASING:</b>	<b>DEPTH:</b>	<b>Drilling Method:</b>									
11/28/2023	17:10	31'	20.5'		14.5'	<b>Drilling Method:</b> 3 1/4" HSA		0' to 29.5'							
						<b>Jet with Drilling Mud:</b>		to							
						<b>Hammer Type:</b>		Auto Hammer (140 lb)							
						<b>Crew Chief:</b> R.H.		<b>Logged By:</b>							
						<b>Backfill Method:</b>									
<b>SOIL TECHNOLOGIES, INC</b>				28822 124TH ST., MOBRIDGE, SD											
				TELEPHONE: (605) 762-3406											

Electronic File Copy 12-12-2023

# BORING LOG

<b>STI JOB #:</b> 23-1847		<b>Project:</b> Lincoln Hall Construction		<b>BORING #:</b> 13											
		<b>Location:</b> NSU - Aberdeen, SD		Sheet 2 of 2											
Latitude (North)=		Longitude (West)=		<b>SURFACE ELEVATION =</b>											
Depth (ft.)	Elev. (ft.)	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	Water Level	N. Value	SAMPLE		LABORATORY TESTS							
						Sample No.	Sample Type	Moisture (%)	Dry Density (pcf)	Pocket Pen (tsf)	Qu (psf)	Liquid Limit	Plastic Limit	200 Sieve (%)	
23	1277.4	(Continued from Sheet 1)													
		<b>Silty Sand with Gravel</b> , fine to medium grained, gray, waterbearing, very dense (SP)	MIXED ALLUVIUM		55	9	SPT								
31	1269.4	<b>END OF BORING</b>			58	10	SPT								
<b>WATER LEVEL MEASUREMENTS</b>				▼	<b>Boring Started:</b> See sheet 1 at <b>Boring Completed:</b> See sheet 1 at <b>Drilling Method:</b> See sheet 1 to <b>Drilling Method:</b> See sheet 1 to <b>Jet with Drilling Mud:</b> See sheet 1 to <b>Hammer Type:</b> Auto Hammer (140 lb) <b>Crew Chief:</b> See sheet 1 <b>Logged By:</b> See sheet 1 <b>Backfill Method:</b> See sheet 1										
<b>DATE:</b>	<b>TIME:</b>	<b>SAMPLED TO:</b>	<b>CAVE IN:</b>	<b>CASING:</b>	<b>DEPTH:</b>										
( SEE SHEET 1 )															
<b>SOIL TECHNOLOGIES, INC</b>						28822 124TH ST., MOBRIDGE, SD TELEPHONE: (605) 762-3406 FAX: 888-518-2157									

Electronic File Copy 12-12-2023

# BORING LOG

<b>STI JOB #:</b> 23-1847		<b>Project:</b> Lincoln Hall Construction		<b>BORING #:</b> 14											
		<b>Location:</b> NSU - Aberdeen, SD		Sheet 1 of 1											
Latitude (North)=		Longitude (West)=		<b>SURFACE ELEVATION =</b> 1300.0											
Depth (ft.)	Elev. (ft.)	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	Water Level	N. Value	SAMPLE		LABORATORY TESTS							
						Sample No.	Sample Type	Moisture (%)	Dry Density (pcf)	Pocket Pen (tsf)	Qu (psf)	Liquid Limit	Plastic Limit	200 Sieve (%)	
3	1297.0	Fill, Organic Lean Clay, black, moist	FILL		8	1	SPT								
		Lean Clay, light brown and gray, moist, firm to stiff (CL)	FINE ALLUVIUM		6	2	SPT								
9	1291.0	Lean Clay, dark brown and gray, moist, a few lenses of Sand above 11', stiff (CL)	FINE ALLUVIUM		6	3	SPT	30							
		Lean Clay, dark brown and gray, moist, a few lenses of Sand above 11', stiff (CL)	FINE ALLUVIUM		9	4	SPT	29	91	0.8					
12	1288.0	Silty Sand, fine grained, dark brown, moist to 14' then waterbearing, loose to medium dense (SM)	MIXED ALLUVIUM		9	5	SPT								
			MIXED ALLUVIUM		7	6	SPT								
21	1279.0			▼	8	7	SPT								
					23	8	SPT								
		<b>END OF BORING</b>													
<b>WATER LEVEL MEASUREMENTS</b>				▼		<b>Boring Started:</b> 11/29/2023 at									
						<b>Boring Completed:</b> 11/29/2023 at 10:55									
<b>DATE:</b>	<b>TIME:</b>	<b>SAMPLED TO:</b>	<b>CAVE IN:</b>	<b>CASING:</b>	<b>DEPTH:</b>	<b>Drilling Method:</b>									
11/29/2023	10:55	21'	15.5'		15'	<b>Drilling Method:</b> 3 1/4" HSA		0' to 19.5'							
						<b>Jet with Drilling Mud:</b>		to							
						<b>Hammer Type:</b> Auto Hammer (140 lb)									
						<b>Crew Chief:</b> R.H.		<b>Logged By:</b>							
						<b>Backfill Method:</b>									
<b>SOIL TECHNOLOGIES, INC</b>				28822 124TH ST., MOBRIDGE, SD TELEPHONE: (605) 762-3406											

**For Floors:** Excavate the Clay "Fill" soils to expose competent native Clay "Alluvium" soils at a depth of at least 3' below existing grade. Final excavation depths shall be determined by STI's on-site Geotechnical Engineer.

**For Footings:** Excavate the Clay "Fill" soils and Clay "Alluvium" soils to expose competent native Sand "Alluvium" soils at a depth of at least 12' below existing grade. Final excavation depths shall be determined by STI's on-site Geotechnical Engineer.

Electronic File Copy 12-12-2023

## **FIELD EXPLORATION PROCEDURES**

### **Soil Sampling**

Soil sampling was performed in accordance with ASTM: D1586. Using this procedure, a 2" O.D. split barrel sampler is driven into the soil by a 140-lb. weight (hammer) falling 30". After an initial set of 6", the number of blows required to drive the sampler an additional 12" is known as the penetration resistance or N value. The N value is an index of the relative density of the cohesionless (sandy) soils and the consistency of cohesive (clayey) soils. Thin walled tube samples, if taken, were obtained according the ASTM: D1587 where indicated by the appropriate symbol on the boring logs. Rock core samples, if taken, were obtained by rotary drilling in accordance with ASTM: D2113. Power auger borings, if performed, were done in general accordance with ASTM: D1452.

### **Soil Classification**

As the samples were obtained in the field, they were visually and manually classified by the crew chief in general accordance with ASTM: D2487. Representative portions of the samples were then returned to the laboratory for further examination and for verification of the field classification. Logs of the borings (test holes) indicating the depth and identification of the various strata, the N value, water level information and pertinent information regarding the method of maintaining and advancing the bore holes are attached. Charts illustrating the descriptive terminology and the symbols used on the boring logs are also attached.

### **LOG OF BORING– “DESCRIPTIONS”**

Depth - Depth below the existing grade at the location and time the sampling was performed.

Description of Material – Soil type based on visual and manual methods and/or laboratory tests (see “Soil Classification” above).

Surface Elevation – Elevation of the existing grade at the boring location and at the time the boring was performed.

Geologic Origin - A description of the most likely source of the soil deposit.

WL - The highest groundwater measurement at the time and location the sampling was performed marked by the symbol ▼. (Also see “Water Level Measurements” on boring log).

N VALUE - The number of hammer blows required to drive the sampler 12" (see “Soil Sampling” above).

SAMPLE NO. – The sample number, i.e. 1, 2, 3....

SAMPLE TYPE – The type of equipment used to sample the soil (SPT = Standard Penetration Test, SB = Split Barrel Sampler, FA = Flight Auger, HSA = Hollow Stem Auger ).

QU – Laboratory test. (See the attached “Symbols and Terminology.”)

Drilling Method – The type of equipment used in to advance (drill) the boring.

# **SYMBOLS AND TERMINOLOGY**

## **DRILLING AND SAMPLING SYMBOLS**

<u><b>SYMBOL</b></u>	<u><b>DEFINITION</b></u>
N	Standard Penetration – blows per foot
WOH	Weight of Hammer
B	Bag Sample
DM	Drilling Mud
FA	Flight Auger
HA	Hand Auger
HSA	Hollow Stem Auger
JW	Jetting Water
NSR	No Sample Recovered
_Q	BQ, NQ or PQ Wireline System
SB	Split Barrel Sampler
SPT	Standard Penetration Test
3TW	3" Thin Walled Tube Sample
CS	California Sampler
▼	Water Level Symbol

## **TEST SYMBOLS**

<u><b>SYMBOL</b></u>	<u><b>DEFINITION</b></u>
W	Water Content by weight (ASTM:D2216)
D	Dry Density - pounds per cubic foot
LL	Liquid Limit (ASTM: D4318)
PL	Plastic Limit (ASTM: D438)
Qu	Unconfined Compressive Strength – pounds per square foot (ASTM: D2166)
Pq	Penetrometer Reading – tons/square ft.
Su	Undrained Shear Strength
R	Laboratory Resistivity
G	Specific Gravity – ASTM: D854
OC	Organic Content
K	Coefficient of Permeability
VS	Field Vane Shear (ASTM: D2573)
RQD	Rock Quality Designation - percent
CR	Core Recovery (percent)

## **WATER LEVELS**

Water levels shown on the test hole (boring) logs are the water levels measured in the test holes at the time and under the conditions indicated. In sand soil, the indicated levels may be considered fairly reliable ground water levels. In clay soil, it may not be possible to determine the ground water level within the normal time required for the test hole, except where lenses or layers of more pervious waterbearing soil are present. Even then, an extended period of time may be necessary to reach equilibrium. Therefore, the water levels shown on the test hole logs for cohesive or mixed texture soils may not indicate the true level of the ground water table. Perched water refers to water above an impervious layer, thus impeded in reaching the water table. The available water level information is given at the bottom of the log sheet.

## **DESCRIPTIVE TERMINOLOGY**

<u><b>RELATIVE DENSITY</b></u>	<u><b>“N” VALUE</b></u>	<u><b>CONSISTENCY</b></u>	<u><b>“N” VALUE</b></u>
very loose	0-4	very soft	0-1
loose	5-10	soft	2-4
medium dense	11-24	firm	5-8
dense	25-50	stiff	9-15
very dense	>50	very stiff	16-30
		hard	31-60
		very hard	>60

“N” is the Standard Penetration, in blows per foot, of a 140 pound hammer falling 30 inches onto a 2 inch OD split barrel sampler.

Lamination	Up to ½” thick stratum
Layer	½” to 6”
Lens	½” to 6” discontinuous stratum, pocket
Varved	Alternating laminations of clay, silt and/or fine grained sand, or colors thereof
Dry	Powdery, no noticeable water
Moist	Below saturation
Wet	Saturated, above liquid limit
Waterbearing	Pervious - soil is below water

### **RELATIVE GRAVEL PROPORTIONS**

<u><b>TERM</b></u>	<u><b>RANGE</b></u>
A trace of gravel	Less than 4%
A little gravel	5 – 15%
With gravel	16 – 50%

### **RELATIVE SIZES**

Boulder	Over 12”
Cobble	3” - 12”
Gravel - Coarse	¾” - 3”
Gravel – Fine	#4 - ¾”
Sand – Coarse	#4 - #10
Sand - Medium	#10 - #40
Sand - Fine	#40 - #200
Silt & Clay	-#200, Based on Plasticity

## **PRECAUTIONS FOR EXCAVATING AND REFILLING DURING COLD WEATHER**

The winter season in this area presents specific problems for foundation construction. Soils which are allowed to freeze undergo a moisture volume expansion, resulting in a loss of density. These frost-expanded soils will consolidate upon thawing, causing settlement of any structure supported on them. To prevent this settlement, frost should not be allowed to penetrate into the soils below any proposed structure.

Ideally, winter excavation should be limited to areas small enough to be refilled to a grade higher than footing grade on the same day. Typically, these areas should be filled to floor grade. Trenching back down to unfrozen soils for foundation construction can then be performed just prior to footing placement. The excavated trenches should be protected from freezing by means of insulating or heating during foundation construction. Backfilling of the foundation trenches should be performed immediately after the below-grade foundation construction is finished. In addition, any interior footings, or footings designed without frost protection should be extended below frost depth, unless adequate precautions are taken to prevent frost intrusion until the building can be enclosed and heated.

In many cases, final grade cannot be attained in one day's time, even though small areas are worked. In the event final grade cannot be attained in one day's time, frost can be expected to develop overnight. The depth of frost penetration can be minimized by leaving a layer of loose soil on top of the compacted material overnight. However, any frost which forms in this loose layer, or snow which accumulates, should be completely removed from the fill area prior to compaction and additional soil placement. Frozen soils, or soils containing frozen material or snow should never be used as fill material.

After the structure has been enclosed, all floor slab areas should be subjected to ample periods of heating to allow thawing of the soil system. Alternatively, the frozen soils can be completely removed and be replaced with an engineered fill. The floor slab areas should be checked at random and representative locations for remnant areas of frost, and density tests should be performed to document fill compaction prior to slab placement.

Due to the potential problems associated with fill placement during cold weather, any filling operations should be monitored by a full-time, on-site soils technician. Full-time monitoring aids in detecting areas of frozen material, or potential problems with frozen material within the fill, so that appropriate measures can be taken. The choice of fill material is particularly important during cold weather, since clean granular fill materials can be placed and compacted more efficiently than silty or clayey soils. In addition, greater magnitudes of heaving can be expected with freezing of the more frost susceptible silts and clays.

If more specific frost information or cold weather data concerning other construction materials is required, please contact us.



# **CONSTRUCTION OBSERVATIONS AND TESTING**

- **Geotechnical Engineer's Observation**

The recommendations made in this report have been made based on the subsurface conditions found in the borings. It is possible that there are soil and water conditions on-site that were not represented by those borings. Therefore, we recommend that the completed excavation and prepared subgrade be observed and tested by a Geotechnical Engineer prior to fill placement or construction of any foundation elements. These observations are necessary to judge if all unsuitable materials have been removed from within the planned construction area and that an appropriate degree of lateral oversize has been provided for in those areas where fill will be placed below the bottom of foundation grade.

- **Field Density Tests**

We recommend a representative number of field density tests be taken in the engineered fill to aid in judging its suitability. We suggest the following guidelines relative to the number and spacing of the density tests:

- Footing Trench Areas: At least one density test should be performed for each 1½ foot depth of engineered fill placed below the footings. The lateral spacing between each 1½ foot test should not exceed 30 lineal feet.
- Floor Slab Areas: At least one density test should be performed for each 1½ foot of engineered fill depth. The density tests should be laterally spaced so that there is a minimum of one test performed for every 2000 square feet of engineered fill placed below the floor slab and at least one test for each 30 lineal feet of engineered fill placed in a footing trench above the footings.
- Exterior Backfill Areas: At least one density test should be performed for each 2 feet of engineered fill depth and at least one test for every 30 lineal feet of engineered fill placed.
- Utility Trench Areas: At least one density test should be performed for each 2 feet of engineered fill depth and at least one test for every 50 lineal feet of engineered fill placed.

Additional tests should be taken in confined areas, such as building corners. The actual number of tests should be left to the discretion of a qualified engineer or his representative. Any proposed engineered fill material should be submitted to the laboratory for tests to check compliance with our recommendations and project specifications.

# IMPORTANT INFORMATION ABOUT YOUR GEOTECHNICAL ENGINEERING REPORT

More construction problems are caused by site subsurface conditions than any other factor. As troublesome as subsurface problems can be, their frequency and extent have been lessened considerably in recent years, due in large measure to programs and publications of ASFE/ The Association of Engineering Firms Practicing in the Geosciences:'

The following suggestions and observations are offered to help you reduce the geotechnical-related delays, cost-overruns and other costly headaches that can occur during a construction project.

## **A GEOTECHNICAL ENGINEERING REPORT IS BASED ON A UNIQUE SET OF PROJECT-SPECIFIC FACTORS**

A geotechnical engineering report is based on a subsurface exploration plan designed to incorporate a unique set of project-specific factors. These typically include: the general nature of the structure involved, its size and configuration, the location of the structure on the site and its orientation; physical concomitants such as access roads, parking lots, and underground utilities, and the level of additional risk which the client assumed by virtue of limitations imposed upon the exploratory program. To help avoid costly problems, consult the geotechnical engineer to determine how any factors which change subsequent to the date of the report may affect its recommendations.

Unless your consulting geotechnical engineer indicates otherwise, *your geotechnical engineering report should not be used:*

- When the nature of the proposed structure is changed, for example, if an office building will be erected instead of a parking garage, or if a refrigerated warehouse will be built instead of an unrefrigerated one;
- when the size or configuration of the proposed structure is altered;
- when the location or orientation of the proposed structure is modified;
- when there is a change of ownership, or
- for application to an adjacent site.

*Geotechnical engineers cannot accept responsibility for problems which may develop if they are not consulted after factors considered in their report's development have changed.*

## **MOST GEOTECHNICAL "FINDINGS" ARE PROFESSIONAL ESTIMATES**

Site exploration identifies actual subsurface conditions only at those points where samples are taken, when they are taken. Data derived through sampling and subsequent laboratory testing are extrapolated by geo-

technical engineers who then render an opinion about overall subsurface conditions, their likely reaction to proposed construction activity, and appropriate foundation design. Even under optimal circumstances actual conditions may differ from those inferred to exist, because no geotechnical engineer, no matter how qualified, and no subsurface exploration program, no matter how comprehensive, can reveal what is hidden by earth, rock and time. The actual interface between materials may be far more gradual or abrupt than a report indicates. Actual conditions in areas not sampled may differ from predictions. *Nothing can be done to prevent the unanticipated, but steps can be taken to help minimize their impact.* For this reason, *most experienced owners retain their geotechnical consultants through the construction stage, to identify variances, conduct additional tests which may be needed, and to recommend solutions to problems encountered on site.*

## **SUBSURFACE CONDITIONS CAN CHANGE**

Subsurface conditions may be modified by constantly-changing natural forces. Because a geotechnical engineering report is based on conditions which existed at the time of subsurface exploration, *construction decisions should not be based on a geotechnical engineering report whose adequacy may have been affected by time.* Speak with the geotechnical consultant to learn if additional tests are advisable before construction starts.

Construction operations at or adjacent to the site and natural events such as floods, earthquakes or ground-water fluctuations may also affect subsurface conditions and, thus, the continuing adequacy of a geotechnical report. The geotechnical engineer should be kept apprised of any such events, and should be consulted to determine if additional tests are necessary.

## **GEOTECHNICAL SERVICES ARE PERFORMED FOR SPECIFIC PURPOSES AND PERSONS**

Geotechnical engineers' reports are prepared to meet the specific needs of specific individuals. A report prepared for a consulting civil engineer may not be adequate for a construction contractor, or even some other consulting civil engineer. Unless indicated otherwise, this report was prepared expressly for the client involved and expressly for purposes indicated by the client. Use by any other persons for any purpose, or by the client for a different purpose, may result in problems. *No individual other than the client should apply this report for its intended purpose without first conferring with the geotechnical engineer. No person should apply this report for any purpose other than that originally contemplated without first conferring with the geotechnical engineer*

## **A GEOTECHNICAL ENGINEERING REPORT IS SUBJECT TO MISINTERPRETATION**

Costly problems can occur when other design professionals develop their plans based on misinterpretations of a geotechnical engineering report. To help avoid these problems, the geotechnical engineer should be retained to work with other appropriate design professionals to explain relevant geotechnical findings and to review the adequacy of their plans and specifications relative to geotechnical issues.

## **BORING LOGS SHOULD NOT BE SEPARATED FROM THE ENGINEERING REPORT**

Final boring logs are developed by geotechnical engineers based upon their interpretation of field logs (assembled by site personnel) and laboratory evaluation of field samples. Only final boring logs customarily are included in geotechnical engineering reports. *These logs should not under any circumstances be redrawn* for inclusion in architectural or other design drawings, because drafters may commit errors or omissions in the transfer process. Although photographic reproduction eliminates this problem, it does nothing to minimize the possibility of contractors misinterpreting the logs during bid preparation. When this occurs, delays, disputes and unanticipated costs are the all-too-frequent result. To minimize the likelihood of boring log misinterpretation, *give contractors ready access to the complete geotechnical engineering report* prepared or authorized for their use. Those who do not provide such access may proceed un-

der the *mistaken* impression that simply disclaiming responsibility for the accuracy of subsurface information always insulates them from attendant liability. Providing the best available information to contractors helps prevent costly construction problems and the adversarial attitudes which aggravate them to disproportionate scale.

## **READ RESPONSIBILITY CLAUSES CLOSELY**

Because geotechnical engineering is based extensively on judgment and opinion, it is far less exact than other design disciplines. This situation has resulted in wholly unwarranted claims being lodged against geotechnical consultants. To help prevent this problem, geotechnical engineers have developed model clauses for use in written transmittals. These are *not* exculpatory clauses designed to foist geotechnical engineers' liabilities onto someone else. Rather, they are definitive clauses which identify where geotechnical engineers' responsibilities begin and end. Their use helps all parties involved recognize their individual responsibilities and take appropriate action. Some of these definitive clauses are likely to appear in your geotechnical engineering report, and you are encouraged to read them closely. Your geotechnical engineer will be pleased to give full and frank answers to your questions.

## **OTHER STEPS YOU CAN TAKE TO REDUCE RISK**

Your consulting geotechnical engineer will be pleased to discuss other techniques which can be employed to mitigate risk. In addition, ASFE has developed a variety of materials which may be beneficial. Contact ASFE for a complimentary copy of its publications directory

Published by

**ASFE** THE ASSOCIATION  
OF ENGINEERING FIRMS  
PRACTICING IN THE GEOSCIENCES

8811 Colesville Road/Suite G106/Silver Spring, Maryland 20910/(301) 565 2733

**SECTION 011000  
SUMMARY**

**PART 1 GENERAL**

**1.01 PROJECT**

- A. Project Name: NSU Lincoln Hall Business & Nursing School
- B. Owner's Name: Northern State University.
- C. Architect's Name: CO-OP Architecture + Anderson Mason Dale Architects.
  
- D. The Project consists of the additions and renovation of Lincoln Hall.

**1.02 DESCRIPTION OF ALTERATIONS WORK**

- A. Scope of alterations work is indicated on drawings.
- B. Plumbing: Alter existing system and add new construction, keeping existing in operation.
- C. HVAC: Alter existing system and add new construction, keeping existing in operation.
- D. Electrical Power and Lighting: Alter existing system and add new construction, keeping existing in operation.
- E. Fire Suppression Sprinklers: Alter existing system and add new construction, keeping existing in operation.
- F. Fire Alarm: Alter existing and add new construction.
- G. Telephone: Alter existing system and add new construction, keeping existing in operation.
- H. Security System: Alter existing system and add new construction, keeping existing in operation.

**1.03 OWNER OCCUPANCY**

- A. Owner intends to continue to occupy adjacent portions of the existing building during the entire construction period.
- B. Cooperate with Owner to minimize conflict and to facilitate Owner's operations.

**1.04 CONTRACTOR USE OF SITE**

- A. Construction Operations: Limited to areas noted on Drawings.
  - 1. Locate and conduct construction activities in ways that will limit disturbance to site.
- B. Provide access to and from site as required by law and by Owner:
  - 1. Do not obstruct roadways, sidewalks, or other public ways without permit.
- C. Utility Outages and Shutdown:
  - 1. Prevent accidental disruption of utility services to other facilities.

**END OF SECTION**

**SECTION 012000  
PRICE AND PAYMENT PROCEDURES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Procedures for preparation and submittal of applications for progress payments.

**1.02 SCHEDULE OF VALUES**

- A. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit draft to Architect for approval.
- B. Forms filled out by hand will not be accepted.
- C. Submit Schedule of Values in duplicate within 15 days after date of Owner-Contractor Agreement.

**1.03 APPLICATIONS FOR PROGRESS PAYMENTS**

- A. Payment Period: Submit at intervals stipulated in the Agreement.
- B. Forms filled out by hand will not be accepted.
- C. For each item, provide a column for listing each of the following:
  - 1. Item Number.
  - 2. Description of work.
  - 3. Scheduled Values.
  - 4. Previous Applications.
  - 5. Work in Place and Stored Materials under this Application.
  - 6. Authorized Change Orders.
  - 7. Total Completed and Stored to Date of Application.
  - 8. Percentage of Completion.
  - 9. Balance to Finish.
  - 10. Retainage.
- D. Execute certification by signature of authorized officer.
- E. Submit three copies of each Application for Payment.

**1.04 MODIFICATION PROCEDURES**

- A. For minor changes not involving an adjustment to the Contract Sum or Contract Time, Architect will issue instructions directly to Contractor.
- B. For other required changes, Architect will issue a document signed by Owner instructing Contractor to proceed with the change, for subsequent inclusion in a Change Order.
  - 1. The document will describe the required changes and will designate method of determining any change in Contract Sum or Contract Time.
  - 2. Promptly execute the change.
- C. For changes for which advance pricing is desired, Architect will issue a document that includes a detailed description of a proposed change with supplementary or revised drawings and specifications, a change in Contract Time for executing the change with a stipulation of any overtime work required and the period of time during which the requested price will be considered valid. Contractor shall prepare and submit a fixed price quotation within 7 days.
- D. Computation of Change in Contract Amount: As specified in the Agreement and Conditions of the Contract.
- E. Substantiation of Costs: Provide full information required for evaluation.
  - 1. On request, provide the following data:
    - a. Quantities of products, labor, and equipment.
    - b. Taxes, insurance, and bonds.
    - c. Overhead and profit.
    - d. Justification for any change in Contract Time.
    - e. Credit for deletions from Contract, similarly documented.
- F. Execution of Change Orders: Architect will issue Change Orders for signatures of parties as provided in the Conditions of the Contract.

#### **1.05 APPLICATION FOR FINAL PAYMENT**

- A. Prepare Application for Final Payment as specified for progress payments, identifying total adjusted Contract Sum, previous payments, and sum remaining due.
- B. Application for Final Payment will not be considered until the following have been accomplished:
  - 1. All closeout procedures specified in Section 017000.

**END OF SECTION**

**SECTION 012200  
UNIT PRICES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. List of unit prices, for use in preparing Bids.
- B. Measurement and payment criteria applicable to Work performed under a unit price payment method.

**1.02 RELATED REQUIREMENTS**

- A. Section 012000 - Price and Payment Procedures: Additional payment and modification procedures.

**1.03 COSTS INCLUDED**

- A. Unit Prices included on the Bid Form shall include full compensation for all required labor, products, tools, equipment, plant, transportation, services and incidentals; erection, application or installation of an item of the Work; overhead and profit.

**1.04 UNIT QUANTITIES SPECIFIED**

- A. Quantities indicated in the Bid Form are for bidding and contract purposes only. Quantities and measurements of actual Work will determine the payment amount.

**1.05 MEASUREMENT OF QUANTITIES**

- A. Measurement methods delineated in the individual specification sections complement the criteria of this section. In the event of conflict, the requirements of the individual specification section govern.
- B. Take all measurements and compute quantities. Measurements and quantities will be verified by Architect in association with Owner's testing agency.
- C. Assist by providing necessary equipment, workers, and survey personnel as required.
- D. Measurement by Volume: Measured by cubic dimension using mean length, width and height or thickness.

**1.06 PAYMENT**

- A. Payment for Work governed by unit prices will be made on the basis of the actual measurements and quantities of Work that is incorporated in or made necessary by the Work and accepted by the Architect, multiplied by the unit price.
- B. Payment will not be made for any of the following:
  - 1. Products wasted or disposed of in a manner that is not acceptable.
  - 2. Products determined as unacceptable before or after placement.
  - 3. Products not completely unloaded from the transporting vehicle.
  - 4. Products placed beyond the lines and levels of the required Work.
  - 5. Products remaining on hand after completion of the Work.
  - 6. Loading, hauling, and disposing of rejected Products.
  - 7. Any work that is not properly documented at the time of removal or placement

**1.07 SCHEDULE OF UNIT PRICES**

- A. Item A – Over Excavation of Unsuitable Material: \$ \_\_\_\_\_ per CuYd
- B. Item B – Imported and Compacted Fill: \$ \_\_\_\_\_ per CuYd

**PART 2 PRODUCTS - NOT USED**

**PART 3 EXECUTION - NOT USED**

**END OF SECTION**

## SECTION 012300

### ALTERNATES

#### PART 1 - GENERAL

##### 1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

##### 1.02 SUMMARY

- A. Section includes administrative and procedural requirements for alternates.

##### 1.03 DEFINITIONS

- A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the bidding requirements that may be added to or deducted from the base bid amount if the Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.
  - 1. Alternates described in this Section are part of the Work only if enumerated in the Agreement.
  - 2. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternates into the Work. No other adjustments are made to the Contract Sum.

##### 1.04 PROCEDURES

- A. Coordination: Revise or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.
  - 1. Include, as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation, whether or not indicated as part of alternate.
- B. Execute accepted alternates under the same conditions as other Work of the Contract.
- C. Schedule: A Part 3 "Schedule of Alternates" Article is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.



## PART 2 - PRODUCTS (Not Used)

## PART 3 - EXECUTION

### 3.01 SCHEDULE OF ALTERNATES

- A. Alternate No. 1: LVT vs sealed concrete as deduct alternate
  - 1. Base Bid: Provide LVT as indicated on Drawings, RE: Architectural Finish Plans and Finish schedule and as specified in section 09 65 00 RESILIENT FLOORING
  - 2. Alternate: Do not provide LVT as indicated on Drawings, and in its place provide sealed concrete, RE: Architectural Finish Schedule and as specified in section 03 35 11 CONCRETE FLOOR FINISHES
- B. Alternate No. 2 Carpet vs sealed concrete as deduct alternate
  - 1. Base Bid: Provide Carpet as indicated on Drawings, RE: Architectural Finish Plans and Finish schedule and as specified in section 09 68 13 TILE CARPETING
  - 2. Alternate: Do not provide Carpet as indicated on Drawings, and in its place provide sealed concrete, RE: Architectural Finish Schedule and as specified in section 03 35 11 CONCRETE FLOOR FINISHES
- C. Alternate No. 3: AGD (Interior All Glass Storefront, Double Glazed) vs AGS (Interior All Glass Storefront, Single Glazed) as deduct alternate
  - 1. Base Bid: Provide Interior Storefronts AGD (Interior All Glass Storefront, Double Glazed) as indicated on Drawings, RE: Interior Window Schedule and as specified in Section 08 41 26 – ALL-GLASS ENTRANCES AND STOREFRONTS
  - 2. Alternate: Provide Interior Storefronts AGS (Interior All Glass Storefront, Single Glazed) i.l.o. type AGD as indicated on Drawings, RE: Interior Window Schedule and as specified in Section 08 41 26 – ALL-GLASS ENTRANCES AND STOREFRONTS.
- D. Deduct Alternate No 4: (SA-1) Exterior Metal Soffit Panels – Revise to Stucco Soffit
  - 1. Base Bid: Provide Exterior Metal Soffit Panels as noted in Division 7 and 9.
  - 2. Alternate: Stucco Soffit in lieu of Metal Soffit Panels.
- E. Alternate No. 5: South Drive and Sidewalk rework vs. patch repair existing south drive and sidewalks as deduct alternate
  - 1. Base Bid: Do not provide new concrete / asphalt drives, curbs and gutters and sidewalks and instead patch and repair existing drives, curbs and gutters and sidewalks as indicated on Drawings and as specified in Section 32 16 00 – CURBS, GUTTERS, SIDEWALKS, AND DRIVEWAYS.
  - 2. Alternate: Provide new concrete / asphalt drives, curbs and gutters and sidewalks as indicated on Drawings and as specified in Division 32
- F. Alternate No. 6: Trash Enclosure Add Alternate
  - 1. Base Bid: Do not provide trash enclosure as indicated on Drawings and as specified in Division 32.
  - 2. Alternate: Provide trash enclosure, as delegated design by manufacturer, as indicated on Drawings and as specified in Division 32.

- G. Alternate No 7. Skyfold Partition as Add Alternate
1. Base Bid: Provide acoustic gypsum board partition between Rooms 101 and 102, as indicated on and as specified in Section 09 21 16 – GYPSUM BOARD ASSEMBLIES
  2. Alternate: Provide Skyfold Partition between Rooms 101 and 102, as indicated on drawings and as specified in Section 10 22 50 – VERTICAL OPERABLE PARTITION
- H. Alternate No 8: Acoustic Wall paneling as Add Alternate
1. Base Bid: Do Not provide Acoustic Wall Paneling, SAP-1, SAP-2, SAP-3, nor SAP-4 as indicated on drawings and as specified in Section 09 84 30 – SOUND-ABSORBING WALL AND CEILING UNITS.
  2. Alternate: Provide Acoustic Wall Paneling, SAP-1, SAP-2, SAP-3, nor SAP-4 as indicated on drawings and as specified in Section 09 84 30 – SOUND-ABSORBING WALL AND CEILING UNITS.
- I. Alternate No 9: Horizontal Operable Partition as Add Alternate
1. Base Bid: Do Not provide Horizontal Operable Partition and associated gypsum board ceiling and partition pocket in Room 212 as indicated on drawings and as specified in Divisions 09 and 10.
  2. Alternate: Provide Horizontal Operable Partition and associated gypsum board ceiling and partition pocket in Room 212 as indicated on drawings and as specified in Divisions 09 and 10.
- J. Alternate No. 10: Monument Sign as Add Alternate
1. Base Bid: Do not provide monument sign as indicated on drawings and as specified in Division 03, Division 04 and Division 32.
  2. Alternate: Provide monument sign as indicated on drawings and as specified in Division 03, Division 04 and Division 32.
- K. Add Alternate No. 11: Sidewalk as Add Alternate
1. Base Bid: Do not provide supplementary sidewalks on west side of building as indicated on drawings and as indicated in specification Section 32 16 00 – CURBS, GUTTERS, SIDEWALKS, AND DRIVEWAYS.
  2. Alternate: Provide supplementary sidewalks on west side of building as indicated on drawings and as indicated in specification Section 32 16 00 – CURBS, GUTTERS, SIDEWALKS, AND DRIVEWAYS.
- L. Add Alternate No. 12: Brick Site Walls as Add Alternate
1. Base Bid: Do not provide brick site walls as indicated on drawings and as specified in Division 03, Division 04 and Division 32.
  2. Alternate: Provide brick site walls as indicated on drawings and as specified in Division 03, Division 04 and Division 32.
- M. Add Alternate No. 13: Free Standing Wall between New Building and Graham Hall as Add Alternate
1. Base Bid: Do not provide free-standing masonry wall between the New Building and the existing Graham Hall as indicated on drawings and as specified in Division 03, Division 04, Division 07 and Division 32.

2. Alternate: Provide free-standing masonry wall between the New Building and existing Graham Hall as indicated on drawings and as specified in Division 03, Division 04, Division 07 and Division 32.
- N. Add Alternate No. 14: Graham Hall Connector: Elevator and Stair Enclosure as Add Alternate
1. Base Bid: Do not provide Graham Hall Connector: Elevator and Stair Enclosure as indicated on drawings and as specified in Divisions 03, 04, 05, 06, 07, 08, 09,14, 23, 26 and 32.
  2. Alternate: Provide Graham Hall Connector: Elevator and Stair Enclosure as indicated on drawings and as specified in Divisions 03, 04, 05, 06, 07, 08, 09,14, 23, 26 and 32.
- O. Add Alternate No. 15: Replace Lincoln Boilers
1. Base Bid: Relocate existing Lincoln Boilers as specified in Division 22 and 23.
  2. Alternate: Replace with new boilers as specified in Division 22 and 23.
- P. Add Alternate No. 16: Replace Lincoln Chiller
1. Base Bid: Relocate existing chiller as specified in Division 22 and 23.
  2. Alternate: Replace with new chiller as specified in Division 22 and 23.

**END OF SECTION**

**SECTION 012500  
SUBSTITUTION PROCEDURES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Procedural requirements for proposed substitutions.

**1.02 RELATED REQUIREMENTS**

- A. Instructions to Bidders.
- B. Section 012200 - Unit Prices, for additional unit price requirements.
- C. Section 016000 - Product Requirements: Fundamental product requirements, product options, delivery, storage, and handling.

**1.03 DEFINITIONS**

- A. Substitutions: Changes from Contract Documents requirements proposed by Contractor to materials, products, assemblies, and equipment.

**PART 2 PRODUCTS - NOT USED**

**PART 3 EXECUTION**

**3.01 GENERAL REQUIREMENTS**

- A. A Substitution Request for products, assemblies, materials, and equipment constitutes a representation that the submitter:
  - 1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product, equipment, assembly, or system.
  - 2. Agrees to provide the same warranty for the substitution as for the specified product.
  - 3. Agrees to provide same or equivalent maintenance service and source of replacement parts, as applicable.
  - 4. Agrees to coordinate installation and make changes to other work that may be required for the work to be complete, with no additional cost to Owner.
  - 5. Waives claims for additional costs or time extension that may subsequently become apparent.
- B. A Substitution Request for specified installer constitutes a representation that the submitter:
  - 1. Has acted in good faith to obtain services of specified installer, but was unable to come to commercial, or other terms.
- C. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents. Burden of proof is on proposer.
- D. Content: Include information necessary for tracking the status of each Substitution Request, and information necessary to provide an actionable response.
  - 1. No specific form is required. Contractor's Substitution Request documentation must include the following:
    - a. Project Information:
      - 1) Official project name and number, and any additional required identifiers established in Contract Documents.
    - b. Substitution Request Information:
      - 1) Discrete and consecutive Substitution Request number, and descriptive subject/title.
      - 2) Indication of whether the substitution is for cause or convenience.
      - 3) Issue date.
      - 4) Reference to particular Contract Document(s) specification section number, title, and article/paragraph(s).
      - 5) Description of Substitution.
      - 6) Differences between proposed substitution and specified item.
      - 7) Description of how proposed substitution affects other parts of work.
    - c. Attached Comparative Data: Provide point-by-point, side-by-side comparison addressing essential attributes specified, as appropriate and relevant for the item:
      - 1) Physical characteristics.

- 2) In-service performance.
  - 3) Expected durability.
  - 4) Visual effect.
  - 5) Warranties.
  - 6) Other salient features and requirements.
  - 7) Include, as appropriate or requested, the following types of documentation:
    - (a) Product Data:
    - (b) Certificates, test, reports or similar qualification data.
    - (c) Drawings, when required to show impact on adjacent construction elements.
- d. Impact of Substitution:
- 1) Savings to Owner for accepting substitution.
  - 2) Change to Contract Time due to accepting substitution.
- E. Limit each request to a single proposed substitution item.
1. Submit an electronic document, combining the request form with supporting data into single document.

### **3.02 SUBSTITUTION PROCEDURES DURING PROCUREMENT**

- A. Submittal Time Restrictions:
1. Instructions to Bidders specifies time restrictions and the documents required for submitting substitution requests during the bidding period.

### **3.03 RESOLUTION**

- A. Architect may request additional information and documentation prior to rendering a decision. Provide this data in an expeditious manner.
- B. Substitution requests that are approved will be documented in the project addenda.

**END OF SECTION**

# PRIOR APPROVAL / SUBSTITUTION REQUEST FORM

Date: \_\_\_\_\_

Company Submitting Request: \_\_\_\_\_  
(Name and Address)

---

Contact Name: \_\_\_\_\_ Phone: \_\_\_\_\_ Fax: \_\_\_\_\_

E-Mail: \_\_\_\_\_

PROJECT NAME: \_\_\_\_\_

SPECIFIED ITEM: \_\_\_\_\_  
(Section) (Page) (Description)

The undersigned requests consideration of the following product substitution:

PROPOSED SUBSTITUTION: \_\_\_\_\_  
Provide Product Name / Model /Manufacturer

1. Attached data includes: \_\_\_\_\_ Product Description    \_\_\_\_\_ Performance and Test Data  
  \_\_\_\_\_ Drawings                                        \_\_\_\_\_ Specifications  
  \_\_\_\_\_ Photographs
2. \_\_\_\_\_ Yes / No changes will be required to the Contract Documents for the proper installation of proposed product substitution. If yes, then attach data that includes description of changes.

**The undersigned states that the following paragraphs, unless modified by attachments, are correct:**

1. The proposed substitution does not affect dimensions shown on the drawings.
2. No changes to the building design, engineering design, or detailing are required by the proposed substitution.
3. The proposed substitution will have no adverse effect on other trades, the construction schedule, or **specified warranty requirements.**

4. No maintenance is required by the proposed substitution other than that required for originally specified product.

5. Other Information

**The undersigned further states that they have read the corresponding specification section in the project manual and confirms that the function, appearance and quality of the proposed substitution are equivalent or superior to the originally specified product.**\_\_initial.

Signature: \_\_\_\_\_ Printed Name: \_\_\_\_\_

Fax Number: \_\_\_\_\_

**For Architect's Use:**

\_\_\_\_ Accepted

\_\_\_\_ Accepted As Noted

\_\_\_\_ Incomplete Information

\_\_\_\_ Not Accepted

\_\_\_\_ Received Too Late

\_\_\_\_ No Substitutions Accepted For

This

Product

Reviewed By / Date:

Processed

by

Addendum

No.

Comments: \_\_\_\_\_

**SECTION 013000  
ADMINISTRATIVE REQUIREMENTS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Electronic document submittal service.
- B. Preconstruction meeting.
- C. Progress meetings.
- D. Submittals for review, information, and project closeout.
- E. Number of copies of submittals.
- F. Submittal procedures.

**PART 2 PRODUCTS - NOT USED**

**PART 3 EXECUTION**

**3.01 ELECTRONIC DOCUMENT SUBMITTAL SERVICE**

- A. All documents transmitted for purposes of administration of the contract are to be in electronic (PDF) format and transmitted via an Internet-based submittal service that receives, logs and stores documents, provides electronic stamping and signatures, and notifies addressees via email.
  - 1. Besides submittals for review, information, and closeout, this procedure applies to requests for information (RFIs), progress documentation, contract modification documents (e.g. supplementary instructions, change proposals, change orders), applications for payment, field reports and meeting minutes, Contractor's correction punchlist, and any other document any participant wishes to make part of the project record.
  - 2. It is Contractor's responsibility to submit documents in PDF format.
  - 3. Users of the service need an email address, Internet access, and PDF review software that includes ability to mark up and apply electronic stamps (such as Adobe Acrobat, [www.adobe.com](http://www.adobe.com), or Bluebeam PDF Revu, [www.bluebeam.com](http://www.bluebeam.com)), unless such software capability is provided by the service provider.
  - 4. Paper document transmittals will not be reviewed; emailed PDF documents will not be reviewed.
- B. Submittal Service: The selected service is:
  - 1. Submittal Exchange (tel: 1-800-714-0024): [www.submittalexchange.com/#sle](http://www.submittalexchange.com/#sle).

**3.02 PRECONSTRUCTION MEETING**

- A. Architect will schedule a meeting after Notice of Award.
- B. Attendance Required:
  - 1. Owner.
  - 2. Architect.
  - 3. Contractor.
- C. Agenda:
  - 1. Execution of Owner-Contractor Agreement.
  - 2. Submission of executed bonds and insurance certificates.
  - 3. Distribution of Contract Documents.
  - 4. Submission of list of Subcontractors, list of Products, schedule of values, and progress schedule.
  - 5. Designation of personnel representing the parties to Contract and .
  - 6. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
  - 7. Scheduling.
- D. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

**3.03 PROGRESS MEETINGS**

- A. Attendance Required:
  - 1. Contractor.



2. Owner.
  3. Architect.
  4. Contractor's Superintendent.
  5. Major Subcontractors.
- B. Agenda:
1. Review minutes of previous meetings.
  2. Review of Work progress.
  3. Field observations, problems, and decisions.
  4. Identification of problems that impede, or will impede, planned progress.
  5. Review of submittals schedule and status of submittals.
  6. Maintenance of progress schedule.
  7. Corrective measures to regain projected schedules.
  8. Planned progress during succeeding work period.
  9. Maintenance of quality and work standards.
  10. Effect of proposed changes on progress schedule and coordination.
  11. Other business relating to Work.
- C. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

### **3.04 CONSTRUCTION PROGRESS SCHEDULE - SEE SECTION 013216**

- A. Within 10 days after date of the Agreement, submit preliminary schedule defining planned operations for the first 60 days of Work, with a general outline for remainder of Work.

### **3.05 SUBMITTALS FOR REVIEW**

- A. Submit to Architect for review for the limited purpose of checking for conformance with information given and the design concept expressed in the contract documents.
- B. Samples will be reviewed only for aesthetic, color, or finish selection.
- C. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article below and for record documents purposes described in Section 017800 - Closeout Submittals.
- D. Submit for Architect's knowledge as contract administrator or for Owner. No action will be taken.
- E. When the following are specified in individual sections, submit them at project closeout:

### **3.06 NUMBER OF COPIES OF SUBMITTALS**

- A. Electronic Documents: Submit one electronic copy in PDF format; an electronically-marked up file will be returned. Create PDFs at native size and right-side up; illegible files will be rejected.

### **3.07 SUBMITTAL PROCEDURES**

- A. Shop Drawing Procedures:
  1. Prepare accurate, drawn-to-scale, original shop drawing documentation by interpreting the Contract Documents and coordinating related Work.
  2. Generic, non-project specific information submitted as shop drawings do not meet the requirements for shop drawings.
- B. Transmit each submittal with a copy of approved submittal form.
- C. Sequentially number the transmittal form. Revise submittals with original number and a sequential alphabetic suffix.
- D. Identify Project, Contractor, Subcontractor or supplier; pertinent drawing and detail number, and specification section number, as appropriate on each copy.
- E. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of Products required, field dimensions, adjacent construction Work, and coordination of information is in accordance with the requirements of the Work and Contract Documents.
- F. Schedule submittals to expedite the Project, and coordinate submission of related items.
- G. For each submittal for review, allow 15 days excluding delivery time to and from the Contractor.
- H. Identify variations from Contract Documents and Product or system limitations that may be detrimental to successful performance of the completed Work.
- I. Provide space for Contractor and Architect review stamps.

- J. When revised for resubmission, identify all changes made since previous submission.
- K. Distribute reviewed submittals as appropriate. Instruct parties to promptly report any inability to comply with requirements.
- L. Submittals not requested will not be recognized or processed.

**END OF SECTION**

**SECTION 013216  
CONSTRUCTION PROGRESS SCHEDULE**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Preliminary schedule.
- B. Construction progress schedule, bar chart type.

**1.02 SUBMITTALS**

- A. Within 10 days after date of Agreement, submit preliminary schedule defining planned operations for the first 60 days of Work, with a general outline for remainder of Work.
- B. If preliminary schedule requires revision after review, submit revised schedule within 10 days.
- C. Within 10 days after joint review, submit complete schedule.
- D. Submit updated schedule with each Application for Payment.

**1.03 SCHEDULE FORMAT**

- A. Listings: In chronological order according to the start date for each activity. Identify each activity with the applicable specification section number.

**PART 2 PRODUCTS - NOT USED**

**PART 3 EXECUTION**

**3.01 PRELIMINARY SCHEDULE**

- A. Prepare preliminary schedule in the form of a horizontal bar chart.

**3.02 CONTENT**

- A. Show complete sequence of construction by activity, with dates for beginning and completion of each element of construction.
- B. Identify each item by specification section number.
- C. Show accumulated percentage of completion of each item, and total percentage of Work completed, as of the first day of each month.
- D. Provide separate schedule of submittal dates for shop drawings, product data, and samples, owner-furnished products, and dates reviewed submittals will be required from Architect. Indicate decision dates for selection of finishes.
- E. Indicate delivery dates for owner-furnished products.
- F. Provide legend for symbols and abbreviations used.

**3.03 BAR CHARTS**

- A. Include a separate bar for each major portion of Work or operation.
- B. Identify the first work day of each week.

**3.04 REVIEW AND EVALUATION OF SCHEDULE**

- A. Participate in joint review and evaluation of schedule with Architect at each submittal.
- B. Evaluate project status to determine work behind schedule and work ahead of schedule.
- C. After review, revise as necessary as result of review, and resubmit within 10 days.

**3.05 UPDATING SCHEDULE**

- A. Maintain schedules to record actual start and finish dates of completed activities.
- B. Indicate progress of each activity to date of revision, with projected completion date of each activity.
- C. Annotate diagrams to graphically depict current status of Work.
- D. Identify activities modified since previous submittal, major changes in Work, and other identifiable changes.
- E. Indicate changes required to maintain Date of Substantial Completion.
- F. Submit reports required to support recommended changes.

**3.06 DISTRIBUTION OF SCHEDULE**

- A. Distribute copies of updated schedules to Contractor's project site file, to subcontractors, suppliers, Architect, Owner, and other concerned parties.

- B. Instruct recipients to promptly report, in writing, problems anticipated by projections shown in schedules.

**END OF SECTION**

**SECTION 013329.03  
SUSTAINABLE DESIGN REPORTING - GREEN GLOBES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. General requirements for sustainable design reporting.

**1.02 REPORTING REQUIREMENTS**

- A. Contractor must familiarize himself with the relevant reporting requirements and provide the necessary information and instruction to all subcontractors and installers.

**1.03 RELATED REQUIREMENTS**

- A. Section 013000 - Administrative Requirements: General submittal requirements.
- B. Section 013566.06 - Project Sustainability Goal Point Summary - Green Globes.
- C. Section 013566.13 - Sustainability Certification Project Procedures - Green Globes.
- D. Section 016000 - Product Requirements.

**1.04 DEFINITIONS**

- A. Definitions in this Article are in addition to sustainable design definitions directly related to products, as listed in Section - 016000 - Product Requirements.
- B. Indoor Air Quality (IAQ) Management Plan: Plan developed by the Contractor to provide a healthy indoor environment for workers and building occupants during construction. Plan must meet or exceed the recommendations of SMACNA (OCC) 'IAQ Guidelines for Occupied Buildings Under Construction'.
- C. Life Cycle Assessment (LCA): Compilation and evaluation of the inputs, outputs and the potential environmental impacts of a product system throughout its life cycle.
  - 1. LCA software has been used during design to evaluate a minimum of two different core designs, based on life cycle assessment (LCA) in compliance with the assessment guidance and resulting in selection of the building core and shell with the least anticipated environmental impact.
- D. Material Cost: The dollar value of materials being provided to the site, after Contractor mark-ups, including transportation costs, taxes, fees, and shop labor, but excluding field equipment and field labor costs.

**1.05 PRODUCT REPORTING SCOPE**

- A. General: Product reporting scope for the purpose of achieving the selected sustainability certification level is limited to those items directly affecting ability to achieve targeted points.
  - 1. Environmental Product Declarations (EPD): Documentation complying with definition and quality requirements in Section 016000 - Product Requirements.
    - a. Material Ingredient Reporting: Use, as is appropriate:
      - 1) Manufacturers' inventories of ingredients.
      - 2) BIFMA e3 furniture sustainability standard assessment or scorecard.
    - b. Provide quantity and cost data for materials and products for which EPDs are available.
  - 2. Multi-Attribute Product Certifications: Documentation complying with definition and quality requirements in Section 016000 - Product Requirements.
    - a. Provide quantity and cost data for materials and products for which certifications are publicly available.
- B. Green Globes Product Reporting Scope: Includes products in the following categories:
  - 1. Building Core and Shell - Materials and Resources:
    - a. Path A - Performance Path:
      - 1) Include for each category of materials listed in the LCA Bill-of-Materials Report.
    - b. Path B - Prescriptive Path: For products used in construction of core and shell and may include any of the products specified in Divisions 2 through 14.
  - 2. Interior Fit-outs (including Finishes and Furnishings) - Materials and Resources:
    - a. Path A - Performance Path:

- 1) Include for each category of materials listed in the LCA Bill of Materials Report.
- b. Path B - Prescriptive Path: For products used in construction of interior fit-outs and may include any of the products specified in Divisions 2 through 14.

#### 1.06 REFERENCE STANDARDS

- A. BIFMA e3 - Furniture Sustainability Standard; Business and Institutional Furniture Manufacturers Association; 2019.
- B. GG (TRM-SI) - Green Globes for Sustainable Interiors, version 1.1; 2016.
- C. SMACNA (OCC) - IAQ Guidelines for Occupied Buildings Under Construction; 2007.

#### 1.07 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for additional submittal procedures requirements.
- B. Sustainable Design Documentation: The scope of required documentation is specified in this section and in applicable individual specification sections.
- C. Green Globes Points - Documentation is required for the following items:
  1. New Product Documentation: Use software tools and/or forms mutually agreed upon by Architect and project assessor; electronic copies of these to be made available to Contractor at preconstruction meeting. Use for documentation of GG (TRM-SI) Materials and Resources points.
    - a. Path A - Performance Path:
      - 1) Submit Contractor's bill of materials for materials listed in the "Product Reporting Scope" Article.
      - 2) For each item, include data for the following environmental performance life-cycle impact indicators:
        - (a) Global warming potential (GWP).
        - (b) Acidification potential.
        - (c) Eutrophication potential.
        - (d) Ozone depletion potential (ODP).
        - (e) Smog potential.
        - (f) Fossil fuel use.
    - b. Path B: Prescriptive Path for Building Core and Shell: More than or equal to 40 percent (20 points) of the products provided for the building core and shell (by cost) require submittal of Environmental Product Declarations (EPD) documentation.
      - 1) Submit the above documentation separately from required product data.
    - c. Path B: Prescriptive Path for Interior Fit-outs, As Part of New Construction Only: More than 39 percent (10 points) of the products provided for the building fit-out (by cost) require submittal of Environmental Product Declarations (EPD) documentation.
      - 1) Submit the above documentation separately from required product data.
    - d. Path B: Prescriptive Path for Interior Fit-outs: More than or equal to 39 percent (50 points) of the products provided for the building fit-out (by cost) require submittal of Environmental Product Declarations (EPD) documentation.
      - 1) Submit the above documentation separately from required product data.
    - e. Submit updated summaries prior to or along with initial application for payment.
    - f. Update and re-submit whenever the total cost changes due to contract modifications.
  2. Contractor's Environmental Management During Construction: Submit documentation of a environmental management system instituted and followed for the project. Include one or more of the required system components.
    - a. Contractor's environmental policy.
    - b. Regulatory compliance and training.
    - c. Environmental risk assessment showing sensitive environmental area and ranking of potential risks that may arise to them due to construction activities.
    - d. Environmental management roles, responsibilities, and reporting structure.
    - e. Site and work instructions for site personnel outlining environmental procedures during construction.
    - f. Environmental inspection checklists.

3. Waste Disposal Management: Periodic reports quantifying diversion of construction and demolition waste away from landfills and incineration facilities.
  - a. Include information on percentage of diverted material and number of material streams.
4. Furniture Cost Statement: Submit the total cost of furniture in the project, including purchase price, taxes, and delivery to site, but not labor, tools, or equipment for installation.
  - a. Submit prior to or along with initial application for payment.
  - b. Update and re-submit whenever the total cost changes due to contract modifications.

**PART 2 PRODUCTS - NOT USED**

**PART 3 EXECUTION**

**3.01 PROCEDURES**

- A. Submit sustainable design documentation required of Contractor, using procedures defined under Submittals for Information in Section 013000.
- B. Where an item of sustainable design documentation is specified, fill out and submit electronically the appropriate form(s), and/or use appropriate software.
  1. Fill out one line for each different brand name product and each different manufacturer of a lot of commodity products.
  2. Where required attachments are specified, attach the documentation.
  3. Mark each blank with the appropriate information; use "ATT" for items attached; if any item is not relevant use the code "NR"; if any item is not available use the code "NA".
- C. Each form must be signed by the entity capable of certifying the information.
  1. Certification signatures must be made by an officer of the company.
  2. For products, certification must be made by the manufacturer not the supplier.
  3. For custom fabricated products, certification by the fabricator is acceptable.
- D. Submit the completed forms in accordance with the requirements of Section 013000, as information submittals.
  1. Give each form a unique submittal number.
  2. Do not combine sustainable design documentation with product data or shop drawing submittals.
- E. Submit forms applicable to work for which application for payment is being made, either prior to or concurrent with application for payment; payment will not be made until relevant forms have been submitted.
- F. For work covered by multiple applications for payment, the initial submittal of a form is sufficient for subsequent applications unless the nature of the product has changed.

**END OF SECTION**

**SECTION 013566.06  
PROJECT SUSTAINABILITY GOAL POINT SUMMARY - GREEN GLOBES**

**PART 1 GENERAL**

**1.01 PROJECT INFORMATION**

- A. Project Name: NSU Lincoln Hall Business & Nursing School 4-9-2024.
- B. City: Aberdeen.
- C. State: South Dakota.

**1.02 PROJECT GOALS**

- A. This project has been designed to achieve 1 Globes (35 to 54 percent of 1,000 available points) rating as defined in The Green Buildings Initiative's program for New Construction.
  - 1. A third-party Green Globes Assessor has been assigned to the project. This entity is a key, integral part of the project delivery team. Full cooperation by Contractor with Assessor's work is expected throughout duration of the construction phase of the project, and beyond, until all necessary work and documentation have been completed.
  - 2. This project intends to earn "Materials and Resources" points by using the following options:
    - a. Building Core and Shell: Path A: Performance Path.
    - b. Interior Fit-outs (including Finishes and Furnishings): Path B - Prescriptive Path.

**1.03 RELATED REQUIREMENTS**

- A. Section 013329.03 - Sustainable Design Reporting - Green Globes, for Contractor's reporting responsibilities.
- B. Section 013566.13 - Sustainability Certification Project Procedures - Green Globes, for Contractor's procedural responsibilities.

**1.04 DEFINITIONS**

- A. Sustainability Rating System: The Green Building Initiative's Green Globes for New Construction.
- B. Sustainability Rating System: The Green Building Initiative's Green Globes for Sustainable Interiors.
- C. Required: Achievement of this point is essential for certification of this project.
- D. Preferred: Achievement of this point would be desirable but is not mandatory.
- E. Not Required: Achievement of this point is not expected or not possible for this project.

**PART 2 PRODUCTS - NOT USED**

**PART 3 EXECUTION - POINT SUMMARY**

**3.01 MATERIALS & RESOURCES - NEW CONSTRUCTION**

**3.02 INDOOR ENVIRONMENT - NEW CONSTRUCTION**

**END OF SECTION**



**SECTION 013566.13  
SUSTAINABILITY CERTIFICATION PROJECT PROCEDURES - GREEN GLOBES**

**PART 1 GENERAL**

**1.01 PROJECT APPROACH**

- A. This project intends to achieve recognition for sustainable design using Green Globes Certification program.
- B. Project goals for sustainability certification are described in Section 013566.06.
- C. Contractor is not responsible for the application for sustainability certification, nor for determination of methods of achieving sustainability credits unless specifically so indicated.
- D. Many sustainability points can be achieved only through intelligent design of the project and are beyond the control of the Contractor. However, certain points relate to the products and procedures used for construction. Therefore, full cooperation of the Contractor and subcontractors is essential to achieving final certification goal, and therefore they must familiarize themselves with the relevant requirements, and provide the necessary information and instructions to product suppliers and installers
- E. Since Contractor and subcontractors may not be familiar with detailed Green Globes sustainability procedures, this section includes a list of other specifications sections that contain related requirements for products and procedures necessary for achievement of targeted sustainability certification level.
  - 1. Achievement of many points is dependent on proper performance by Contractor and subcontractors, using specific required project management and work execution means and methods.
  - 2. Achievement of other points involves quantifying percentages of installed products by weight and cost; these require careful recordkeeping and reporting by the Contractor.
  - 3. See [www.thegbi.org](http://www.thegbi.org) for more information.

**1.02 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for additional submittal procedures requirements.

**PART 2 PRODUCTS (NOT USED)**

**PART 3 EXECUTION**

**3.01 PROCEDURES**

- A. General: Conduct project management and construction operations in a manner consistent with, and in support of successful achievement of Owner's targeted certification level.
  - 1. Collect the cost information for materials and products.
    - a. Collect cost information for building core and shell materials and products with appropriate sustainability documentation, to establish their share of the total core and shell cost.
    - b. Collect cost information for building interior fit-out materials and products with appropriate sustainability documentation, to establish their share of the total interior fit-out cost.
- B. Construction Waste Management and Disposal: Implement approved waste management plan during the entire duration of the Contract.
- C. Commissioning Authority Activities: Cooperate with Commissioning Authority to coordinate construction and closeout activities scheduling.
- D. Sustainable Design Reporting: Comply with requirements of Section 013329.03.
- E. Green Globes Assessor: Coordinate construction and closeout activities with Assessor's on-site assessment responsibilities.
  - 1. Verification of Complying Construction: Where elements of construction are required to be incorporated in the work in a particular manner required for designed in-service performance, keep records of installation details and procedures.
    - a. For elements of construction that become concealed from view prior to being visually inspected, or become unable to be tested without disturbing in-place construction, document as-built conditions using digital photographs and/or digital video. Make

digital record available to the Assessor.

### **3.02 SMOKING POLICY**

- A. General: Smoking policy on the project site is implemented for the following reasons:
  - 1. Protection and promotion of health of all persons on the project site.
  - 2. Prevention of fire.
  - 3. Prevention of exposure of building occupants, indoor surfaces, and ventilation air distribution systems to environmental tobacco smoke, resulting in build-up on hard surfaces, and absorption of smoke by textiles and fabrics.
  - 4. Promotion of successful results of Indoor Air Quality
- B. Smoking is not permitted anywhere on project site.
- C. Include explanation of smoking policy as part of orientation and safety training for every worker on the site.
  - 1. Require every worker to sign a consent form stating s/he understands the policy and will comply with it.
  - 2. Post durable signs at prominent locations on the project site, with language as appropriate for the required policy.
  - 3. Reinforce the policy at regular Health and Safety, and other regular employee or labor-management meetings.
- D. Enforcement: Institute smoking policy enforcement measures.
  - 1. Violations of smoking policy are subject to payment of fines assessed by authorities having jurisdiction.
  - 2. Issue a written warning for a worker's first violation of smoking policy.
  - 3. Suspend a worker for one-day, without pay, for second violation within two months.

### **3.03 CONSTRUCTION WASTE MANAGEMENT**

- A. Comply with applicable requirements of Section 017419 - Construction Waste Management and Disposal.

### **3.04 TEMPORARY ENVIRONMENTAL CONTROLS**

- A. Comply with applicable requirements of Section 015719 - Temporary Environmental Controls.

**END OF SECTION**

**SECTION 014000  
QUALITY REQUIREMENTS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Control of installation.
- B. Testing and inspection agencies and services.
- C. Control of installation.
- D. Mock-ups.
- E. Defect Assessment.

**1.02 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Test Reports: After each test/inspection, promptly submit two copies of report to Architect and to Contractor.
  - 1. Include:
    - a. Date issued.
    - b. Project title and number.
    - c. Name of inspector.
    - d. Date and time of sampling or inspection.
    - e. Identification of product and specifications section.
    - f. Location in the Project.
    - g. Type of test/inspection.
    - h. Date of test/inspection.
    - i. Results of test/inspection.
    - j. Conformance with Contract Documents.
    - k. When requested by Architect, provide interpretation of results.

**1.03 TESTING AND INSPECTION AGENCIES AND SERVICES**

- A. Owner will employ and pay for services of an independent testing agency to perform other specified testing.
- B. Employment of agency in no way relieves Contractor of obligation to perform Work in accordance with requirements of Contract Documents.

**PART 3 EXECUTION**

**2.01 CONTROL OF INSTALLATION**

- A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce Work of specified quality.
- B. Comply with manufacturers' instructions, including each step in sequence.
- C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Architect before proceeding.
- D. Comply with specified standards as minimum quality for the Work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
- E. Have Work performed by persons qualified to produce required and specified quality.
- F. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.
- G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, and disfigurement.

**2.02 TESTING AND INSPECTION**

- A. Testing Agency Duties:
  - 1. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
  - 2. Perform specified sampling and testing of products in accordance with specified standards.
  - 3. Ascertain compliance of materials and mixes with requirements of Contract Documents.

4. Promptly notify Architect and Contractor of observed irregularities or non-compliance of Work or products.
  5. Perform additional tests and inspections required by Architect.
  6. Submit reports of all tests/inspections specified.
- B. Limits on Testing/Inspection Agency Authority:
1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
  2. Agency may not approve or accept any portion of the Work.
  3. Agency may not assume any duties of Contractor.
  4. Agency has no authority to stop the Work.
- C. Contractor Responsibilities:
1. Deliver to agency at designated location, adequate samples of materials proposed to be used that require testing, along with proposed mix designs.
  2. Cooperate with laboratory personnel, and provide access to the Work and to manufacturers' facilities.
  3. Provide incidental labor and facilities:
    - a. To provide access to Work to be tested/inspected.
    - b. To obtain and handle samples at the site or at source of Products to be tested/inspected.
    - c. To facilitate tests/inspections.
    - d. To provide storage and curing of test samples.
  4. Notify Architect and laboratory 24 hours prior to expected time for operations requiring testing/inspection services.
  5. Employ services of an independent qualified testing laboratory and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
  6. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
- D. Re-testing required because of non-compliance with specified requirements shall be performed by the same agency on instructions by Architect.
- E. Re-testing required because of non-compliance with specified requirements shall be paid for by Contractor.

### **2.03 DEFECT ASSESSMENT**

- A. Replace Work or portions of the Work not conforming to specified requirements.

**END OF SECTION**

**SECTION 014100  
REGULATORY REQUIREMENTS**

**PART 1 GENERAL**

**1.01 ESSER FUNDING**

- A. The NSU Lincoln Hall Business & Nursing project may be partially funded using American Rescue Plan Act (ARPA) funds. As a condition of the ARPA funding guidelines, the Contractor shall meet the following minimum requirements:
1. Based on the “Build America, Buy America” provisions of the Infrastructure Investment and Jobs Act (IIJA) and E.O. 14005 which provide that, as appropriate and to the extent consistent with law, a preference will be provided to Contractors for the purchase, acquisition, or use of goods, products, or materials produced in the United States (including but not limited to iron, aluminum, steel, cement, and other manufactured products.) The Contractor shall provide documentation of their efforts to meet the provisions of “Build America, Buy America” upon request.
  2. The Contractor shall make a good faith effort to utilize Disadvantaged Business Enterprises (DBE) and/or Minority Business Enterprises (MBE) and shall provide documentation of the effort to solicit bids from qualified entities upon request.
  3. A copy of the ARPA funding guidance that outlines the requirements associated with projects that utilize this funding can be found at the following link:  
<https://home.treasury.gov/policy-issues/coronavirus/assistance-for-state-local-and-tribal-governments/state-and-local-fiscal-recovery-funds/>

**PART 2 PRODUCTS - NOT USED**

**PART 3 EXECUTION - NOT USED**

**END OF SECTION**

**SECTION 015000  
TEMPORARY FACILITIES AND CONTROLS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Temporary utilities.
- B. Temporary telecommunications services.
- C. Temporary sanitary facilities.
- D. Temporary Controls: Barriers, enclosures, and fencing.
- E. Security requirements.
- F. Vehicular access and parking.
- G. Waste removal facilities and services.
- H. Field offices.

**1.02 TEMPORARY UTILITIES**

- A. Owner will provide the following:
  - 1. Electrical power and metering, consisting of connection to existing facilities.
  - 2. Water supply, consisting of connection to existing facilities.

**1.03 TELECOMMUNICATIONS SERVICES**

- A. Provide, maintain, and pay for telecommunications services to field office at time of project mobilization.

**1.04 TEMPORARY SANITARY FACILITIES**

- A. Provide and maintain required facilities and enclosures. Provide at time of project mobilization.
- B. Maintain daily in clean and sanitary condition.

**1.05 BARRIERS**

- A. Provide barriers to prevent unauthorized entry to construction areas, to prevent access to areas that could be hazardous to workers or the public, to allow for owner's use of site and to protect existing facilities and adjacent properties from damage from construction operations and demolition.
- B. Provide barricades and covered walkways required by governing authorities for public rights-of-way and for public access to existing building.
- C. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

**1.06 FENCING**

- A. Construction: Commercial grade chain link fence.
- B. Provide 6 foot high fence around construction site; equip with vehicular and pedestrian gates with locks.

**1.07 EXTERIOR ENCLOSURES**

- A. Provide temporary insulated weather tight closure of exterior openings to accommodate acceptable working conditions and protection for Products, to allow for temporary heating and maintenance of required ambient temperatures identified in individual specification sections, and to prevent entry of unauthorized persons. Provide access doors with self-closing hardware and locks.

**1.08 SECURITY**

- A. Provide security and facilities to protect Work, existing facilities, and Owner's operations from unauthorized entry, vandalism, or theft. Job site security is the responsibility of the Contractor.

**1.09 VEHICULAR ACCESS AND PARKING**

- A. Comply with regulations relating to use of streets and sidewalks, access to emergency facilities, and access for emergency vehicles.
- B. Coordinate access and haul routes with governing authorities and Owner.
- C. Provide and maintain access to fire hydrants, free of obstructions.
- D. Provide means of removing mud from vehicle wheels before entering streets.

- E. Provide temporary parking areas to accommodate construction personnel. When site space is not adequate, provide additional off-site parking.

**1.10 WASTE REMOVAL**

- A. Provide waste removal facilities and services as required to maintain the site in clean and orderly condition.
- B. Provide containers with lids. Remove trash from site periodically.
- C. If materials to be recycled or re-used on the project must be stored on-site, provide suitable non-combustible containers; locate containers holding flammable material outside the structure unless otherwise approved by the authorities having jurisdiction.
- D. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.

**1.11 FIELD OFFICES**

- A. Office: Weathertight, with lighting, electrical outlets, heating, cooling equipment, and equipped with sturdy furniture, drawing rack and drawing display table.
- B. Provide space for Project meetings, with table and chairs to accommodate 6 persons.
- C. Locate offices a minimum distance of 30 feet from existing and new structures.

**1.12 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS**

- A. Remove temporary utilities, equipment, facilities, materials, prior to Date of Substantial Completion inspection.
- B. Remove underground installations to a minimum depth of 2 feet. Grade site as indicated.
- C. Clean and repair damage caused by installation or use of temporary work.

**PART 2 PRODUCTS - NOT USED**

**PART 3 EXECUTION - NOT USED**

**END OF SECTION**

**SECTION 016000  
PRODUCT REQUIREMENTS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Transportation, handling, storage and protection.
- B. Product option requirements.
- C. Substitution limitations and procedures.
- D. Maintenance materials, including extra materials, spare parts, tools, and software.

**1.02 SUBMITTALS**

- A. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.
- B. Shop Drawing Submittals: Prepared specifically for this Project; indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.
- C. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
  - 1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.

**PART 2 PRODUCTS**

**2.01 PRODUCT OPTIONS**

- A. Products Specified by Reference Standards or by Description Only: Use any product meeting those standards or description.
- B. Products Specified by Naming One or More Manufacturers: Use a product of one of the manufacturers named and meeting specifications, no options or substitutions allowed.
- C. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.

**2.02 MAINTENANCE MATERIALS**

- A. Furnish extra materials, spare parts, tools, and software of types and in quantities specified in individual specification sections.
- B. Deliver to Project site; obtain receipt prior to final payment.

**PART 3 EXECUTION**

**3.01 SUBSTITUTION PROCEDURES**

- A. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents.
- B. A request for substitution constitutes a representation that the submitter:
  - 1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product.
  - 2. Agrees to provide the same warranty for the substitution as for the specified product.
  - 3. Agrees to coordinate installation and make changes to other Work that may be required for the Work to be complete with no additional cost to Owner.
  - 4. Waives claims for additional costs or time extension that may subsequently become apparent.

**3.02 TRANSPORTATION AND HANDLING**

- A. Package products for shipment in manner to prevent damage; for equipment, package to avoid loss of factory calibration.
- B. If special precautions are required, attach instructions prominently and legibly on outside of packaging.
- C. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.
- D. Transport and handle products in accordance with manufacturer's instructions.



- E. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.
- F. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.
- G. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage, and to minimize handling.
- H. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

### **3.03 STORAGE AND PROTECTION**

- A. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication.
- B. Store and protect products in accordance with manufacturers' instructions.
- C. Store with seals and labels intact and legible.
- D. Store sensitive products in weather tight, climate controlled, enclosures in an environment favorable to product.
- E. For exterior storage of fabricated products, place on sloped supports above ground.
- F. Protect products from damage or deterioration due to construction operations, weather, precipitation, humidity, temperature, sunlight and ultraviolet light, dirt, dust, and other contaminants.
- G. Comply with manufacturer's warranty conditions, if any.
- H. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.
- I. Prevent contact with material that may cause corrosion, discoloration, or staining.
- J. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.
- K. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

**END OF SECTION**

**SECTION 017000  
EXECUTION AND CLOSEOUT REQUIREMENTS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Examination, preparation, and general installation procedures.
- B. Requirements for alterations work, including selective demolition, except removal, disposal, and/or remediation of hazardous materials and toxic substances.
- C. Pre-installation meetings.
- D. Cutting and patching.
- E. Cleaning and protection.
- F. Starting of systems and equipment.
- G. Demonstration and instruction of Owner personnel.
- H. Closeout procedures, including Contractor's Correction Punch List, except payment procedures.

**1.02 RELATED REQUIREMENTS**

- A. Section 017900 - Demonstration and Training: Demonstration of products and systems to be commissioned and where indicated in specific specification sections

**1.03 PROJECT CONDITIONS**

- A. Use of explosives is not permitted.
- B. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.

**1.04 COORDINATION**

- A. Coordinate scheduling, submittals, and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.
- B. Notify affected utility companies and comply with their requirements.
- C. Verify that utility requirements and characteristics of new operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.
- D. Coordinate space requirements, supports, and installation of mechanical and electrical work that are indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.
- E. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.
- F. Coordinate completion and clean-up of work of separate sections.
- G. After Owner occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

**PART 2 PRODUCTS**

**2.01 PATCHING MATERIALS**

- A. New Materials: As specified in product sections; match existing products and work for patching and extending work.
- B. Type and Quality of Existing Products: Determine by inspecting and testing products where necessary, referring to existing work as a standard.
- C. Product Substitution: For any proposed change in materials, submit request for substitution described in Section 016000 - Product Requirements.

**PART 3 EXECUTION**

**3.01 EXAMINATION**

- A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Start of work means acceptance of existing conditions.

- B. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.
- C. Examine and verify specific conditions described in individual specification sections.
- D. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or misfabrication.
- E. Verify that utility services are available, of the correct characteristics, and in the correct locations.
- F. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.

### **3.02 PREPARATION**

- A. Clean substrate surfaces prior to applying next material or substance.
- B. Seal cracks or openings of substrate prior to applying next material or substance.
- C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

### **3.03 PREINSTALLATION MEETINGS**

- A. When required in individual specification sections, convene a preinstallation meeting at the site prior to commencing work of the section.
- B. Require attendance of parties directly affecting, or affected by, work of the specific section.
- C. Notify Architect four days in advance of meeting date.
- D. Prepare agenda and preside at meeting:
  1. Review conditions of examination, preparation and installation procedures.
  2. Review coordination with related work.
- E. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

### **3.04 GENERAL INSTALLATION REQUIREMENTS**

- A. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.
- B. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.
- C. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.
- D. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.
- E. Make neat transitions between different surfaces, maintaining texture and appearance.

### **3.05 ALTERATIONS**

- A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
  1. Verify that construction and utility arrangements are as shown.
  2. Report discrepancies to Architect before disturbing existing installation.
  3. Beginning of alterations work constitutes acceptance of existing conditions.
- B. Maintain weatherproof exterior building enclosure except for interruptions required for replacement or modifications; take care to prevent water and humidity damage.
  1. Where openings in exterior enclosure exist, provide construction to make exterior enclosure weatherproof.
  2. Insulate existing ducts or pipes that are exposed to outdoor ambient temperatures by alterations work.
- C. Remove existing work as indicated and as required to accomplish new work.
  1. Remove items indicated on drawings.
  2. Relocate items indicated on drawings.
  3. Where new surface finishes are to be applied to existing work, perform removals, patch, and prepare existing surfaces as required to receive new finish; remove existing finish if necessary for successful application of new finish.

4. Where new surface finishes are not specified or indicated, patch holes and damaged surfaces to match adjacent finished surfaces as closely as possible.
- D. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications): Remove, relocate, and extend existing systems to accommodate new construction.
1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components; if necessary, modify installation to allow access or provide access panel.
  2. Where existing systems or equipment are not active and Contract Documents require reactivation, put back into operational condition; repair supply, distribution, and equipment as required.
  3. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
    - a. Disable existing systems only to make switchovers and connections; minimize duration of outages.
    - b. Provide temporary connections as required to maintain existing systems in service.
  4. Verify that abandoned services serve only abandoned facilities.
  5. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification; patch holes left by removal using materials specified for new construction.
- E. Protect existing work to remain.
1. Prevent movement of structure; provide shoring and bracing if necessary.
  2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
  3. Repair adjacent construction and finishes damaged during removal work.
- F. Adapt existing work to fit new work: Make as neat and smooth transition as possible.
- G. Patching: Where the existing surface is not indicated to be refinished, patch to match the surface finish that existed prior to cutting. Where the surface is indicated to be refinished, patch so that the substrate is ready for the new finish.
- H. Refinish existing surfaces as indicated:
1. Where rooms or spaces are indicated to be refinished, refinish all visible existing surfaces to remain to the specified condition for each material, with a neat transition to adjacent finishes.
  2. If mechanical or electrical work is exposed accidentally during the work, re-cover and refinish to match.
- I. Clean existing systems and equipment.
- J. Remove demolition debris and abandoned items from alterations areas and dispose of off-site; do not burn or bury.
- K. Do not begin new construction in alterations areas before demolition is complete.
- L. Comply with all other applicable requirements of this section.

### **3.06 CUTTING AND PATCHING**

- A. Whenever possible, execute the work by methods that avoid cutting or patching.
- B. See Alterations article above for additional requirements.
- C. Perform whatever cutting and patching is necessary to:
  1. Complete the work.
  2. Fit products together to integrate with other work.
  3. Provide openings for penetration of mechanical, electrical, and other services.
  4. Match work that has been cut to adjacent work.
  5. Repair areas adjacent to cuts to required condition.
  6. Repair new work damaged by subsequent work.
  7. Remove samples of installed work for testing when requested.
  8. Remove and replace defective and non-conforming work.

- D. Execute work by methods that avoid damage to other work and that will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to original condition.
- E. Restore work with new products in accordance with requirements of Contract Documents.
- F. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
- G. Patching:
  1. Finish patched surfaces to match finish that existed prior to patching. On continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
  2. Match color, texture, and appearance.
  3. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to condition of substrate, repair substrate prior to repairing finish.

### **3.07 PROGRESS CLEANING**

- A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.
- B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.
- C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.
- D. Collect and remove waste materials, debris, and trash/rubbish from site periodically and dispose off-site; do not burn or bury.

### **3.08 PROTECTION OF INSTALLED WORK**

- A. Protect installed work from damage by construction operations.
- B. Provide special protection where specified in individual specification sections.
- C. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.
- D. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.
- E. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.
- F. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.
- G. Remove protective coverings when no longer needed; reuse or recycle coverings if possible.

### **3.09 SYSTEM STARTUP**

- A. Coordinate schedule for start-up of various equipment and systems.
- B. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions that may cause damage.
- C. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.
- D. Verify that wiring and support components for equipment are complete and tested.
- E. Execute start-up under supervision of applicable Contractor personnel and manufacturer's representative in accordance with manufacturers' instructions.
- F. Submit a written report that equipment or system has been properly installed and is functioning correctly.

### **3.10 DEMONSTRATION AND INSTRUCTION**

- A. See Section 017900 - Demonstration and Training.

### **3.11 ADJUSTING**

- A. Adjust operating products and equipment to ensure smooth and unhindered operation.

### **3.12 FINAL CLEANING**

- A. Use cleaning materials that are nonhazardous.

- B. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.
- C. Remove all labels that are not permanent. Do not paint or otherwise cover fire test labels or nameplates on mechanical and electrical equipment.
- D. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.
- E. Clean filters of operating equipment.
- F. Clean debris from roofs, gutters, downspouts, scuppers, overflow drains, area drains, and drainage systems.
- G. Clean site; sweep paved areas, rake clean landscaped surfaces.
- H. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.

### **3.13 CLOSEOUT PROCEDURES**

- A. Make submittals that are required by governing or other authorities.
- B. Accompany Project Coordinator on preliminary inspection to determine items to be listed for completion or correction in the Contractor's Correction Punch List for Contractor's Notice of Substantial Completion.
- C. Notify Architect when work is considered ready for Architect's Substantial Completion inspection.
- D. Submit written certification containing Contractor's Correction Punch List, that Contract Documents have been reviewed, work has been inspected, and that work is complete in accordance with Contract Documents and ready for Architect's Substantial Completion inspection.
- E. Conduct Substantial Completion inspection and create Final Correction Punch List containing Architect's and Contractor's comprehensive list of items identified to be completed or corrected and submit to Architect.
- F. Correct items of work listed in Final Correction Punch List and comply with requirements for access to Owner-occupied areas.
- G. Notify Architect when work is considered finally complete and ready for Architect's Substantial Completion final inspection.
- H. Complete items of work determined by Architect listed in executed Certificate of Substantial Completion.

### **3.14 MAINTENANCE**

**END OF SECTION**

# **SECTION 01 73 29 CUTTING AND PATCHING**

## **PART 1 GENERAL**

### 1.01 RELATED DOCUMENTS

- A. The general requirements of the Contract including General and Supplementary Conditions and as supplemented herein shall apply to the Work covered by this Section.

### 1.02 SCOPE AND DESCRIPTION

- A. This section describes the necessary coordination, materials and labor associated with cutting and patching of completed Work or connection of specified Work to existing facilities.

### 1.03 SUBMITTALS

- A. Prior to cutting which may affect the structural integrity of any structure, facility or portion of the project, or Work of another Contractor, or completed Work or existing facilities, the Contractor shall submit written notice to the Engineer requesting consent to proceed with the cutting. The notice shall designate the location, date and time the Work will be exposed for observation, and cutting will be initiated and completed.

## **PART 2 PRODUCTS**

### 2.01 MATERIALS

- A. All materials for cutting and patching shall comply with the Specifications for the type of Work to be done.

## **PART 3 EXECUTION**

### 3.01 GENERAL

- A. Cutting (including excavating), fitting or patching of Work shall be executed as required to:
  - 1. Uncover Work to provide for installation of ill-timed Work.
  - 2. Remove and replace defective Work
  - 3. Install and properly fit specified Work in existing construction, facilities, or structures.
  - 4. Remove and replace Work not conforming to requirements of Contract-Legal Documents, Specifications, or Drawings.
  - 5. Remove samples of installed Work as specified for testing.
- B. The Work of another Contractor, Work already completed, or existing facilities shall not be cut without the consent of the Engineer.

### 3.02 INSPECTION

- A. Representatives of the Contractor, Owner, and Engineer shall, before starting Work on that portion of the project, inspect and record the existing conditions of Work, including elements subject to movement or damage during:
  - 1. Cutting and patching
  - 2. Excavating and backfilling

- B. After uncovering the Work, the Contractor and Engineer shall inspect Work and note all

conditions affecting installation of new products.

### 3.03 PREPARATION

- A. The Contractor shall be responsible for providing shoring, backing and support as required to maintain structural integrity of the Work, protect other work, and provide protection from the elements.

### 3.04 PERFORMANCE

- A. The fitting and adjustment of products and material shall be executed to provide a finished installation that will comply with specified tolerances and finishes.
- B. All cutting and demolition shall be executed by methods that will prevent damage to other Work, and will provide the proper surfaces to receive installation of repairs and new Work.

## **PART 4 MEASUREMENT AND PAYMENT**

### 4.01 METHOD OF MEASUREMENT

- A. Cutting and patching is considered incidental Work with no separate measurement to be made.

### 4.02 BASIS OF PAYMENT

- A. The cost of cutting and patching to complete Work as specified and shown on the Drawings shall not be measured and paid directly but shall be considered incidental to the project as bid.

\* \* \* END OF SECTION \* \* \*



**SECTION 017800  
CLOSEOUT SUBMITTALS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Project Record Documents.
- B. Operation and Maintenance Data.
- C. Warranties and bonds.

**1.02 RELATED REQUIREMENTS**

- A. Section 013000 - Administrative Requirements: Submittals procedures, shop drawings, product data, and samples.
- B. Individual Product Sections: Warranties required for specific products or Work.

**1.03 SUBMITTALS**

- A. Project Record Documents: Submit documents to Architect with claim for final Application for Payment.
- B. Operation and Maintenance Data:
  - 1. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit completed documents within ten days after acceptance.
  - 2. Submit one copy of completed documents 15 days prior to final inspection. This copy will be reviewed and returned after final inspection, with Architect comments. Revise content of all document sets as required prior to final submission.
  - 3. Submit two sets of revised final documents in final form within 10 days after final inspection.
- C. Warranties and Bonds:
  - 1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within 10 days after acceptance.
  - 2. Make other submittals within 10 days after Date of Substantial Completion, prior to final Application for Payment.
  - 3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period.

**PART 3 EXECUTION**

**2.01 PROJECT RECORD DOCUMENTS**

- A. Maintain on site one set of the following record documents; record actual revisions to the Work:
  - 1. Drawings.
  - 2. Addenda.
  - 3. Change Orders and other modifications to the Contract.
- B. Ensure entries are complete and accurate, enabling future reference by Owner.
- C. Store record documents separate from documents used for construction.
- D. Record information concurrent with construction progress.
- E. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:
  - 1. Field changes of dimension and detail.
  - 2. Details not on original Contract drawings.

**2.02 OPERATION AND MAINTENANCE DATA FOR MATERIALS AND FINISHES**

- A. For Each Product, Applied Material, and Finish:
- B. Instructions for Care and Maintenance: Manufacturer's recommendations for cleaning agents and methods, precautions against detrimental cleaning agents and methods, and recommended schedule for cleaning and maintenance.
- C. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

### **2.03 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS**

- A. For Each Item of Equipment and Each System:
  - 1. Description of unit or system, and component parts.
  - 2. Identify function, normal operating characteristics, and limiting conditions.
  - 3. Include performance curves, with engineering data and tests.
  - 4. Complete nomenclature and model number of replaceable parts.
- B. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.
- C. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.
- D. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and trouble shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
- E. Provide servicing and lubrication schedule, and list of lubricants required.
- F. Include manufacturer's printed operation and maintenance instructions.
- G. Include sequence of operation by controls manufacturer.
- H. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- I. Additional Requirements: As specified in individual product specification sections.

### **2.04 WARRANTIES AND BONDS**

- A. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work. Except for items put into use with Owner's permission, leave date of beginning of time of warranty until Date of Substantial completion is determined.
- B. Verify that documents are in proper form, contain full information, and are notarized.
- C. Co-execute submittals when required.
- D. Retain warranties and bonds until time specified for submittal.

**END OF SECTION**

**SECTION 017900  
DEMONSTRATION AND TRAINING**

**PART 1 GENERAL**

**1.01 SUMMARY**

- A. Demonstration of products and systems where indicated in specific specification sections.
- B. Training of Owner personnel in operation and maintenance is required for:
  - 1. All software-operated systems.
  - 2. HVAC systems and equipment.
  - 3. Plumbing equipment.
  - 4. Electrical systems and equipment.
  - 5. Items specified in individual product Sections.
- C. Training of Owner personnel in care, cleaning, maintenance, and repair is required for:
  - 1. Items specified in individual product Sections.

**1.02 RELATED REQUIREMENTS**

- A. Section 017800 - Closeout Submittals: Operation and maintenance manuals.
- B. Other Specification Sections: Additional requirements for demonstration and training.

**1.03 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Training Plan: Owner will designate personnel to be trained; tailor training to needs and skill-level of attendees.
  - 1. Submit to Architect for transmittal to Owner.
- C. Training Manuals: Provide training manual for each attendee; allow for minimum of two attendees per training session.
  - 1. Include applicable portion of O&M manuals.
  - 2. Include copies of all hand-outs, slides, overheads, video presentations, etc., that are not included in O&M manuals.
  - 3. Provide one extra copy of each training manual to be included with operation and maintenance data.

**1.04 QUALITY ASSURANCE**

- A. Instructor Qualifications: Familiar with design, operation, maintenance and troubleshooting of the relevant products and systems.
  - 1. Provide as instructors the most qualified trainer of those contractors and/or installers who actually supplied and installed the systems and equipment.
  - 2. Where a single person is not familiar with all aspects, provide specialists with necessary qualifications.

**PART 2 PRODUCTS - NOT USED**

**PART 3 EXECUTION**

**3.01 DEMONSTRATION - GENERAL**

- A. Demonstrations conducted during system start-up do not qualify as demonstrations for the purposes of this section, unless approved in advance by Owner.
- B. Demonstration may be combined with Owner personnel training if applicable.
- C. Operating Equipment and Systems: Demonstrate operation in all modes, including start-up, shut-down, seasonal changeover, emergency conditions, and troubleshooting, and maintenance procedures, including scheduled and preventive maintenance.
  - 1. Perform demonstrations not less than two weeks prior to Substantial Completion.
  - 2. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.
- D. Non-Operating Products: Demonstrate cleaning, scheduled and preventive maintenance, and repair procedures.
  - 1. Perform demonstrations not less than two weeks prior to Substantial Completion.

### **3.02 TRAINING - GENERAL**

- A. Conduct training on-site unless otherwise indicated.
- B. Owner will provide classroom and seating at no cost to Contractor.
- C. Provide training in minimum two hour segments.
- D. Training schedule will be subject to availability of Owner's personnel to be trained; re-schedule training sessions as required by Owner; once schedule has been approved by Owner failure to conduct sessions according to schedule will be cause for Owner to charge Contractor for personnel "show-up" time.
- E. Review of Facility Policy on Operation and Maintenance Data: During training discuss:
  - 1. The location of the O&M manuals and procedures for use and preservation; backup copies.
  - 2. Typical contents and organization of all manuals, including explanatory information, system narratives, and product specific information.
  - 3. Typical uses of the O&M manuals.
- F. Product- and System-Specific Training:
  - 1. Review the applicable O&M manuals.
  - 2. For systems, provide an overview of system operation, design parameters and constraints, and operational strategies.
  - 3. Review instructions for proper operation in all modes, including start-up, shut-down, seasonal changeover and emergency procedures, and for maintenance, including preventative maintenance.
  - 4. Provide hands-on training on all operational modes possible and preventive maintenance.
  - 5. Emphasize safe and proper operating requirements; discuss relevant health and safety issues and emergency procedures.
  - 6. Discuss common troubleshooting problems and solutions.
  - 7. Discuss any peculiarities of equipment installation or operation.
  - 8. Discuss warranties and guarantees, including procedures necessary to avoid voiding coverage.
  - 9. Review recommended tools and spare parts inventory suggestions of manufacturers.
  - 10. Review spare parts and tools required to be furnished by Contractor.
  - 11. Review spare parts suppliers and sources and procurement procedures.
- G. Be prepared to answer questions raised by training attendees; if unable to answer during training session, provide written response within three days.

**END OF SECTION**

**SECTION 019113  
GENERAL COMMISSIONING REQUIREMENTS**

**PART 1 GENERAL**

**1.01 SUMMARY**

- A. Section Includes:
  - 1. Commissioning Plan.
  - 2. Systems to be commissioned.
  - 3. Commissioning team.
  - 4. Submittals.
  - 5. Materials.
  - 6. Coordination.
  - 7. Commissioning scheduling.
  - 8. Training tours.
  - 9. Equipment training.
  - 10. Systems Manual
  - 11. Installation checklists.
  - 12. Functional performance testing.
  - 13. Deficiency tracking and corrective actions.
  - 14. Retesting
  - 15. Maintenance acceptance.
  - 16. Operations acceptance.
  - 17. Commissioning documentation.
  
- B. Related Requirements:
  - 1. Commissioning Plan - The February 12, 2024, Commissioning Plan and subsequent revisions shall be incorporated by reference into this contract.
  - 2. Section 019119 – Building Enclosure Commissioning

**1.02 SYSTEMS TO BE COMMISSIONED**

- A. Mechanical Systems (Graham Hall and Student Center):
  - 1. Air handling unit AHU-1G
  - 2. Air-cooled condensing unit for AHU-1G
  - 3. Existing heating hot water system modifications in Student Center (Boilers B-1 & B-2, heating pumps P-1 & P-2)
  - 4. Cabinet Unit Heaters (new)
  - 5. Radiant Heat (new)
  
- B. Mechanical Systems (Lincoln Hall)
  - 1. Chilled Water System
  - 2. Heating Hot Water System
  - 3. Air handling units (3)
  - 4. Variable air volume terminal units with reheat
  - 5. Variable air volume terminal units with reheat and supplemental heat
  - 6. Exhaust fans (3)
  - 7. Hot water unit heaters
  - 8. Cabinet unit heaters
  - 9. Electric unit heaters
  - 10. Fire alarm interface the building automation system
  - 11. Building automation system

- C. Plumbing Systems (Graham and Student Center):
  1. Existing Domestic Hot Water System modifications (water heater, recirculation pump and mixing valve)
  
- D. Plumbing Systems (Lincoln Hall)
  1. Domestic water heater, recirculation pump, and mixing valve
  2. Sump pump interface to the building automation system
  3. Natural gas meter interface to the building automation system
  4. Water meter interface to the building automation system (7)
  
- E. Electrical Systems:
  1. Lighting Systems and Controls
  
- F. Building Envelope (Refer to 019119 – Building Enclosure Commissioning for more information)

### **1.03 COMMISSIONING TEAM**

- A. In general, the commissioning team will be comprised of the following entities:
  1. Owner's Representative: South Dakota Office of the State Engineer
  2. Owner's Operation and Maintenance: Northern State University Facilities Department
  3. Architect: CO-OP Architecture
  4. Mechanical and Plumbing Design Engineer: Sichmeller Engineering
  5. Electrical Design Engineer: IMEG
  
  6. Mechanical Contractor: TBD
  7. Electrical Contractor: TBD
  8. Commissioning Professional: Questions & Solutions Engineering (QSE)
  
- B. Commissioning Coordination Supervisor: The Construction Manager shall assign a person with five (5) years of experience with the coordination of disciplines of construction. The coordinator's responsibilities include:
  1. Communication with Owner's Commissioning Professional
  2. Commissioning coordination meeting attendance
  3. Planning
  4. Scheduling
  5. Enforcement of subcontractors' specification requirements
  6. Subcontractors' quality assurance
  7. Documentation
  8. Direction of subcontractors' corrective actions
  
- C. Contractors' Representative: Each of the subcontractors shall assign a person responsible for communications with the Construction Manager's Commissioning Coordination Supervisor. Responsibilities include:
  1. Communication with Commissioning Coordination Supervisor
  2. Commissioning coordination meeting attendance
  3. Planning
  4. Scheduling
  5. Operations & Maintenance training and manuals
  6. Complete installation checklists
  7. Review of final functional performance test procedures
  8. Functional performance test participation

9. Corrective actions

#### 1.04 SUBMITTALS

- A. Construction Manager shall submit the name of person(s) assigned as Commissioning Coordination Supervisor within (2) weeks of construction notice to proceed. Construction Manager shall submit the following information for each assigned Commissioning Representative:
  1. Company Name
  2. Name
  3. Title
  4. Years of Experience
  5. Office Phone Number
  6. Cell Phone Number
  7. Fax Number
  8. E-Mail Address
- B. Each subcontractor shall submit the name of person(s) assigned as representatives to Commissioning Team within (2) weeks of construction notice to proceed. Each Subcontractor shall submit the following information for each assigned Commissioning Representative:
  1. Company Name
  2. Name
  3. Title
  4. Years of Experience
  5. Office Phone Number
  6. Cell Phone Number
  7. Fax Number
  8. E-Mail Address
- C. Equipment submittals and shop drawings:
  1. Provide access to shared electronic submittal site, if being used for the project.
  2. If electronic site sharing for submittals is not being used:
    - a. Submit a list of all required submittals to the Commissioning Professional prior to submitting any equipment submittals for review.
    - b. Commissioning Professional will identify submittals for which copies shall be submitted to the Commissioning Professional.
    - c. Submit copies of selected submittals to Commissioning Professional, Owner's Representative, and Owner's Facilities Staff for review.
- D. Master Construction Schedule: Incorporate all commissioning milestones into the Master Construction Schedule. See 3.02-A below for a listing of minimum milestones for inclusion in the Master Construction Schedule.
  1. Submit Master Construction Schedule with the inclusion of the commissioning milestones no later than 8 weeks after Construction Notice-to-Proceed.
  2. Submit updated Master Construction Schedule to the Commissioning Professional at a minimum once per month.
- E. Submit copies of Construction Meeting Minutes, Field Change Requests (FCR), Requests for Information (RFI), Addendums, Proposal Requests (PR), etc., to the Commissioning Professional or provide access to these documents via the project's electronic documentation sharing site if being used.

- F. Submit review comments on the equipment training session agendas issued by the Commissioning Professional no later than two (2) weeks after receipt of Training Agendas from the Commissioning Professional.
- G. Submit the specific date, time, and place for individual training sessions no later than 4 weeks prior to the scheduled training sessions.
- H. Submit required documentation for the Systems Manual (see 3.05 below) as it becomes available to the responsible parties.
- I. Submit test plan review comments to the Commissioning Professional at least four (4) weeks prior to the start of testing.
- J. Submit fully executed Installation Checklists and TAB Reports to the Commissioning Professional upon completion and at least two (2) working days before the scheduled start of functional performance testing for the respective system. System functional performance testing shall not commence until its system is documented to be ready for testing.
- K. Submit estimated completion dates and status updates to outstanding items on the Commissioning Action List to the Commissioning Professional weekly.

## **PART 2 - GENERAL**

### **2.01 MATERIALS**

- A. Provide tools, services and instruments required to test and adjust equipment and to verify compliance with design documents. Refer to individual Functional Performance Test Procedures for the requirements of each procedure.

## **PART 3 – EXECUTION**

### **3.01 COORDINATION**

- A. Assign Commissioning Representatives (see 1.04-A. and 1.04-B. for submittal requirements).
- B. Participate in Commissioning Coordination meetings conducted by the Commissioning Professional.
- C. Review the commissioning requirements.
- D. Request clarification as needed.

### **3.02 COMMISSIONING SCHEDULING**

- A. Include the following commissioning milestone activities in the master schedule (not a separate commissioning schedule):
  1. Testing and balancing
  2. Controls completion
  3. Equipment training sessions
  4. Installation checklist completion
  5. Functional performance testing
  6. Deficiency correction
  7. Functional performance retesting (as necessary)
  8. Systems Manual Submission

### **3.03 TRAINING TOURS**

- A. Construction Manager shall conduct guided training tours prior to each Commissioning Coordination Meeting. The primary objective of the tours will be to orient Department of Health staff to the locations of equipment and components of interest that have recently been installed to allow the end-of-construction equipment and systems training sessions to focus more on how equipment and systems work and less on where the system components are located.



Equipment and components of interest include, but are not limited to terminal units, DDC control sensors, shutoff valves, control panels, etc.

- B. Department of Health staff will also use the tours as an opportunity for site observation. Comments generated during the Training Tours will be discussed at the subsequent Commissioning Coordination meeting, documented in the minutes, and tracked through the Commissioning Action List. Refer to the Commissioning Plan for the Commissioning Action List Template.

### **3.04 EQUIPMENT TRAINING**

- A. Coordinate operation and maintenance training activities through the Commissioning Professional and the Owner.
- B. The Training Plan (refer to 3.12-B below) lists each training session and associated specification for equipment associated with systems being commissioned. The Training Plan will be used to document level of rigor for each session, pre-substantial completion and post-substantial completion training hours and tracking of training to completion. In addition, the Training Plan will be used as the tool for scheduling the training sessions with the Owner's Operations and Maintenance Personnel. Note: this is not a comprehensive list of training for the project, just the training for the commissioned systems.
- C. One Equipment Training Agenda will be provided by the Commissioning Professional for each training session associated with the systems being commissioned. A sample training agenda has been provided for reference in 3.12-A below. The contractor shall have the opportunity to submit comments on each Training Agenda. Comments are due to the Commissioning Professional no later than two (2) weeks after receipt of Training Agendas from the Commissioning Professional.
- D. The contractor shall submit the name, company, and phone number for the proposed trainer(s) on each training session. This information shall be submitted to the Commissioning Professional no later than two (2) weeks after receipt of Training Agendas from the Commissioning Professional.
- E. Schedule the training dates with the Owner for the convenience of the trainees. Training may be deferred for equipment that is inoperable (e.g., due to weather conditions, future startup, etc.) during pre-substantial completion training.
- F. Controls system training shall occur on site using the Owner's computer.
- G. Document completion of each training session by completing the approved Equipment Training Agenda Form (refer to 3.12-A below) and sending completed forms back to the Commissioning Professional.
- H. Contractor shall provide post-occupancy training for the number of hours indicated in the Training Plan (3.12-B). Post-occupancy training shall be scheduled for up to one year after building turnover and at the request of the owner after Department of Health staff has had time to operate the systems and develop additional questions for the contractors.
- I. The contractor is responsible for videotaping all training sessions. This includes both classroom and hand-on training. Video will be in electronic format and turned over to the owner.
- J. Provide electronic copies to the Owner of all training materials provided during training including presentations, drawings, manuals, etc. Provide source files and PDF files of this training material.

### **3.05 SYSTEMS MANUAL**

- A. Prepare and submit the following documents for inclusion in the Systems Manual:
  - 1. System single line diagrams
  - 2. As-built sequences of operation, control drawings, and original setpoints.
  - 3. Operating instructions for integrated building systems.
  - 4. Recommended schedule for recalibrating sensors and actuators.

5. Recommended schedule and frequency for each manufacturer's recommended maintenance activity.
- B. The submission shall be in an electronic format compatible with the rest of the Systems Manual sections (Adobe PDF). It shall be formatted for printing no larger than 11 in x 17 in and preferably 8.5 in x 11 in.
- C. The Systems Manual is a collaborative effort. The following table details the involvement of each team member. "R" identifies the party responsible for overseeing task completion. "X" identifies the commissioning team members who will be required to participate in each task. The Systems Manual will document the systems being commissioned.
- D.

<b>Systems Manual Component</b>	<b>PM</b>	<b>OM</b>	<b>AR</b>	<b>DE</b>	<b>CMR</b>	<b>MC</b>	<b>EC</b>	<b>CP</b>
Final Version of Owner's Project Requirements	X	X	X	X				R
System single line diagrams				R	X	R	R	X
As-built sequences of operations and initial control setpoints		X		X	X	R	R	X
Operating instructions for integrated building systems		X	X	X	R	X	X	X
Recommended schedule of maintenance requirements and frequency		X			X	R	R	X
Recommended recommissioning schedule with blank test forms		X						R
Recommended schedule for calibration of sensors and actuators		X			X	R	R	X

PM=Owner's Project Manager, OM=Owner's Operations & Maintenance, AR=Architect, DE = Design Engineer, CMR=Construction Manager, MC=Mechanical Contractor, EC=Electrical Contractor, CP = Commissioning Professional

### 3.06 INSTALLATION CHECKLISTS

- A. The table below shows the list of Installation Checklists expected for this project.
- B. Installation Checklists have not yet been customized for the Department of Health Campus project. See 3.12-C for examples.

C. Checklists will be developed during construction.

<b>INSTALLATION CHECKLISTS</b>	
<b>SYSTEM</b>	<b>SAMPLE</b>
New AHU-1G (with Return Fan, DX coil, HW coil and controls)	100%
Air-cooled condensing unit for AHU-1G	100%
Existing Graham DHW system mods (EWH, recirc pump and mixing valve)	100%
Existing Heating Hot Water System Modifications in Student Center (Boilers B-1 & B-2, new pumps P-1 to P-2 to re-feed Graham Hall)	100%
Cabinet Unit Heaters	100%
Radiant Heat RAD-XD	100%
Chilled Water System - 1 air-cooled chiller & pumps	100%
Heating Hot Water System- 2 hot water boilers, circ pumps and distribution pumps	100%
New AHU with HW and CHW coils (AHU-1 to 3)	100%
VAV Box Terminal Units with Hot Water Reheats.	20%
VAV Box Terminal Units with Hot Water Reheats and supplemental radiation	25%
Exhaust Fans - Bldg Pressure Relief (EF-1, 2 & 3)	66%
Hot Water Unit Heaters (HUH-161 & HUH-M300)	100%
Cabinet Unit Heaters (CUH-100A, 100B, 114A)	100%
Electric Heaters (West Water Entry 160 and Elevator Shaft E100)	100%
Domestic Hot Water System (WH-1, Recirc pump and mixing valve)	100%
Sump Pump	100%
Natural Gas Meter Interface to the BAS	100%
Water Meter Interface to the BAS	100%
Fire Alarm Interface to the BAS	100%
Building Automation System	100%
Building Lighting Controls	4 hours total field testing allowance

- D. Final Installation Checklists shall be prepared by the Commissioning Professional after reviewing submittals, change orders, supplemental instructions, proposal requests, and other construction-phase modifications and/or additions to the designed systems.
- E. Prior to the scheduled start of functional performance test procedures, check systems to confirm readiness for testing.
- F. Commissioning Professional will be on site to perform periodic site observations. In addition to noting completeness of items that may fall on the installation checklist, the Commissioning Professional will also be noting accessibility issues for future maintenance activities. Accessibility issues will be documented in a field observation report by the Commissioning Professional and distributed to the team. Contractors will be responsible for responding to each noted issue by either correction of issue or demonstration of maintenance activity(ies) given equipment's current location to the Owner.

- G. Submit Installation Checklists to the Commissioning Professional upon completion of the checklist. System functional performance testing shall not commence until its system is documented as being ready for testing.
- H. Completion of the Installation Checklists shall be a joint effort between the Construction Manager and the subcontractors responsible for each system. The Construction Manager shall be responsible for coordinating and submitting completed Installation Checklists.

**3.07 FUNCTIONAL PERFORMANCE TESTING**

- A. The table below shows the list of Functional Performance Test Procedures expected for this project.
- B. Functional Performance Tests have not yet been customized for the Department of Health Campus project. Other test procedures will be developed during construction. See 3.12-D for example tests.
- C. Test procedures will be developed during construction.

<b>FUNCTIONAL PERFORMANCE TESTS</b>	
<b>SYSTEM</b>	<b>SAMPLE</b>
New AHU-1G (with Return Fan, DX coil, HW coil and controls)	100%
Air-cooled condensing unit for AHU-1G	100%
Existing Graham DHW system mods (EWH, recirc pump and mixing valve)	100%
Existing Heating Hot Water System Modifications in Student Center (Boilers B-1 & B-2, new pumps P-1 to P-2 to re-feed Graham Hall)	100%
Cabinet Unit Heaters	100%
Radiant Heat RAD-XD	100%
Chilled Water System - 1 air-cooled chiller & pumps	100%
Heating Hot Water System- 2 hot water boilers, circ pumps and distribution pumps	100%
New AHU with HW and CHW coils (AHU-1 to 3)	100%
VAV Box Terminal Units with Hot Water Reheats.	20%
VAV Box Terminal Units with Hot Water Reheats and supplemental radiation	25%
Exhaust Fans - Bldg. Pressure Relief (EF-1, 2 & 3)	66%
Hot Water Unit Heaters (HUH-161 & HUH-M300)	100%
Cabinet Unit Heaters (CUH-100A, 100B, 114A)	100%
Electric Heaters (West Water Entry 160 and Elevator Shaft E100)	100%
Domestic Hot Water System (WH-1, Recirc pump and mixing valve)	100%
Sump Pump	100%
Natural Gas Meter Interface to the BAS	100%
Water Meter Interface to the BAS	100%
Fire Alarm Interface to the BAS	100%
Building Automation System	100%
Building Lighting Controls	4 hours total field testing allowance

- D. Final functional performance test procedures shall be prepared by the Commissioning Professional after reviewing submittals, change orders, supplemental instructions, proposal requests, and other construction-phase modifications and/or additions to the designed systems. The Construction Manager shall review and comment on draft procedures and acceptance criteria prior to the Commissioning Professional issuing final procedures. Provide feedback as to the efficiency of the procedures and possible alternate approaches to achieving the same results.
- E. Provide input into the master scheduling process with regard to timing and duration of the functional performance test procedures.
- F. Provide personnel and equipment as required to perform the functional performance test procedures under the direction of the Commissioning Professional.
- G. Participate in seasonal testing as scheduled by the Commissioning Professional. If project completion is set for the summer, seasonal testing of systems will be conducted the following winter and vice versa.
- H. If a system cannot be fully and adequately tested at the end of construction, participate in post-substantial completion testing scheduled by the Commissioning Professional. The exact systems requiring deferred testing will be dependent on the final construction schedule.

### **3.08 DEFICIENCY TRACKING/CORRECTIVE ACTIONS**

- A. Perform corrective actions for resolution of deficiencies found during:
  - 1. Site Observation
- B. Test and Balance
  - 1. Installation Checkout
  - 2. Functional Performance Testing
  - 3. Warranty Phase
- C. During Functional Performance Testing, a deficiency is defined as equipment that does not function as expected and more than five (5) minutes is required to correct the problem.
- D. During construction or testing anyone finding deficiencies may document the deficiencies on a Commissioning Action List (CAL) (refer to 3.12-E for an example) within one working day of discovery. The deficiency shall then be forwarded to the Commissioning Professional.
  - 1. Deficiency Identification Process (by Commissioning Professional)
    - a. Date
    - b. Comment Generator
    - c. Responsible Party
    - d. Description of deficiency
    - e. Distribute copies to the commissioning team
  - 2. Corrective Action Completed (by Construction Manager or subcontractor)
    - a. Date of correction
    - b. Description of final equipment status or corrective action performed
    - c. Name of person(s) performing the work
    - d. Construction Manager to inform the Commissioning Professional (who will update the CAL)
    - e. Commissioning Professional distributes updated copies to the commissioning team
  - 3. Verification of Corrective Action Completion (by Commissioning Professional)
    - a. Date of retest
    - b. Status description: resolved or more work required
    - c. Name(s) of person(s) performing verification
    - d. Enter resolution into the CAL.
    - e. Distribute copies to the commissioning team

### **3.09 RETESTING**

- A. The Commissioning Professional will be on site for one visit and an allowance of 16 hours to perform retesting of corrected deficiencies. If more retesting is required beyond this, the resulting retesting labor and expenses incurred by the Commissioning Professional shall be paid by the contractor.

### **3.10 MAINTENANCE ACCEPTANCE**

- A. The Owner will take responsibility for maintenance of the equipment associated with the mechanical and electrical systems once both of the following have occurred:
  - 1. The project has reached Substantial Completion.
  - 2. All training sessions have been accepted by the Owner.

### **3.11 OPERATIONS ACCEPTANCE**

- A. Prior to the successful completion of commissioning functional performance tests:
  - 1. The Construction Manager shall be responsible for the operation of all systems and all adjustments necessary to successfully pass the functional performance test procedures.
  - 2. The Construction Manager shall document and respond to all concerns and questions from building occupants in a timely and professional manner.
  - 3. The Owner shall not attempt to change system operating setpoints, programming, or user interfaces but must work through the Construction Manager to resolve issues that come to the Owner's attention.
- B. Upon successful completion of all functional performance testing:
  - 1. The Owner shall take responsibility for operation of the mechanical and electrical systems. This may or may not occur at the same time as Maintenance Acceptance.
  - 2. The Construction Manager shall not attempt to change system operating setpoints, programming, or user interfaces but must work through the Owner to resolve issues that come to the Construction Manager's attention
- C. The contractor will be responsible for the monitoring of the systems and call-backs related to the operation of the commissioned system equipment until all three of the following requirements have been met:
  - 1. Successful completion of functional performance testing.
  - 2. O&M manuals have been delivered to the Owner.
  - 3. O&M training sessions have been completed and accepted by the Owner.
- D. Operational acceptance is a requirement of final completion and must be documented prior to submitting the Final Application for Payment. This is in addition to any requirements defined in other Division 01 sections.
- E. Acknowledgment of operations acceptance shall be at the discretion of the Owner.

### **3.12 COMMISSIONING DOCUMENTATION (ATTACHED)**

- A. Equipment Training Agenda Form
- B. Example Equipment Training Plan
- C. Example Installation Checklists
- D. Example Functional Performance Test Procedures
- E. Commissioning Action List Template

**END OF SECTION**



# Equipment: Operations & Maintenance Training Agenda

<b>Equipment</b>	Air Handling Units
<b>Specification section(s)</b>	23 0800

## Agenda

Agenda of general subjects covered	Complete
X General purpose of the equipment	
X Review of control drawings and schematics (have copies for attendees)	
X Startup, loading, normal operation, unloading, shutdown, unoccupied operation, seasonal changeover, optimal start logic, etc., as applicable.	
X Integral controls (packaged): programming, troubleshooting, alarms, & manual/bypass operation	
X Building automation controls (BAS): programming, troubleshooting, alarms, manual operation, interface with integral controls	
X Interactions with other systems, operation during power outage and fire alarm system	
X Relevant health and safety issues & concerns, special safety features, and special access issues for this equipment	
X Energy conserving operation and strategies	
X Any special issues to maintain warranty	
X Common troubleshooting issues and methods, control system warnings and error messages, including using the control system for diagnostics	
X Special requirements of tenants for this equipment's function	
X Service, maintenance and preventative maintenance (sources, spare parts inventory, special tools, etc.)	
X Question & Answer Period	
8 Total Hours: 2 sessions @ 2 hours on-site & 2 hours classroom per session.	

Training Methods	Notes
X Use O&M manuals (show where the training information is found)	
X Completed factory start-up checklist/report	
X Control drawings, schematics, and sequence of operations	
X A copy of this agenda.	
X Discussion/lecture at site	Mechanical Design Engineer should be available to discuss the design intent
X Site demonstration of equipment operation	
X Written handouts	
X Manufacturer training manuals	
X Classroom lecture	
Classroom hands-on equipment	
X Video presentation	
X Question and answer period	



X Online Resources

## Documentation of Training Session

Date	Start Time
Location	End Time

Attendee Name	Organization / Department	Comments

## Owner Acceptance of Training Session

This training session has been accepted by the following individuals, subject to the additions and clarifications noted.

Signature	Date
Client	

Notes

---

---

---

---



<b>O&amp;M STAFF EQUIPMENT TRAINING PLAN (FOR SYSTEMS BEING COMMISSIONED ONLY)</b>																
Equipment	Spec Section	Pre-Substantial Completion Training				TOTAL	Post Occupancy Hours	Off-Site Training Required	Video Required	Manuf/ Factory Rep Required	Responsible Contractor	Agenda Received	Agenda Approved	Training Session Scheduled	Training Session Complete	Training Session Approved
		<sup>1</sup> Scope A	<sup>1</sup> Scope B	<sup>1</sup> Scope C												
		Total Hours	Total Hours	Total Hours												
<b>PLUMBING</b>																
2																
Domestic Hot Water Systems								Y		PC						
Domestic hot water recirculation pump	224000	0.25	0	0	0.25			Y		PC						
Digital water tempering system	224000	0.25	0	0	0.25			Y		PC						
Domestic-water heaters	224000	0.5	0	0	0.5			Y		PC						
Water meters with BAS output	22400	0.5	0	0	0.5			Y		PC						
Sump pumps and BAS monitoring	22400	0.25	0	0	0.25			Y		PC						
<b>MECHANICAL</b>																
22 8																
Building Automation System		0	0	0	0			Y		CC						
Controls and control sequences	230900	0	0	8	8	8		Y	Y	CC						
Variable Frequency Drives	230900	0	1		1			Y	Y	CC						
Hydronic Systems		0	0	0	0			Y		MC						
Hydronic specialties	232113	0.25	0		0.25			Y		MC						
Boilers	232113	0	2		2			Y	Y	MC						
Flow control and strainer valves	232113	0.5	0		0.5			Y		MC						
Hot water cabinet unit heaters	232113	0.5	0		0.5			Y		MC						
Hot water hanging unit heaters	232113	0.25	0		0.25			Y		MC						
Hot water finned tube radiation	232113	0.25	0		0.25			Y		MC						
Hot water radiant panels	232113	0.25	0		0.25			Y		MC						
Hydronic pumps	232123	0.5	0		0.5			Y		MC						
Ventilation and Air Conditioning		0	0	0	0			Y		MC						
VAV AHU with DX Cooling	237000	0	1		1			Y		MC						
DX air cooled condensing unit	237000	0	1		1			Y		MC						
VAV AHU with cooling water and hot water reheat coils	237000	0	2		2			Y		MC						
Shutoff VAV air terminals	237000	0.5	0		0.5			Y		MC						
Ductless split system source heat pumps	237000	0.5	0		0.5			Y		MC						
Air cooled scroll liquid chiller	237000	0	2		2			Y	Y	MC						
Exhaust fans	237000	0.25	0	1	1.25			Y		MC						
Dryer exhaust booster fans	237000	0.25	0		0.25			Y		MC						
<b>ELECTRICAL</b>																
4.25																
Lighting control systems	260933	0	4		4				Y	EC						
Electric unit heater	Plans	0.25	0		0.25			Y		EC						

<sup>1</sup>**Scope Codes** (refer to the specific equipment Training Agenda for additional details)

- A. Provide an **overview** of the purpose and operation of this equipment, including required interactions of trainees with the equipment. (Approximately 15 to 30 minutes)
- B. At an **intermediate level**, provide technical information regarding the purpose, operation and maintenance of this equipment, expecting that serious malfunctions will be addressed by factory reps. (Approximately 1 to 2 hours)
- C. At a **very technical level**, provide information regarding the purpose, operation, troubleshooting and maintenance of this equipment, expecting that almost all operation, service and repair will be provided by the trainees. (Hours vary by level of complexity.)

**General Remarks/Assumptions** (refer to the specific equipment Training Agenda for additional details)

- A. The Owner reserves the right to require additional training, if the content and scope of the training is not accepted as satisfactory.

**Specifications** (refer to the specific specification section for additional details)

- A. Refer to 019113 General Commissioning Requirements
- B. Refer to 017900 Demonstration and Training

CHILLED WATER SYSTEM		Heat Exchanger HX-3	CP-1	CP-2	Distribution Piping
SERVICE AREA		CHW Loop	Distribution Loop	Distribution Loop	CHW Loop
<b>DEVICE LOCATIONS</b>					
1	Heat exchanger isolation valves are easily accessible.	DATE APPROVED			
2	Heat exchanger supply and return water thermometers are easily accessible and visible.	DATE APPROVED	DATE APPROVED	DATE APPROVED	
3	Chilled water pressure gauges are easily accessible and visible.				
4	Temperature sensors are accessible/replaceable.				DATE APPROVED
5	System differential pressure sensor is accessible/replaceable.	DATE APPROVED			DATE APPROVED
6	Pump is easily accessible.		DATE APPROVED	DATE APPROVED	
7	Pump is replaceable without removing other systems (ductwork, conduit, piping, etc.)		DATE APPROVED	DATE APPROVED	
8	Expansion tank is piped downstream of air separator, on the suction side of the pumps and connection is off the side of				DATE APPROVED
9	Accessory Equipment is replaceable without removing other systems (ductwork, conduit, piping, etc.)				
<b>COMPONENTS</b>					
10	Pump's suction diffuser, suction reducer, flex connections, shut-off valves, check valve, pressure gauge and strainer installed.		DATE APPROVED	DATE APPROVED	
<b>CONTROLS</b>					
11	Chilled water control valve responds to BAS commands.				DATE APPROVED
12	Chilled water pump/VFD responds to BAS commands.		DATE APPROVED	DATE APPROVED	
13	Accessory Equipment control integration is complete.				
14	Building Control System graphics screen has been updated and points have been properly mapped.	DATE APPROVED	DATE APPROVED	DATE APPROVED	
15	System is able to fully execute all steps of the sequence of operations and is able to maintain all system setpoints.	DATE APPROVED	DATE APPROVED	DATE APPROVED	

CHILLED WATER SYSTEM		Heat Exchanger		Distribution Piping	
		HX-3	CP-1	CP-2	
SERVICE AREA		CHW Loop	Distribution Loop	Distribution Loop	CHW Loop
<b>SENSOR CALIBRATION</b>					
16	Water temperature sensors are calibrated and showing accurate values at the front-end computer.				DATE APPROVED
17	Water pressure sensors are calibrated and showing accurate values at the front-end computer.				DATE APPROVED
18	Plant differential pressure sensor is calibrated and showing accurate values at the front-end computer.	DATE APPROVED			
19	Building differential pressure sensors are calibrated and showing accurate values at the front-end computer.				DATE APPROVED
20	Building Differential pressure setpoint has been programmed based on the TAB contractor's findings.				DATE APPROVED
<b>EQUIPMENT STARTUP &amp; QUALITY CONTROL TESTS</b>					
21	Pipe hydrostatic testing is complete				DATE APPROVED
22	Pre-operational pipe flushing and cleaning has been completed.				DATE APPROVED
23	Air has been vented from the entire system.				DATE APPROVED
24	Pump startup is complete and correct rotation has been verified.		DATE APPROVED	DATE APPROVED	
<b>REPORTS &amp; DOCUMENTATION</b>					
25	Water side testing, adjusting, and balancing information has been submitted and deficiencies corrected.	DATE APPROVED	DATE APPROVED	DATE APPROVED	DATE APPROVED

### CHILLED WATER SYSTEM

	SERVICE AREA	Reference Documents	Trend Required	Notes to Tester	CHW	CHW Notes
1a	INSTALLATION CHECK			Compare installation to the schematic	PASS?	INSERT NOTES
1b	OBSERVE INSTALLATION OF EXPANSION TANK					
2a	GRAPHIC CHECK			Compare graphic to the installation and the schematic.	PASS?	INSERT NOTES
3	RECORD STARTING VALUES FOR SETPOINTS AND I/O POINTS				PASS?	INSERT NOTES
4a	<u>SYSTEM DESCRIPTION:</u>				PASS?	INSERT NOTES
5a	CONTROL OF ALL CHILLER PLANT SYSTEM COMPONENTS SHALL BE THROUGH THE EMCS				PASS?	INSERT NOTES
5b	ALL CONTROLS SHALL BE VIEWED GRAPHICALLY THROUGH THE EXISTING METASYS SYSTEM.			Request screen shot of BAS graphic (including text screens) as a starting point for test.	PASS?	INSERT NOTES
<b>CHILLER PARAMETERS</b>						
6	THE EMCS SHALL UTILIZE THE FOLLOWING PARAMETERS OF EACH CHILLER TO OPERATE THE CHILLER PLANT: RATED CAPACITY RATED CURRENT/POWER RATED CONDENSER WATER FLOW CONDENSER WATER MINIMUM FLOW RATED CHILLED WATER FLOW CHILLED WATER MINIMUM FLOW CHILLED WATER MAXIMUM FLOW CHILLER PEAK COP (COEFFICIENT OF PERFORMANCE) CHILLER LIFT SENSITIVITY CHILLER DESIGN LIFT	Submittal Sequence Sheet 2-4 / 2-5			PASS?	INSERT NOTES
<b>SYSTEM ENABLE</b>						
7	THE CHILLED WATER SYSTEM SHALL BE ENABLED AT ALL TIMES THROUGH POINT SYSTEM ENABLE (SYSTEM-EN)	Submittal Sequence Sheet 2-4 / 2-5		Does the chiller control system start the pump prior to the lead chiller starting?	PASS?	INSERT NOTES
8a	WHEN A CHILLER IS GIVEN A START COMMAND, THE PRIMARY CHILLED WATER ISOLATION VALVE SHALL OPEN				PASS?	INSERT NOTES
b	WHEN THE ISOLATION VALVE END SWITCH HAS PROVEN OPEN STATUS, A PRIMARY CHILLED WATER PUMP SHALL START AND RUN CONTINUOUSLY.				PASS?	INSERT NOTES
c	THE PRIMARY PUMP WILL RUN FOR A PREDETERMINED TIME (ADJ) BEFORE THE CHILLER IS ENABLED.				PASS?	INSERT NOTES
d	WHEN A GIVEN CHILLER STARTS, THE EMCS SHALL START THE CORRESPONDING LEAD CONDENSER WATER PUMP AND ENABLE THE CONDENSER WATER SYSTEM TO MAINTAIN THE CONDENSER WATER TEMPERATURE SETPOINT.				PASS?	INSERT NOTES
e	WHEN A CHILLER IS ENABLED, ITS CONDENSER ISOLATION VALVE SHALL OPEN.				PASS?	INSERT NOTES

f	ONCE THE ISOLATION VALVE END SWITCH MAKES, THE LEAD CONDENSER WATER PUMP SHALL START AND RUN CONTINUOUSLY.					
g	CHILLER STARTS					
9	IF THE ISOLATION VALVE (EVAPORATOR OR CONDENSER) FAILS TO OPEN, THE EMCS SHALL ALARM, AND THE LAG CHILLER WILL BE ENABLED.				PASS?	INSERT NOTES
10a	IF THE PUMP CURRENT TRANSFORMER (CT) INDICATES THE PRIMARY CHILLED WATER PUMP IS NOT RUNNING, THE EMCS SHALL ALARM. THEN, THE 1ST LAG PRIMARY CHILLED WATER PUMP SHALL BE GIVEN A START COMMAND.				PASS?	INSERT NOTES
b	IF THE PUMP CURRENT TRANSFORMER (CT) INDICATES THE PUMP IS NOT RUNNING, THE CONDENSER PUMP SHALL SHUT DOWN AND THE EMCS SHALL ALARM AND THE LAG CONDENSER WATER PUMP SHALL START. FOR EACH ADDITIONAL CHILLER THAT STARTS, A CONDENSER WATER PUMP SHALL START IN A SIMILAR MANNER AS ABOVE.					
11	THE EMCS SHALL MONITOR THE STATUS/ALARM OF EACH CHILLER. IF A CHILLER FAILS FOR ANY REASON, THE EMCS SHALL ALARM.			It's assumed then that the system would command the next lag chiller on.	PASS?	INSERT NOTES
12	UPON THE START OF EACH CHILLER AUTOMATICALLY START CHILLER SPECIFIC TREND LOG REPORTS TO INCLUDE: FIVE MINUTE LOGGING OF CHILLER: -UNIT CHILLED WATER SETPOINT -COMPRESSOR(S) RLA -EVAPORATOR ENTERING WATER TEMP -EVAPORATOR LEAVING WATER TEMP -EVAPORATOR FLOW RATE -EVAPORATOR APPROACH TEMP -CONDENSER ENTERING WATER TEMP -CONDENSER LEAVING WATER TEMP -CONDENSER APPROACH TEMP	(Not stated in sequence)		This was taken from another Chiller test. Does something like this exist for the SDSU plant?	PASS?	INSERT NOTES
<b>CHILLER LEAD-LAG ALTERNATION</b>						
13	WHEN THE OUTSIDE AIR TEMPERATURE IS LESS THAN 55 DEG F (ADJ), CHILLER CH-3 AND CHILLER CH-4 SHALL BE ENABLED AND CHILLER CH-1 AND CHILLER CH-2 SHALL BE DISABLED.  CHILLER CH-3 AND CHILLER CH-4 SHALL BE ENABLED DUE TO ITS ABILITY TO UTILIZE LOWER CONDENSER WATER TEMPERATURES.	Submittal Sequence Sheet 2-4 / 2-5			PASS?	INSERT NOTES
14	WHEN THE OUTSIDE AIR TEMPERATURE IS BELOW 55 DEG F, CHILLER CH-1 AND CH-2 WILL NOT BE COMMANDED ON DUE TO BEING DISABLED BY OUTSIDE AIR TEMPERATURES. OPERATOR INTERVENTION WILL BE REQUIRED TO MANUALLY ENABLE CHILLER CH-1 OR CH-2.				PASS?	INSERT NOTES
15	WHEN THE OUTSIDE AIR TEMPERATURE IS GREATER THAN 60 (55 DEG F PLUS A 5 DEG DIFFERENTIAL) THE EMCS SHALL ALTERNATE THE DESIGNATION OF LEAD, 1ST LAG, 2ND LAG, AND 3RD LAG CHILLERS BASED ON RUNTIME (ADJUSTABLE) AS WELL AS NUMBER OF STARTS/STOPS (ADJUSTABLE).				PASS?	INSERT NOTES

CHILLER OPERATION AND SEQUENCING						
16	THE EMCS SHALL MAINTAIN SECONDARY CHILLED WATER TEMPERATURE OF 42 DEG F (ADJ) AT ALL TIMES.	Submittal Sequence Sheet 2-4 / 2-5			PASS?	INSERT NOTES
17	THE CHILLERS WILL BE CONTROLLED TO MEET THE SYSTEM SUPPLY WATER TEMPERATURE SETPOINT.	(Not stated in sequence)		Review proper loading/unloading of CH-4 as supply temperature changes.	PASS?	INSERT NOTES
18	THE EMCS SHALL START ADDITIONAL CHILLERS AND PUMPS AS NECESSARY TO SATISFY THE LOAD	Submittal Sequence Sheet 2-4 / 2-5			PASS?	INSERT NOTES
19	CHILLER SEQUENCING SHALL BE BASED OFF BUILDING LOAD AS SENSED BY A WATER FLOW METER, SUPPLY AND RETURN WATER TEMPERATURE SENSORS LOCATED IN SECONDARY CHILLED WATER PIPING.				PASS?	INSERT NOTES
20	AS LOADS DECREASE, THE EMCS SHALL SHUT DOWN LAG CHILLERS AND ASSOCIATED PUMPS. THE EMCS SHALL COMPARE ACTUAL CHILLER LIFT TO				PASS?	INSERT NOTES
21	AS THE LOAD DECREASES TO LOW LEVELS, THE CH-3 HOT GAS BYPASS SHALL OPERATE PER ITS INTERNAL CONTROLS IN ORDER TO PROVIDE THE REQUIRED CAPACITY AT LOW TURNDOWN CONDITIONS.				PASS?	INSERT NOTES
22	THE EMCS SHALL COMPARE ACTUAL CHILLER LIFT TO THE DESIGN CHILLER LIFT AND ADJUST THE RATED CAPACITY OF THE CHILLERS USING THE MANUFACTURERS SPECIFICATIONS BEFORE STARTING ADDITIONAL EQUIPMENT.				PASS?	INSERT NOTES
INDIVIDUAL EQUIPMENT ENABLE						
23	THE EMCS SHALL HAVE THE ABILITY TO TAKE KNOWN DEFECTIVE EQUIPMENT OUT OF SERVICE AND REMOVE FROM CONSIDERATION FOR SELECTION VIA SOFTWARE POINT "MAINTENANCE SWITCH".	Submittal Sequence Sheet 2-4 / 2-5			PASS?	INSERT NOTES
24	THIS POINT SHALL BE USED TO AUTOMATICALLY REMOVE TOWERS, PUMPS AND CHILLERS DURING LOW AMBIANT, SUMMER/WINTER MODES AS DESCRIBED BELOW.			Confirm point is operational for a variety of equipment (including new CHW equipment)	PASS?	INSERT NOTES
SECONDARY PUMP OPERATION AND SEQUENCING						
25	THE EXISTING PUMPS, SCWP-1, SCWP-2, AND SCWP-3 SHALL BE STANDBY PUMPS. SCWP-4 AND SCWP-5 SHALL FUNCTION AS THE NEW DISTRIBUTION PUMPS	Submittal Sequence Sheet 2-4 / 2-5			PASS?	INSERT NOTES
26	WHEN THE SYSTEM IS ENABLED, THE LEAD SECONDARY CHILLED WATER PUMP SHALL START AND RUN CONTINUOUSLY.				PASS?	INSERT NOTES
27	THE EMCS SHALL MODULATE THE SPEED OF THE PUMPS TO MAINTAIN PLANT DIFFERENTIAL PRESSURE AT SETPOINT. THE PLANT DIFFERENTIAL PRESSURE SETPOINT SHALL BE RESET FROM 17 TO 22 PSI (ADJ) BASED ON THE COOLING VALVES BEING SERVED BY THE PLANT.			Does only one pump run, even at full load conditions? Submitted sequence implies so but design sequence (see next step says something different).  Confirm full pump modulation. Record minimum speed setting.	PASS?	INSERT NOTES

28	IF ONE PUMP INCREASES TO 95% FOR A SPECIFIED TIME PERIOD (ADJUSTABLE, INITIALLY 15 MINUTES) AND THE CHILLED WATER DIFFERENTIAL PRESSURE SETPOINT CAN NOT BE MAINTAINED, THE DESIGNATED LAG PUMP SHALL BE SENT A START COMMAND AND THE PUMPS SHALL OPERATE IN PARALLEL.	CHW DESIGN Sequence 2.3			PASS?	INSERT NOTES
29	THE SPEEDS OF BOTH PUMPS SHALL BE MODULATED THROUGH THE RESPECTIVE VFDS TO MAINTAIN THE CHILLED WATER DIFFERENTIAL PRESSURE SETPOINT.	CHW DESIGN Sequence 2.3			PASS?	INSERT NOTES
30	IF THE PUMPS DECREASE TO 50% SPEED FOR A SPECIFIED TIME PERIOD (ADJUSTABLE, INITIALLY 15 MINUTES), A STOP COMMAND SHALL BE SENT TO THE LAGE PUMP.	CHW DESIGN Sequence 2.3			PASS?	INSERT NOTES
31	THE EMCS SHALL CONTINUOUSLY MONITOR ALL 22 COOLING VALVES AND INCREMENTALLY STAGE UP 3 PSI AND STAGE DOWN 2 PSI TO MAINTAIN AT LEAST ONE VALVE NEAR THE FULLY SATURATED (FULLY OPEN) CONDITION.	Submittal Sequence Sheet 2-4 / 2-5			PASS?	INSERT NOTES
32	THE EMCS SHALL ALTERNATE THE DESIGNATION OF LEAD/LAG ON THE FIRST MONDAY OF THE MONTH AT 10:00 AM BASED ON RUNTIME.			Rotate pumps and confirm full pump modulation and record minimum pump speed setting on the new Lead pump.	PASS?	INSERT NOTES
33	IF THE PUMP HAS BEEN COMMANDED TO START AND THE CURRENT TRANSFORMER (CT) INDICATES THE PUMP IS NOT RUNNING, THE PUMP SHALL SHUT DOWN AND THE EMCS SHALL ALARM. THEN, THE LAG SECONDARY CHILLED WATER PUMP SHALL START.				PASS?	INSERT NOTES
LOW FLOW CONDITIONS						
34	IF ONLY ONE PUMP IS RUNNING AND THE SPEED FALLS BELOW 25% (ADJUSTABLE) FOR AN ADJUSTABLE TIME PERIOD (INITIALLY 5 MINUTES), THE SECONDARY CHILLED WATER PUMP BYPASS VALVE SHALL MODULATE TO MAINTAIN PUMP SPEED 25%.	CHW DESIGN Sequence 2.5		Not included in submittal sequence but was included in design sequence.	PASS?	INSERT NOTES
DEMAND LIMITING						
35	AS PART OF THE DEMAND LIMITING SCHEME ON THE BUILDING, THE CHILLER PLANT CONTROL SYSTEM WILL BE ABLE TO MONITOR AND REDUCE PEAK POWER DEMAND THROUGH THE LIMITING OF CHILLER CURRENT DRAW.	(Not stated in sequence)		This was taken from another Chiller test. Does something like this exist for the SDSU plant?	PASS?	INSERT NOTES
CHILLER PLANT OPTIMIZATION						
36	CONTROL SHALL BE THROUGH THE EMCS.	CHW DESIGN Sequence 4.1		Not included in submittal sequence but was included in design sequence.	PASS?	INSERT NOTES
37	THE EXISTING EMCS SHALL CONTAIN PROGRAMMING (JCI CPO-10) TO CONTINUOUSLY ADJUST THE PERFORMANCE OF ALL CHILLED WATER AND CONDENSER WATER SYSTEM COMPONENTS EXISTING AND NEW UNDER THE PROJECT, INCLUDING, BUT NOT LIMITED TO, CHILLERS, COOLING TOWERS, AND PUMPS TO OPTIMIZE THE ENTRIE SYSTEM PERFORMANCE AND MINIMIZE ENERGY EFFICIENCY.	CHW DESIGN Sequence 4.2			PASS?	INSERT NOTES
38	THE ACTUAL DATA FOR EACH ITEM IN THE SYSTEM, INCLUDING PERFORMANCE CURVES, MINIMUM/MAXIMUM FLOWRATES, ETC SHALL BE ENTERED INTO THE EXISTING CHILLER SYSTEM PANEL PROGRAMMING AFTER ALL THE EQUIPMENT HAS BEEN PURCHASED.	CHW DESIGN Sequence 4.2			PASS?	INSERT NOTES
REFRIGERANT MANAGEMENT MONITORING						

39	CONTROL SHALL BE THROUGH THE EMCS.	CHW DESIGN Sequence 3.1		Not included in submittal sequence but was included in design sequence.	PASS?	INSERT NOTES
40	EXISTING REFRIGERANT MONITORING: THE EXISTING REFRIGERANT MONITORING PANEL SHALL CONTINUOUSLY MONITOR THE BUILDING.	CHW DESIGN Sequence 3.2			PASS?	INSERT NOTES
41	IF ANY OF THE REFRIGERANT SENSORS SENSE A REFRIGERANT LEAK AUDIBLE AND VISUAL INDICATORS SHALL BE ENABLED IN ACCORDANCE WITH ASHRAE 15-2004. THE EXISTING EMCS SHALL ALSO ALARM.	CHW DESIGN Sequence 3.2			PASS?	INSERT NOTES
42	AUDIBLE AND VISUAL INDICATORS SHALL BE ENABLED AT THE FOLLOWING THRESHOLDS: LEAK - 100 PPM OF R-134A (ADJ) SPILL - 300 PPM OF R-134A (ADJ) EVACUATION - 1000 PPM OF R-134A (MODEL CODE REQUIRED MAXIMUM REFRIGERANT CONCENTRATION)	CHW DESIGN Sequence 3.2			PASS?	INSERT NOTES
<b>ALARMS:</b>						
43	THE EMCS SHALL MONITOR THE STATUS/ALARM OF EACH CHILLER.	Submittal Sequence Sheet 2-4 / 2-5			PASS?	INSERT NOTES
44	<b>SAFETIES:</b> Test safeties at chiller.			Flow switch? Isolation Valve End Switch	PASS?	INSERT NOTES
45	<b>ALARMS:</b> TEMPERATURE?			Specific alarms were not covered in submittal sequence. Note in field.	PASS?	INSERT NOTES
46	CHILLED WATER DIFFERENTIAL PRESSURE?			Specific alarms were not covered in submittal sequence. Note in field.	PASS?	INSERT NOTES
47	CHILLER LOW FLOW?			Specific alarms were not covered in submittal sequence. Note in field.	PASS?	INSERT NOTES
<b>CHILLER/SYSTEM DISABLE</b>						
48	NOT SPECIFICALLY COVERED IN SEQUENCE. INITIATE A DISABLE:	Submittal Sequence Sheet 2-4 / 2-5			PASS?	INSERT NOTES
49	PRIMARY PUMP AND ISOLATION VALVES....				PASS?	INSERT NOTES
50	TOWER FAN AND PUMPS...				PASS?	INSERT NOTES
51	CHILLED WATER BYPASS VALVE....				PASS?	INSERT NOTES
<b>TREND LOG SETUP</b>						
52a	CONFIRM BASED ON TEST OBSERVATIONS WHETHER OR NOT PERFORMANCE SHOULD CONTINUE TO BE EVALUATED VIA TRENDS.				PASS?	INSERT NOTES
b	COMMUNICATE TREND SETUP REQUIREMENTS WITH CONTROLS CONTRACTOR				PASS?	INSERT NOTES



**CLIENT  
PROJECT**

ACTION ITEM #	DATE LOGGED	ENTRY TYPE	TECHNICAL CATEGORY	COMMENT GENERATOR	RESPONSIBLE TEAM MEMBER(S)	ITEM DESCRIPTION	STATUS	EXPECTED COMPLETION DATE	STATUS UPDATE	CLOSE DATE
1	06/18/10	Meeting Minutes	General	RTE	[OWNER]		DEFERRED	MM/DD/YYYY		
2	06/18/10	Email Correspondence	Mechanical	MSM	[ARCHITECT]		ON GOING	MM/DD/YYYY		
3	06/18/10	Verbal	Electrical	JPH	[ELEC CONTR]		OPEN	MM/DD/YYYY		
4	06/18/10	Site Observation	Plumbing	MBM	[MECH CONTR]		CLOSED	MM/DD/YYYY		
5	06/18/10	Verification Testing	Fire Protection	AAK	[CONTROLS]		READY TO VERIFY	MM/DD/YYYY		

**SECTION 01 91 19**  
**COMMISSIONING OF BUILDING ENCLOSURE (BECx)**

**PART 1 GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. This project shall include Building Enclosure Commissioning (BECx) as part of the design and construction processes. The primary intent of BECx is to provide a process for independent, third-party verification that the performance of the building enclosure meets or exceeds the minimum performance requirements per Owner Project Requirements (OPR), Code requirements, and/or design team objectives. Materials, components, and assemblies that comprise the building's exterior enclosure shall be evaluated and tested as outlined in this Section to confirm compliance with performance requirements.
  - 1. The exterior enclosure generally includes floor, exterior wall, fenestration, door, and roof assemblies that separate interior and exterior environments. Performance requirements will be established in coordination with the design team for materials and assemblies that comprise the building enclosure. These performance requirements will be related to the following physical properties:
    - a. Water Penetration Resistance
    - b. Air Leakage Rates
    - c. Thermal performance
    - d. Condensation Resistance
    - e. Material Permeance
    - f. Durability
- B. Related Sections, specific to the Work of each Section:
  - 1. Division 4
  - 2. Division 7
  - 3. Division 8

**1.3 REFERENCE STANDARDS**

- A. ASHRAE Guideline 0-2013 – The Commissioning Process
- B. NIBS Guideline 3-2012 – Exterior Enclosure Technical Requirements for the Commissioning Process
- C. ASTM E 2813-12 – Standard Practice for Building Enclosure Commissioning
- D. ASTM E 2947-16-a – Standard Guide for Building Enclosure Commissioning
- E. ASTM C 1193-13 – Standard Guide for Use of Joint Sealants
- F. ASTM E 783-02 – Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors
- G. ASTM E 1105-00 – Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference
- H. AAMA 501.2-09 – Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtain Walls, and Sloped Glazing Systems

**1.4 DEFINITIONS AND ABBREVIATIONS**

- A. Building Enclosure: All materials, components, systems, and assemblies intended to provide shelter and environmental separation between the interior and exterior, or between two or more environmentally distinct interior spaces in a building or structure.

- B. Building Enclosure Commissioning (BECx): A process to validate that the building enclosure achieves the objectives and requirements as outlined by the Owner and contract documents.
- C. Building Enclosure Commissioning Provider (BECxP): The individual or firm retained by the Commissioning Authority (CxA) that develops, manages, and is responsible for the BECx process.
- D. Commissioning Authority (CxA): The entity who leads, plans, schedules, and coordinates the commissioning team to implement the commissioning process.
- E. Building Enclosure Commissioning Plan: A document which outlines the BECx process for all related components and assemblies, identifies the Commissioning Team, and provides a general schedule of BECx tasks.
- F. Building Enclosure Commissioning Report: A summary document of all commissioning activities that occurred as part of the commissioning plan.
- G. Building Enclosure Commissioning Team: Owner, Contractor, Architect, CxA, and BECxP.
- H. Contract Documents: Documents governing the responsibilities and relationships between parties involved in the design and construction of this project, including (but not limited to): Agreements/Contracts, Drawings and Specifications, Addenda, and Change Orders.
- I. Construction Documents: Refers to the Contract Documents that dictate the details of construction.
- J. Contractor: As used herein, "Contractor" is a general reference to the installing Party and can therefore refer to the General Contractor, Project Manager, subcontractors, or vendors as inferred by its usage.

## 1.5 CONTRACTOR RESPONSIBILITIES

- A. Schedule: Contractor to incorporate BECx meetings, review time for submittals, QA observation reports dates, test dates, and any other BECx activities into the project schedule through coordination with BECx; prior to publishing BECx related activity schedules, the schedule must be mutually agreed upon between the Contractor and BECx teams.
- B. Submittals: Furnish copies of all submittals, shop drawings, manufacturer's literature, installation instructions, maintenance information, schedules, warranties, or other information as requested.
- C. Quality Assurance and Control (QA/QC): Submit project QA/QC program for review and comment by the BECx and Architect prior to beginning of construction.
- D. Facilitate a Commissioning Kick Off Meeting prior to construction which shall include the BECxP, Owner, Owner's Representative, CxA, Architect, Contractor, all enclosure trade partners, and any other interested parties.
  - 1. Ensure the Project Manager and field supervisor, if different people, are present from each subcontractor associated with building enclosure.
  - 2. Agenda:
    - i. Commissioning Plan
    - ii. Construction Schedule
    - iii. Contractor Teams and Contact Information
    - iv. Designation of key personnel and their duties.
    - v. Submittal Procedures
    - vi. Inspection and Testing Procedures
    - vii. Closeout Documents
    - viii. Owner Training
- E. Complete project-specific installation verification checklists for building enclosure materials and assemblies.
- F. Contractor to coordinate with and provide the testing agency with access, labor, and materials required to perform each type of test.
  - 1. Provide access to work, which may include scissor lifts, boom lifts, or scaffolding to perform BECx tasks.
  - 2. Provide qualified personnel for assistance to complete functional performance testing of the building envelope.

3. Provide safe access to all testing locations.
  4. Provide access to utilities as needed for testing (power, water, etc.)
  5. Perform all building preparation measures for whole building air leakage testing, if included in the test program.
  6. Provide safety plan and temporary signs, fencing, gateways, and other safety measures where testing occurs outside of construction zone limits or after regular construction fencing has been removed.
- G. Contractor to confirm test specimens are ready for testing at least one week prior to the mutually agreed upon test date.
1. Contractor is responsible for test specimens to be ready for testing on the test date. If testing cannot be undertaken on the test date, Contractor to pay additional mobilization costs associated with rescheduling.
- H. Maintain an issues log of non-compliant building enclosure assemblies identified by the BECxP, Architect, CxA, manufacturer's rep, 3<sup>rd</sup> party consultant, or any other parties involved in the Quality Assurance and Control of the project.
1. Contractor to provide photographs of remediation and description of remediation steps for review by Architect for approval of remedial actions.
- I. Reimburse Owner for additional testing and inspections if building enclosure assemblies are not constructed per Construction Documents or do not pass testing;
1. Retest assemblies which do not pass testing and add one additional test for each failed test, unless more stringent criteria is identified within the applicable Specification Section.
- J. Facilitate operator and occupant training meeting after substantial completion.
- K. Provide maintenance documentation to Owner or building operations team; information to include requirements as outlined in Division 1.
- L. Participate in building facade condition assessment warranty site walk prior to end of Contractor warranty period. Review to include BECxP, Owner, Owner's Representative, Facilities Management, CM, manufacturer reps, and/or any other interested party for the purpose of identifying non-compliant and call-back work items to be resolved under warranty.
1. Include non-compliant items in the project issues log for tracking, review, and approval of the remediation by the Architect

## **1.6 ARCHITECT RESPONSIBILITIES**

- A. Provide electronic copies of Contract Documents to the BECxP.
- B. Provide response to all BECxP comments for technical review of Contract Documents, shop drawings, submittals.
- C. Review and approve remedial actions taken for identified non-compliant installations during construction and the facade condition assessment warranty site visit, tracked by the Contractor in the project issues log.
- D. Determine with BECxP workflow for review and commenting of Contract Documents and submittals.
- E. Determine with BECxP commissioning meeting frequency and identify which project meetings BECxP is to attend, if any.
- F. Coordinate with BECxP functional performance testing locations.

## **1.7 BUILDING ENCLOSURE COMMISSIONING AGENT RESPONSIBILITIES**

- A. Submittal Reviews
  1. BECxP will review and comment on submittals for compliance with the building enclosure requirements set forth in the Contract Documents, manufacture requirements, and industry best practices. The BECxP submittal reviews will be in coordination with the design team's review. Note the BECxP shall not have the authority to accept or reject submittals.
- B. QA/QC Review

1. BECxP will review Contractor and Subcontractor site specific quality control/quality assurance processes with respect to the building enclosure.
2. BECxP will verify Contractor and Subcontractor completion of checklists. Contactor can utilize checklists developed as part of their QA/QC program if they are reviewed by the BECxP and comments incorporated.
- C. Quality Assurance (QA) Observations and Reports
  1. BECxP to conduct QA observations during construction to document progress and identify non-conformant work.
- D. Field Performance Testing
  1. BECxP to perform functional performance testing as identified in Part 3 of this specification.
  2. BECxP to provide a report for each test that documents the procedure, description of test specimens, test results, and relevant equipment calibration records.
- E. Field Performance Testing
  1. Owner shall engage testing agency to perform the functional performance testing identified in Contract Documents.
  2. BECxP to review and compile test reports for inclusion in BECx close-out report.
- F. Review Contractor closeout documentation for compliance with the Contract Documents prior to approval by Architect.
- G. Provide to Owner a BECx Close-out Report which includes copies of the BECx Plan, document reviews, meeting minutes, observation reports, Contractor issues log, test reports, and any other BECx related documentation.
- H. Facade Condition Assessment Warranty Site Visit: Review building enclosure assemblies for non-compliant assemblies for remediation by the Contractor at least two months prior to expiry of the workmanship warranties.
  1. BECxP to issue a report documenting non-compliant assemblies.
- I. Building Enclosure Commissioning Agent is not authorized to:
  1. Revise, release, revoke, alter, or expand requirements of Contract Documents
  2. Approve or accept any portion of the work
  3. Perform any duties of the Contractor

## **PART 2 PRODUCTS - NOT USED**

## **PART 3 EXECUTION**

- A. Functional Performance Testing
  1. In Situ Testing: Perform functional performance testing per project Contract Documents. The required number or frequency of each test below matches the number of frequency provided in the applicable enclosure specification. If the number of frequency does not match, then the specific enclosure specification controls.
- B. Tests
  1. Sealant Pull Test (07 90 05, 3.04): Perform sealant pull tests at a rate of 1 per 100 linear feet (LF) for the first 1,000 LF, and 1 per 1,000 LF thereafter in accordance with ASTM C 1193, Appendix X1 Method A.
    - a. Sealant pull tabs must exhibit adhesion as required by the sealant manufacturer. If manufacturer requirements do not exist, then the sealant should tear cohesively within itself before releasing from the substrate. Sealants that fail in adhesion will be considered test failures.
  2. Water Penetration Test (08 44 13, 3.04 & 08 43 13, 3.04): Perform 4 tests in accordance with ASTM E 1105. Test specimen sizes will be no larger than 10' x 10'.
    - a. The static air pressure differential for testing shall be 6.66 psf.
    - b. Test failure is defined as any water penetration.
  3. Air Leakage Test (08 44 13, 3.04 & 08 43 13, 3.04): Perform 4 tests in accordance with ASTM E 783. Test specimen sizes will be no larger than 10' x 10'. Test specimens will be same specimens tested during water penetration testing.

- a. The uniform static air pressure differential for testing shall be 6.24 psf and the allowable leakage shall be 0.09 cfm/ft<sup>2</sup>.
- 4. Water Spray Test (08 44 13, 3.04 & 08 43 13, 3.04): Testing shall be provided as a diagnostic tool in the event of test failures per Part 3-B-2 of this Section.
  - a. Test failure is defined as uncontrolled water that appears on any normally exposed interior surface, that is not contained or drained back to the exterior, or that can cause damage to adjacent materials and finished. Water contained within drained flashings, gutters, and sills is not considered water leakage. The collection of up to 15 ml of water in a five minute test period on top of an interior stop or stool integral with the system shall not be considered water leakage.

**END OF SECTION**

## **SECTION 024100 DEMOLITION**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Selective demolition of building elements for alteration purposes.

#### **1.02 REFERENCE STANDARDS**

- A. 29 CFR 1926 - U.S. Occupational Safety and Health Standards; current edition.
- B. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations; 2019.

### **PART 3 EXECUTION**

#### **2.01 SCOPE**

- A. Remove all items as specified on Drawing Sheets.

#### **2.02 GENERAL PROCEDURES AND PROJECT CONDITIONS**

- A. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.
  - 1. Obtain required permits.
  - 2. Take precautions to prevent catastrophic or uncontrolled collapse of structures to be removed; do not allow worker or public access within range of potential collapse of unstable structures.
  - 3. Provide, erect, and maintain temporary barriers and security devices.
  - 4. Use physical barriers to prevent access to areas that could be hazardous to workers or the public.
  - 5. Conduct operations to minimize effects on and interference with adjacent structures and occupants.
  - 6. Do not close or obstruct roadways or sidewalks without permit.
  - 7. Obtain written permission from owners of adjacent properties when demolition equipment will traverse, infringe upon or limit access to their property.
- B. Do not begin removal until receipt of notification to proceed from Owner.
- C. Protect existing structures and other elements that are not to be removed.
  - 1. Provide bracing and shoring.
  - 2. Prevent movement or settlement of adjacent structures.
  - 3. Stop work immediately if adjacent structures appear to be in danger.
- D. If hazardous materials are discovered during removal operations, stop work and notify Architect and Owner; hazardous materials include regulated asbestos containing materials, lead, PCB's, and mercury.

#### **2.03 EXISTING UTILITIES**

- A. Coordinate work with utility companies; notify before starting work and comply with their requirements; obtain required permits.
- B. Protect existing utilities to remain from damage.
- C. Do not disrupt public utilities without permit from authority having jurisdiction.
- D. Locate and mark utilities to remain; mark using highly visible tags or flags, with identification of utility type; protect from damage due to subsequent construction, using substantial barricades if necessary.
- E. Remove exposed piping, valves, meters, equipment, supports, and foundations of disconnected and abandoned utilities.

#### **2.04 SELECTIVE DEMOLITION FOR ALTERATIONS**

- A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
  - 1. Verify that construction and utility arrangements are as shown.
  - 2. Report discrepancies to Architect before disturbing existing installation.

3. Beginning of demolition work constitutes acceptance of existing conditions that would be apparent upon examination prior to starting demolition.
- B. Remove existing work as indicated and as required to accomplish new work.
  1. Remove items indicated on drawings.
- C. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications): Remove existing systems and equipment as indicated.
  1. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
  2. Verify that abandoned services serve only abandoned facilities before removal.
  3. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification.
- D. Protect existing work to remain.
  1. Prevent movement of structure; provide shoring and bracing if necessary.
  2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
  3. Repair adjacent construction and finishes damaged during removal work.
  4. Patch as specified for patching new work.

#### **2.05 DEBRIS AND WASTE REMOVAL**

- A. Remove debris, junk, and trash from site.
- B. Leave site in clean condition, ready for subsequent work.
- C. Clean up spillage and wind-blown debris from public and private lands.

**END OF SECTION**



**SECTION 030516  
UNDERSLAB VAPOR BARRIER**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Sheet vapor barrier under concrete slabs on grade.

**1.02 RELATED REQUIREMENTS**

- A. Section 033000 - Cast-in-Place Concrete: Preparation of subgrade, granular fill, placement of concrete.

**1.03 REFERENCE STANDARDS**

- A. ASTM E1643 - Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs; 2018a.
- B. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs; 2017 (Reapproved 2023).

**1.04 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Submit manufacturers' data on manufactured products.
- C. Test Data: Submit report of tests showing compliance with specified requirements.
- D. Manufacturer's Installation Instructions: Indicate installation procedures and interface required with adjacent construction.

**PART 2 PRODUCTS**

**2.01 MATERIALS**

- A. Underslab Vapor Barrier:
  - 1. Water Vapor Permeance: Not more than 0.010 perms, maximum.
  - 2. Thickness: 15 mils.
  - 3. Basis of Design:
    - a. Stego Industries LLC; Stego Wrap Vapor Barrier (15-mil): [www.stegoindustries.com/#sle](http://www.stegoindustries.com/#sle).
    - b. Vapor Block by Raven Industries.
    - c. Substitutions: See Section 016000 - Product Requirements.
- B. Accessory Products: Vapor barrier manufacturer's recommended tape, adhesive, mastic, etc., for sealing seams and penetrations in vapor barrier.

**PART 3 EXECUTION**

**3.01 EXAMINATION**

- A. Verify that surface over which vapor barrier is to be installed is complete and ready before proceeding with installation of vapor barrier.

**3.02 INSTALLATION**

- A. Install vapor barrier in accordance with manufacturer's instructions and ASTM E1643.
- B. Install vapor barrier under interior slabs on grade; lap sheet over footings and seal to foundation walls.
- C. Lap joints minimum 6 inches.
- D. Seal joints, seams and penetrations watertight with manufacturer's recommended products and follow manufacturer's written instructions.
- E. No penetration of vapor barrier is allowed except for reinforcing steel and permanent utilities.
- F. Repair damaged vapor retarder before covering with other materials.

**END OF SECTION**

**SECTION 033000  
CAST-IN-PLACE CONCRETE**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Concrete formwork.
- B. Slabs-on-grade.
- C. Concrete foundation walls and footings.
- D. Concrete reinforcement.
- E. Joint devices associated with concrete work.
- F. Concrete curing.

**1.02 REFERENCE STANDARDS**

- A. ACI 117 - Standard Specifications for Tolerances for Concrete Construction and Materials; American Concrete Institute International; 2010.
- B. ACI 301 - Specifications for Structural Concrete; American Concrete Institute International; 2010.
- C. ACI 302.1R - Guide for Concrete Floor and Slab Construction; American Concrete Institute International; 2004 (Errata 2007).
- D. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete; American Concrete Institute International; 2000.
- E. ACI 308R - Guide to Curing Concrete; American Concrete Institute International; 2001 (Reapproved 2008).
- F. ACI 318 - Building Code Requirements for Structural Concrete and Commentary; American Concrete Institute International; 2011.
- G. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon Billet-Steel Bars for Concrete Reinforcement; 2013.
- H. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2013.
- I. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens; 2012a.
- J. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2013.
- K. ASTM C150/C150M - Standard Specification for Portland Cement; 2012.
- L. ASTM C173/C173M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method; 2012.
- M. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete; 2012.

**1.03 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Submit manufacturers' data on manufactured products showing compliance with specified requirements and installation instructions.
- C. Mix Design: Submit proposed concrete mix designs.

**1.04 QUALITY ASSURANCE**

- A. Perform work of this section in accordance with ACI 301 and ACI 318.

**PART 2 PRODUCTS**

**2.01 FORMWORK**

- A. Form Materials: Contractor's choice of standard products with sufficient strength to withstand hydrostatic head without distortion in excess of permitted tolerances.
  - 1. Form Coating: Release agent that will not adversely affect concrete or interfere with application of coatings.

**2.02 REINFORCEMENT**

- A. Reinforcing Steel: ASTM A615/A615M Grade 60 (420).
  - 1. Type: Deformed billet-steel bars.
  - 2. Finish: Unfinished, unless otherwise indicated.

- B. Reinforcement Accessories:
  - 1. Tie Wire: Annealed, minimum 16 gage (1.5 mm).
  - 2. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for adequate support of reinforcement during concrete placement.

### **2.03 CONCRETE MATERIALS**

- A. Cement: ASTM C150, Type I - Normal Portland type.
  - 1. Acquire all cement for entire project from same source.
- B. Fine and Coarse Aggregates: ASTM C 33.
  - 1. Acquire all aggregates for entire project from same source.
- C. Fly Ash: ASTM C618, Class C or F.
- D. Water: Clean and not detrimental to concrete.
- E. Fiber Reinforcement: Alkali-resistant polypropylene complying with ASTM C1116/C1116M.
  - 1. Fiber Length: 0.25 inch (6 mm), nominal.

### **2.04 BONDING AND JOINTING PRODUCTS**

- A. Slab Isolation Joint Filler: 1/2 inch (13 mm) thick, height equal to slab thickness, with removable top section that will form 1/2 inch (13 mm) deep sealant pocket after removal.

### **2.05 CONCRETE MIX DESIGN**

- A. Fiber Reinforcement: Add to mix at rate of 1.5 pounds per cubic yard (0.89 kg per cubic meter), or as recommended by manufacturer for specific project conditions.
- B. Footings and Foundation Walls:
  - 1. Compressive Strength, when tested in accordance with ASTM C39/C39M at 28 days: 3,500 pounds per square inch (20.7 MPa).
  - 2. Fly Ash Content: Maximum 15 percent of cementitious materials by weight.
  - 3. Water-Cement Ratio: Maximum 45 percent by weight.
  - 4. Total Air Content: 6 percent plus or minus 1.5 percent at point of delivery, determined in accordance with ASTM C173/C173M.
  - 5. Maximum Slump: 4 inches (100 mm), plus or minus 1 inch (25 mm).
  - 6. Maximum Aggregate Size: 1-inch (25 mm).
- C. Slabs-on-Grade:
  - 1. Compressive Strength, when tested in accordance with ASTM C39/C39M at 28 days: 4,000 pounds per square inch (31 MPa).
  - 2. Fly Ash Content: Maximum 15 percent of cementitious materials by weight.
  - 3. Minimum Cementitious Materials Content: 520 lb/cu. yd (309 kg/cu. m).
  - 4. Total Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.
  - 5. Maximum Slump: 4 inches (100 mm), plus or minus 1 inch (25 mm).
  - 6. Maximum Aggregate Size: 3/4-inch (19 mm).

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify lines, levels, and dimensions before proceeding with work of this section.

### **3.02 PREPARATION**

- A. Formwork: Comply with requirements of ACI 301. Design and fabricate forms to support all applied loads until concrete is cured, and for easy removal without damage to concrete.
- B. Verify that forms are clean and free of rust before applying release agent.
- C. In locations where new concrete is doweled to existing work, drill holes in existing concrete, insert steel dowels and pack solid with non-shrink grout.
- D. Interior Slabs on Grade: Install vapor retarder under interior slabs on grade. Lap joints minimum 6 inches (150 mm). Seal joints, seams and penetrations watertight with manufacturer's recommended products and follow manufacturer's written instructions. Repair damaged vapor retarder before covering.

### **3.03 INSTALLING REINFORCEMENT AND OTHER EMBEDDED ITEMS**

- A. Comply with requirements of ACI 301. Clean reinforcement of loose rust and mill scale, and accurately position, support, and secure in place to achieve not less than minimum concrete coverage required for protection.

### **3.04 PLACING CONCRETE**

- A. Place concrete in accordance with ACI 304R.
- B. Place concrete for floor slabs in accordance with ACI 302.1R.
- C. Finish floors level and flat, unless otherwise indicated, within the tolerances specified below.

### **3.05 SLAB JOINTING**

- A. Locate joints as indicated on the drawings.
- B. Anchor joint fillers and devices to prevent movement during concrete placement.
- C. Isolation Joints: Use preformed joint filler with removable top section for joint sealant, total height equal to thickness of slab, set flush with top of slab.
- D. Saw Cut Contraction Joints: Saw cut joints before concrete begins to cool, within 4 to 12 hours after placing; use 3/16 inch (5 mm) thick blade and cut at least 1 inch (25 mm) deep but not less than one quarter (1/4) the depth of the slab.

### **3.06 FLOOR FLATNESS AND LEVELNESS TOLERANCES**

- A. Maximum Variation of Surface Flatness:
  - 1. Exposed Concrete Floors: 1/4 inch (6 mm) in 10 ft (3 m).
  - 2. Under Seamless Resilient Flooring: 1/4 inch (6 mm) in 10 ft (3 m).
  - 3. Under Carpeting: 1/4 inch (6 mm) in 10 ft (3 m).
- B. Correct the slab surface if tolerances are less than specified.
- C. Correct defects by grinding or by removal and replacement of the defective work. Areas requiring corrective work will be identified. Re-measure corrected areas by the same process.

### **3.07 CONCRETE FINISHING**

- A. Concrete Slabs: Finish to requirements of ACI 302.1R, and as follows:
  - 1. Surfaces to Receive Thin Floor Coverings: "Steel trowel" as described in ACI 302.1R; thin floor coverings include carpeting, resilient flooring, seamless flooring, thin set quarry tile, and thin set ceramic tile.
  - 2. Decorative Exposed Surfaces: "Steel trowel" as described in ACI 302.1R; use steel-reinforced plastic trowel blades instead of steel blades to avoid black-burnish marks; decorative exposed surfaces include surfaces to be stained or dyed, pigmented concrete, surfaces to be polished, and all other slab surfaces.

### **3.08 CURING AND PROTECTION**

- A. Comply with requirements of ACI 308R. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.
- B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.
- C. Surfaces Not in Contact with Forms:
  - 1. Initial Curing: Start as soon as free water has disappeared and before surface is dry. Keep continuously moist for not less than three days by water ponding, water-saturated sand, water-fog spray, or saturated burlap.
  - 2. Final Curing: Begin after initial curing but before surface is dry.

### **3.09 DEFECTIVE CONCRETE**

- A. Defective Concrete: Concrete not conforming to required lines, details, dimensions, tolerances or specified requirements.
- B. Repair or replacement of defective concrete will be determined by the Architect. The cost of additional testing shall be borne by Contractor when defective concrete is identified.
- C. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Architect for each individual area.

**3.10 PROTECTION**

- A. Do not permit traffic over unprotected concrete floor surface until fully cured.

**3.11 FIELD QUALITY CONTROL**

- A. Owner will engage a qualified testing and inspecting agency to perform field tests and inspection and to prepare test reports.

**END OF SECTION**

**SECTION 033511  
CONCRETE FLOOR FINISHES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Surface treatments for concrete floors and slabs.
- B. Liquid densifiers and hardeners.

**1.02 RELATED REQUIREMENTS**

- A. Section 033000 - Cast-in-Place Concrete: Finishing of concrete surface to tolerance; floating, troweling, and similar operations; curing.

**1.03 ADMINISTRATIVE REQUIREMENTS**

- A. Coordinate the work with concrete floor placement and concrete floor curing.

**1.04 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's published data on each finishing product, including information on compatibility of different products and limitations.
- C. Maintenance Data: Provide data on maintenance and renewal of applied finishes.

**1.05 MOCK-UP**

- A. For coatings, construct mock-up area under conditions similar to those that will exist during application, with coatings applied.
- B. Mock-Up Size: 10 feet square.
- C. Locate where directed.
- D. Mock-up may remain as part of the work.

**1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver materials in manufacturer's sealed packaging, including application instructions.

**1.07 FIELD CONDITIONS**

- A. Maintain light level equivalent to a minimum 200 W light source at 8 feet above the floor surface over each 20 foot square area of floor being finished.
- B. Do not finish floors until interior heating system is operational.
- C. Maintain ambient temperature of 50 degrees F minimum.

**1.08 WARRANTY**

- A. See Section 017800 - Closeout Submittals for additional warranty requirements.
- B. Correct defective work within a two-year period commencing on the Date of Substantial Completion.
- C. Manufacturer Warranty: Provide two-year manufacturer warranty for concrete floor finishes commencing on the Date of Substantial Completion.

**PART 2 PRODUCTS**

**2.01 DENSIFIERS AND HARDENERS**

- A. Liquid Densifier/Hardener: Penetrating chemical compound that reacts with concrete, filling the pores and dustproofing; for application to concrete after set.
  - 1. Composition: Lithium silicate.
  - 2. Products:
    - a. ARDEX Engineered Cements; ARDEX PC-50: [www.ardexamericas.com/#sle](http://www.ardexamericas.com/#sle).
    - b. Euclid Chemical Company; ULTRASIL LI+: [www.euclidchemical.com/#sle](http://www.euclidchemical.com/#sle).
    - c. L&M Construction Chemicals, Inc, a subsidiary of Laticrete International, Inc; LiON HARD: [www.lmcc.com/#sle](http://www.lmcc.com/#sle).
    - d. PROSOCO, Inc; Consolideck LS: [www.prosoco.com/consolideck/#sle](http://www.prosoco.com/consolideck/#sle).
    - e. Surface Koatings, Inc; Aqualon L-100: [www.surfkoat.com/#sle](http://www.surfkoat.com/#sle).
    - f. Basis of Design: Laticrete/L&M Construction Chemicals Dress & Seal WB and Lion Hard.

- g. Substitutions: See Section 016000 - Product Requirements.

## **2.02 COATINGS**

- A. Low Gloss Clear Coating: Transparent, non-yellowing, water- or solvent-based coating.
  - 1. Composition: Acrylic polymer-based.
  - 2. Nonvolatile Content: 15 percent, minimum, when measured by volume.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that floor surfaces are acceptable to receive the work of this section.
- B. Verify that flaws in concrete have been patched and joints filled with methods and materials suitable for further finishes.

### **3.02 GENERAL**

- A. Apply materials in accordance with manufacturer's instructions.

### **3.03 COATING APPLICATION**

- A. Verify that water vapor emission from concrete and relative humidity in concrete are within limits established by coating manufacturer.
- B. Apply coatings in accordance with manufacturer's instructions, matching approved mock-ups for color, special effects, sealing and workmanship.

**END OF SECTION**

**SECTION 042000  
UNIT MASONRY**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Concrete Block.
- B. Clay Facing Brick.
- C. Mortar and Grout.
- D. Reinforcement and Anchorage.
- E. Flashings.
- F. Accessories.

**1.02 RELATED REQUIREMENTS**

- A. Section 019119-Commissioning of Building Enclosure (BECx): Commissioning requirements and procedures.
- B. Section 055000 - Metal Fabrications: Loose steel lintels.
- C. Section 061000 - Rough Carpentry: Nailing strips built into masonry.
- D. Section 072100 - Thermal Insulation: Insulation for cavity spaces.
- E. Section 079200 - Joint Sealants: Sealing control and expansion joints.

**1.03 REFERENCE STANDARDS**

- A. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures; 2022, with Errata.
- B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.
- C. ASTM A240/A240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications; 2023.
- D. ASTM A641/A641M - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire; 2019.
- E. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2023.
- F. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2022.
- G. ASTM C90 - Standard Specification for Loadbearing Concrete Masonry Units; 2022.
- H. ASTM C91/C91M - Standard Specification for Masonry Cement; 2023.
- I. ASTM C129 - Standard Specification for Nonloadbearing Concrete Masonry Units; 2022.
- J. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar; 2018.
- K. ASTM C150/C150M - Standard Specification for Portland Cement; 2022.
- L. ASTM C404 - Standard Specification for Aggregates for Masonry Grout; 2018.
- M. ASTM C476 - Standard Specification for Grout for Masonry; 2023.
- N. BIA Technical Notes No. 7 - Water Penetration Resistance – Design and Detailing; 2017.
- O. BIA Technical Notes No. 13 - Ceramic Glazed Brick Exterior Walls; 2017.
- P. BIA Technical Notes No. 28B - Brick Veneer/Steel Stud Walls; 2005.
- Q. BIA Technical Notes No. 46 - Maintenance of Brick Masonry; 2017.

**1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by all relevant installers.

**1.05 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data for masonry units, fabricated wire reinforcement, mortar, and masonry accessories.
- C. Shop Drawings: Indicate pertinent dimensions, materials, anchorage, size and type of fasteners, and accessories for brickwork support system.
  - 1. Include calculations or selections from the manufacturer's prescriptive design tables that indicate compliance with the applicable building code and project conditions.
  - 2. Include the design engineer's stamp or seal on each sheet of shop drawings.



- D. Samples: Submit panel samples of facing brick units to illustrate color, texture, and extremes of color range.
- E. Manufacturer's Certificate: Certify that masonry units meet or exceed specified requirements.
- F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 016000 - Product Requirements, for additional provisions.

### **1.06 QUALITY ASSURANCE**

- A. Comply with provisions of TMS 402/602, except where exceeded by requirements of the contract documents.
- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least five years of documented experience.

### **1.07 MOCK-UP**

- A. Construct a masonry wall as a mock-up panel sized 4 feet long by 4 feet high; include mortar, accessories, and flashings (with lap joint, corner, and end dam) in mock-up.

### **1.08 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.

## **PART 2 PRODUCTS**

### **2.01 CONCRETE MASONRY UNITS**

- A. Concrete Block: Comply with referenced standards and as follows:
  - 1. Size: Standard units with nominal face dimensions of 16 by 8 inches and nominal depths as indicated on drawings for specific locations.
  - 2. Load-Bearing Units: ASTM C90, normal weight.
    - a. Hollow block, as indicated.
    - b. Exposed Faces: Manufacturer's standard color and texture where indicated.
  - 3. Non-Loadbearing Units: ASTM C129.
    - a. Hollow block, as indicated.

### **2.02 BRICK UNITS**

- A. Manufacturers:
  - 1. Belden Brick; Belcrest: [www.beldenbrick.com](http://www.beldenbrick.com).
  - 2. Boral Bricks, Inc: [www.boralbricks.com/#sle](http://www.boralbricks.com/#sle).
  - 3. Endicott Clay Products Co: [www.endicott.com/#sle](http://www.endicott.com/#sle).
  - 4. Glen-Gery Co..
  - 5. Yankee Hill Brick & Tile: [www.yankeehillbrick.com/](http://www.yankeehillbrick.com/)
- B. Facing Brick: ASTM C216, Type FBS, Grade SW.
  - 1. Color and texture: Basis of Design: BRK-1- Yankee Hill Medium Red Ironspot Velour; BRK-2 Yankee Hill Dark Ironspot Smooth .
  - 2. Nominal size: As indicated on drawings.
  - 3. Special shapes: Molded units as required by conditions indicated, unless standard units can be sawn to produce equivalent effect.

### **2.03 MORTAR AND GROUT MATERIALS**

- A. Masonry Cement: ASTM C91/C91M, Type N.
- B. Portland Cement: ASTM C150/C150M, Type I; color as required to produce approved color sample.
  - 1. Not more than 0.60 percent alkali.
- C. Mortar Aggregate: ASTM C144.
- D. Grout Aggregate: ASTM C404.
- E. Water: Clean and potable.

### **2.04 REINFORCEMENT AND ANCHORAGE**

- A. Manufacturers of Joint Reinforcement and Anchors:
  - 1. Blok-Lok Limited: [www.blok-lok.com/#sle](http://www.blok-lok.com/#sle).

2. Hohmann & Barnard, Inc; 2-Seal Tie: [www.h-b.com/#sle](http://www.h-b.com/#sle).
  3. WIRE-BOND: [www.wirebond.com/#sle](http://www.wirebond.com/#sle).
- B. Reinforcing Steel: ASTM A615/A615M, Grade 40 (40,000 psi), deformed billet bars; galvanized.
  - C. Joint Reinforcement: Use ladder type joint reinforcement where vertical reinforcement is involved and truss type elsewhere, unless otherwise indicated.
  - D. Single Wythe Joint Reinforcement: Truss or ladder type; ASTM A1064/A1064M steel wire, mill galvanized to ASTM A641/A641M, Class 3; 0.1483 inch side rods with 0.1483 inch cross rods; width as required to provide not more than 1 inch and not less than 1/2 inch of mortar coverage on each exposure.
  - E. Masonry Veneer Anchors: 2-piece anchors that permit differential movement between masonry veneer and structural backup, hot dip galvanized to ASTM A 153/A 153M, Class B.
    1. Anchor plates: Not less than 0.075 inch thick, designed for fastening to structural backup through sheathing by two fasteners; provide design with legs that penetrate sheathing and insulation to provide positive anchorage.
    2. Wire ties: Manufacturer's standard shape, 0.1875 inch thick.
    3. Vertical adjustment: Not less than 3-1/2 inches.
  - F. Metal-to-Metal Fasteners: Self-drilling, self-tapping screws; corrosion resistant finish or hot dip galvanized to ASTM A153/A153M.

## 2.05 FLASHINGS

- A. Stainless Steel/Polymer Fabric Drainage Plane Flashing - Self-Adhering: ASTM A240/A240M; 2 mil type 304 stainless steel sheet with co-polymer butyl adhesive and a removable release liner on one side and a sheet of non-woven drainage material bonded to the other side.
  1. Manufacturers:
    - a. York Manufacturing, Inc: [www.yorkmfg.com/#sle](http://www.yorkmfg.com/#sle).
    - b. Substitutions: See Section 016000 - Product Requirements.
- B. Stainless Steel Flashing: ASTM A666, Type 304, soft temper; 26 gage, 0.0187 inch thick; finish 2B to 2D.

## 2.06 ACCESSORIES

- A. Prefomed Control Joints: Rubber material. Provide with corner and tee accessories, fused joints.
  1. Manufacturers:
    - a. Blok-Lok Limited: [www.blok-lok.com/#sle](http://www.blok-lok.com/#sle).
    - b. Hohmann & Barnard, Inc: [www.h-b.com/#sle](http://www.h-b.com/#sle).
    - c. WIRE-BOND: [www.wirebond.com/#sle](http://www.wirebond.com/#sle).
- B. Cavity Mortar Control: Semi-rigid polyethylene or polyester mesh panels, sized to thickness of wall cavity, and designed to prevent mortar droppings from clogging weeps and cavity vents and allow proper cavity drainage.
  1. Mortar Diverter: Semi-rigid mesh designed for installation at flashing locations.
    - a. Manufacturers:
      - 1) Advanced Building Products Inc; Mortar Break DT: [www.advancedflashing.com/#sle](http://www.advancedflashing.com/#sle).
      - 2) Mortar Net Solutions: [www.mortarnet.com](http://www.mortarnet.com).
      - 3) Substitutions: See Section 016000 - Product Requirements.
- C. Termination Bars: 316 Stainless steel; 1/8" thick with pre-punched hole spacing of 8" o.c.; compatible with membrane and adhesives.
- D. Drip Edge: Stainless steel; compatible with membrane and adhesives.
- E. Cavity Vents:
  1. Type: Polyester mesh.
  2. Color(s): As selected by Architect from manufacturer's full range.
  3. Manufacturers:
    - a. Advanced Building Products, Inc: [www.advancedbuildingproducts.com/#sle](http://www.advancedbuildingproducts.com/#sle).
    - b. Blok-Lok Limited: [www.blok-lok.com/#sle](http://www.blok-lok.com/#sle).

- c. CavClear, a Division of Archovations Inc: [www.cavclear.com/#sle](http://www.cavclear.com/#sle).
- d. Hohmann & Barnard, Inc: [www.h-b.com/#sle](http://www.h-b.com/#sle).
- e. Mortar Net Solutions: [www.mortarnet.com/#sle](http://www.mortarnet.com/#sle).
- f. WIRE-BOND: [www.wirebond.com/#sle](http://www.wirebond.com/#sle).
- g. Substitutions: See Section 016000 - Product Requirements.

F. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.

## **2.07 MORTAR AND GROUT MIXES**

- 1. Exterior, non-loadbearing masonry: Type N.
  - 2. Interior, loadbearing masonry: Type N.
  - 3. Interior, non-loadbearing masonry: Type O.
- B. Grout: ASTM C476; consistency required to fill completely volumes indicated for grouting; fine grout for spaces with smallest horizontal dimension of 2 inches or less; coarse grout for spaces with smallest horizontal dimension greater than 2 inches.
- C. Admixtures: Add to mixture at manufacturer's recommended rate and in accordance with manufacturer's instructions; mix uniformly.
- D. Mixing: Use mechanical batch mixer and comply with referenced standards.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that field conditions are acceptable and are ready to receive masonry.
- B. Verify that related items provided under other sections are properly sized and located.
- C. Verify that built-in items are in proper location, and ready for roughing into masonry work.

### **3.02 PREPARATION**

- A. Direct and coordinate placement of metal anchors supplied for installation under other sections.
- B. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.

### **3.03 COLD AND HOT WEATHER REQUIREMENTS**

- A. Maintain materials and surrounding air temperature to minimum 40 degrees F prior to, during, and 48 hours after completion of masonry work.
- B. Maintain materials and surrounding air temperature to maximum 90 degrees F prior to, during, and 48 hours after completion of masonry work.

### **3.04 COURSING**

- A. Establish lines, levels, and coursing indicated. Protect from displacement.
- B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.
- C. Concrete Masonry Units:
  - 1. Bond: Running.
  - 2. Coursing: One unit and one mortar joint to equal 8 inches.
  - 3. Mortar Joints: Concave.
- D. Brick Units:
  - 1. Bond: Stacked.
  - 2. Coursing: Two units and two mortar joints to equal 8 inches.
  - 3. Mortar Joints: Concave.

### **3.05 PLACING AND BONDING**

- A. Lay hollow masonry units with face shell bedding on head and bed joints.
- B. Remove excess mortar and mortar smears as work progresses.
- C. Remove excess mortar with water repellent admixture promptly. Do not use acids, sandblasting or high pressure cleaning methods.
- D. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.
- E. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.

- F. Isolate masonry partitions from vertical structural framing members with a control joint as indicated.
- G. Isolate top joint of masonry partitions from horizontal structural framing members and slabs or decks with compressible joint filler.

### **3.06 WEEPS/CAVITY VENTS**

- A. Install weeps in veneer and cavity walls at 24 inches on center horizontally above through-wall flashing, above shelf angles and lintels, and at bottom of walls.

### **3.07 CAVITY MORTAR CONTROL**

- A. Do not permit mortar to drop or accumulate into cavity air space or to plug weep/cavity vents.

### **3.08 REINFORCEMENT AND ANCHORAGE - GENERAL**

- A. Unless otherwise indicated on drawings or specified under specific wall type, install horizontal joint reinforcement 16 inches on center.
- B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches each side of opening.
- C. Place continuous joint reinforcement in first and second joint below top of walls.
- D. Lap joint reinforcement ends minimum 6 inches.

### **3.09 REINFORCEMENT AND ANCHORAGE - MASONRY VENEER**

- A. Install horizontal joint reinforcement 16 inches on center.
- B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches each side of opening.
- C. Place continuous joint reinforcement in first and second joint below top of walls.
- D. Stud Back-Up: Secure veneer anchors to stud framed back-up and embed into masonry veneer at maximum 16 inches on center vertically and 24 inches on center horizontally. Place additional anchors at perimeter of openings and ends of panels, so maximum spacing of anchors is 8 inches on center.

### **3.10 MASONRY FLASHINGS**

- A. *Whether or not specifically indicated, install masonry flashing to divert water to exterior at all locations where downward flow of water will be interrupted.*
  - 1. *Extend flashings full width at such interruptions and at least 6 inches, minimum, into adjacent masonry or turn up flashing ends at least 1 inch, minimum, to form watertight pan at non-masonry construction.*
  - 2. *Remove or cover protrusions or sharp edges that could puncture flashings.*
  - 3. *Seal lapped ends and penetrations of flashing before covering with mortar.*
- B. *Terminate flashing up 8 inches minimum on vertical surface of backing:*
  - 1. *Install vertical leg of flashing over fluid-applied or self-adhered air/vapor barriers over backing or per manufacturer's directions.*
  - 2. *Anchor vertical leg of flashing into backing with a termination bar and sealant.*
- C. *Install flashing in accordance with manufacturer's instructions.*
- D. *Install termination bar flat and level anchoring at 8" O.C. per manufacturer's instructions.*
- E. *Install stainless steel drip edging within 1/2" of the face of masonry at the foundation in a bed of sealant.*
- F. *Extend metal flashings through exterior face of masonry and terminate in an angled drip with hemmed edge and adhere to top of stainless steel drip flashing. Install joint sealer below drip edge to prevent moisture migration under flashing.*
- G. *Extend metal flashings to within 1/4 inch of exterior face of masonry.*
- H. *Support flexible flashings across gaps and openings.*
- I. *Lap end joints of flashings at least 6 inches, minimum, and seal watertight with flashing sealant/adhesive.*

### **3.11 CONTROL AND EXPANSION JOINTS**

- A. Do not continue horizontal joint reinforcement through control or expansion joints.
- B. Form expansion joint as detailed on drawings.

### **3.12 BUILT-IN WORK**

- A. As work progresses, install built-in metal door frames and other items to be built into the work and furnished under other sections.
- B. Install built-in items plumb, level, and true to line.
- C. Bed anchors of metal door and glazed frames in adjacent mortar joints. Fill frame voids solid with grout.
- D. Do not build into masonry construction organic materials that are subject to deterioration.

### **3.13 TOLERANCES**

- A. Maximum Variation From Unit to Adjacent Unit: 1/16 inch.
- B. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft and 1/2 inch in 20 ft or more.
- C. Maximum Variation from Plumb: 1/4 inch per story non-cumulative; 1/2 inch in two stories or more.
- D. Maximum Variation from Level Coursing: 1/8 inch in 3 ft and 1/4 inch in 10 ft; 1/2 inch in 30 ft.
- E. Maximum Variation of Mortar Joint Thickness: Head joint, minus 1/4 inch, plus 3/8 inch.
- F. Maximum Variation from Cross Sectional Thickness of Walls: 1/4 inch.

### **3.14 CLEANING**

- A. Remove excess mortar and mortar droppings.
- B. Clean soiled surfaces with cleaning solution.

### **3.15 PROTECTION**

- A. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.

**END OF SECTION**

**SECTION 051200  
STRUCTURAL STEEL FRAMING**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Structural steel framing members, support members.
- B. Base plates, expansion joint plates.
- C. Grouting under base plates.

**1.02 RELATED REQUIREMENTS**

- A. Section 05 2100 - Steel Joist Framing.
- B. Section 05 3100 - Steel Decking: Support framing for small openings in deck.

**1.03 REFERENCE STANDARDS**

- A. AISC (MAN) - Steel Construction Manual; American Institute of Steel Construction, Inc.; 2011.
- B. AISC S303 - Code of Standard Practice for Steel Buildings and Bridges; American Institute of Steel Construction, Inc.; 2005.
- C. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2012.
- D. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.
- E. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength; 2012.
- F. ASTM A514/A514M - Standard Specification for High-Yield Strength, Quenched and Tempered Alloy Steel Plate, Suitable for Welding; 2005 (Reapproved 2009).
- G. ASTM A992/A992M - Standard Specification for Structural Steel Shapes; 2011.
- H. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink); 2013.
- I. AWS D1.1/D1.1M - Structural Welding Code - Steel; American Welding Society; 2010.
- J. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel; International Accreditation Service, Inc.; 2011.

**1.04 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings:
  - 1. Indicate profiles, sizes, spacing, locations of structural members, openings, attachments, and fasteners.
- C. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification within the previous 12 months.
- D. Fabricator's Qualification Statement: Provide documentation showing steel fabricator is accredited under IAS AC172.

**1.05 QUALITY ASSURANCE**

- A. Fabricate structural steel members in accordance with AISC "Steel Construction Manual."
- B. Erector: Company specializing in performing the work of this section with minimum 5 years of documented experience.
- C. Design connections not detailed on the drawings under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located.

**PART 2 PRODUCTS**

**2.01 MATERIALS**

- A. Steel Angles and Plates: ASTM A36/A36M.
- B. Steel W Shapes and Tees: ASTM A992/A992M.
- C. Rolled Steel Structural Shapes: ASTM A992/A992M.
- D. Steel Plate: ASTM A514/A514M.
- E. Structural Bolts and Nuts: Carbon steel, ASTM A307, Grade A galvanized to ASTM A 153/A 153M, Class C.

- F. Welding Materials: AWS D1.1; type required for materials being welded.
- G. Grout: Non-shrink, non-metallic aggregate type, complying with ASTM C1107/C1107M and capable of developing a minimum compressive strength of 7,000 psi (48 MPa) at 28 days.
- H. Shop and Touch-Up Primer: Fabricator's standard, complying with VOC limitations of authorities having jurisdiction.

## **2.02 FABRICATION**

- A. Fabricator to be in compliance with AISC (Steel Construction Manual).
- B. Shop fabricate to greatest extent possible.
- C. Continuously seal joined members by continuous welds. Grind exposed welds smooth.
- D. Fabricate connections for bolt, nut, and washer connectors.

## **2.03 FINISH**

- A. Shop prime structural steel members. Do not prime surfaces that will be fireproofed, field welded, in contact with concrete, or high strength bolted.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that conditions are appropriate for erection of structural steel and that the work may properly proceed.

### **3.02 ERECTION**

- A. Erect structural steel in compliance with AISC "Code of Standard Practice for Steel Buildings and Bridges".
- B. Allow for erection loads, and provide sufficient temporary bracing to maintain structure in safe condition, plumb, and in true alignment until completion of erection and installation of permanent bracing.
- C. Do not field cut or alter structural members without approval of Architect.
- D. After erection, prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with concrete.
- E. Grout solidly between column plates and bearing surfaces, complying with manufacturer's instructions for nonshrink grout. Trowel grouted surfaces smooth, splaying neatly to 45 degrees.

### **3.03 FIELD QUALITY CONTROL**

- A. An independent testing agency will perform field quality control tests, as specified in Section 01 4000.

**END OF SECTION**

**SECTION 051213**  
**ARCHITECTURALLY EXPOSED STRUCTURAL STEEL FRAMING**

**PART 1 GENERAL**

**1.01 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

**1.02 SUMMARY**

- A. Section Includes:
  - 1. Architecturally exposed structural steel (AESS).
  - 2. Section 051200 "Structural Steel Framing" requirements that also apply to AESS.
- B. Related Requirements:
  - 1. Section 055000 "Metal Fabrications" for not defined as structural steel.
  - 2. [Section 099113 "Exterior Painting"] [Section 099123 "Interior Painting"] [and] [Section 099600 "High-Performance Coatings"] for surface preparation and priming requirements.

**1.03 DEFINITIONS**

- A. AESS: Architecturally exposed structural steel.
- B. Category AESS 1: Structural steel that is categorized by ANSI/AISC 303, Section 10, as AESS 1 and may be designated AESS 1 or Category AESS 1 in the Contract Documents.
- C. Category AESS 2: Structural steel that is categorized by ANSI/AISC 303, Section 10, as AESS 2 and is designated as AESS 2 or Category AESS 2 in the Contract Documents.
- D. Category AESS 3: Structural steel that is categorized by ANSI/AISC 303, Section 10, as AESS 3 and is designated as AESS 3 or Category AESS 3 in the Contract Documents.
- E. Category AESS 4: Structural steel that is categorized by ANSI/AISC 303, Section 10, as AESS 4 and is designated as AESS 4 or Category AESS 4 in the Contract Documents.
- F. Category AESS C: Structural steel with custom characteristics that is categorized by ANSI/AISC 303, Section 10, as AESS C and is designated as AESS C or Category AESS C in the Contract Documents.
- G. SEAC/RMSCA Guide Specification: SEAC/RMSCA's "Sample Specification, Section 05 02 13: Architecturally Exposed Structural Steel."

**1.04 COORDINATION**

- A. Coordinate surface preparation requirements for shop-primed items.
- B. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

**1.05 PREINSTALLATION MEETINGS**

- A. Preinstallation Conference: Conduct conference at Project site.

**1.06 ACTION SUBMITTALS**

- A. Product Data:
  - 1. Tension-control, high-strength, bolt-nut-washer assemblies.
  - 2. Filler.
  - 3. Primer.
  - 4. Galvanized-steel primer.
  - 5. Etching cleaner.
  - 6. Galvanized repair paint.
- B. Shop Drawings: Show fabrication of AESS components. Shop Drawings for structural steel may be used for AESS.
  - 1. Identify AESS category for each steel member and connection, including transitions between AESS categories and between AESS and non-AESS.
  - 2. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
  - 3. Include embedment Drawings.



4. Indicate orientation of mill marks and HSS seams.
  5. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain. Indicate grinding, finish, and profile of welds.
  6. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical, high-strength bolted connections. Indicate orientation and location of bolt heads.
  7. Indicate exposed surfaces and edges and surface preparation being used.
  8. Indicate special tolerances and erection requirements.
  9. Indicate weep holes for HSS and vent holes for galvanized HSS.
  10. Indicate surface preparation, primer, and coating requirements, including systems specified in other Sections.
- C. Samples: Submit Samples to set quality standards for AESS.
1. Two steel plates, 3/8 by 8 by 4 inches, with long edges joined by a groove weld and with weld ground smooth.
  2. Steel plate, 3/8 by 8 by 8 inches, with one end of a short length of rectangular steel tube, 4 by 6 by 3/8 inches, welded to plate with a continuous fillet weld and with weld ground smooth and blended.
  3. Round steel tube or pipe, minimum 8 inches in diameter, with end of another round steel tube or pipe, approximately 4 inches in diameter, welded to its side at a 45-degree angle with a continuous fillet weld and with weld ground smooth and blended.

#### **1.07 INFORMATIONAL SUBMITTALS**

- A. Qualification Data: For Installer and fabricator.
- B. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

#### **1.08 QUALITY ASSURANCE**

- A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category BU, or is accredited by the IAS Fabricator Inspection Program for Structural Steel (AC 172) and is experienced in fabricating AESS similar to that indicated on this Project.
- B. Installer Qualifications: A qualified Installer who participates in the AISC Quality Certification Program, is designated an AISC-Certified Erector, Category CSE, and is experienced in erecting AESS similar to that indicated on this Project.
- C. Shop-Painting Applicators: Qualified according to AISC's Sophisticated Paint Endorsement P3 or SSPC-QP 3.
- D. Mockups: Build mockups of AESS to set quality standards for fabrication and installation.
  1. Build mockup of typical portion of AESS as shown on Drawings.
  2. Coordinate painting requirements with [Section 099113 "Exterior Painting."] [Section 099123 "Interior Painting."]
  3. Coordinate high-performance coatings requirements with Section 099600 "High-Performance Coatings."
  4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

#### **1.09 DELIVERY, STORAGE, AND HANDLING**

- A. Use special care in handling AESS to prevent twisting, warping, nicking, and other damage during fabrication, delivery, and erection. Store materials to permit easy access for inspection and identification. Keep AESS members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect AESS members and packaged materials from corrosion and deterioration.
  1. Do not store AESS materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

## 1.10 FIELD CONDITIONS

- A. Field Measurements: Where AESS is indicated to fit against other construction, verify actual dimensions by field measurements before fabrication.

## PART 2 PRODUCTS

### 2.01 PERFORMANCE REQUIREMENTS

- A. Comply with requirements of ANSI/AISC 303, Sections 1 through 9 and as modified in Section 10, "Architecturally Exposed Structural Steel."

### 2.02 BOLTS, CONNECTORS, AND ANCHORS

- A. Tension-Control, High-Strength, Bolt-Nut-Washer Assemblies: ASTM F3125/F3125M, Grade F1852, Type 1, round-head assemblies consisting of steel structural bolts with splined ends; ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers.
  - 1. Finish: Plain.
- B. Corrosion-Resisting (Weathering) Steel, Tension-Control, High-Strength, Bolt-Nut-Washer Assemblies: ASTM F3125/F3125M, Grade F1852, Type 3, round-head assemblies consisting of steel structural bolts with splined ends; ASTM A563, Grade DH3 heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 3, hardened carbon-steel washers.

### 2.03 FILLER

- A. Polyester filler intended for use in repairing dents in automobile bodies.

### 2.04 PRIMER

- A. Steel Primer:
  - 1. Shop Primers: Provide product compatible with system as required per Sections 09 9113 "Exterior Painting," 09 9123 "Interior Painting," or 09 9601 "High-Performance Coatings" as appropriate for location and painting system indicated.
  - 2. Comply with [Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."] [Section 099600 "High-Performance Coatings."] [Section 099113 "Exterior Painting," Section 099123 "Interior Painting," and Section 099600 "High-Performance Coatings."]
  - 3. SSPC-Paint 23, latex primer.
  - 4. Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.
- B. Galvanized-Steel Primer: [MPI#26] [MPI#80] [MPI#134].
  - 1. Etching Cleaner: MPI#25, for galvanized steel.
  - 2. Galvanizing Repair Paint: [MPI#18, MPI#19, or SSPC-Paint 20] [ASTM A780/A780M].

### 2.05 FABRICATION

- A. Shop fabricate and assemble AESS to the maximum extent possible. Locate field joints at concealed locations if possible. Detail assemblies to minimize handling and to expedite erection.
  - 1. Use special care handling and fabricating AESS before and after shop painting to minimize damage to shop finish.
- B. Category AESS 1:
  - 1. Comply with overall profile dimensions of AWS D1.1/D1.1M for welded built-up members. Keep appearance and quality of welds consistent. Maintain true alignment of members without warp exceeding specified tolerances.
  - 2. Prepare surfaces according to Part 2 "Shop Priming" Article and SSPC-SP 6 (WAB)/NACE WAB-3.
  - 3. Grind sheared, punched, and flame-cut edges to remove burrs and provide smooth surfaces and eased edges.
  - 4. Make intermittent welds appear continuous, using filler or additional welding.
  - 5. Seal weld open ends of hollow structural sections with 3/8-inch closure plates.
  - 6. Limit butt and plug weld projections to 1/16 inch.

7. Install bolt heads on the same side of each connection and maintain orientation consistently from one connection to another.
  8. Remove weld spatter, slivers, and similar surface discontinuities.
  9. Remove blemishes and surface irregularities resulting from temporary braces or fixtures by filling or grinding, before cleaning, treating, and shop priming.
  10. Grind tack welds smooth unless incorporated into final welds.
  11. Remove backing and runoff tabs, and grind welds smooth.
- C. Category AESS 2:
1. Comply with overall profile dimensions of AWS D1.1/D1.1M for welded built-up members. Keep appearance and quality of welds consistent. Maintain true alignment of members without warp exceeding specified tolerances.
  2. Prepare surfaces according to Part 2 "Shop Priming" Article and SSPC-SP 6 (WAB)/NACE WAB-3.
  3. Grind sheared, punched, and flame-cut edges to remove burrs and provide smooth surfaces and eased edges.
  4. Make intermittent welds appear continuous, using filler or additional welding.
  5. Seal weld open ends of hollow structural sections with 3/8-inch closure plates.
  6. Limit butt and plug weld projections to 1/16 inch.
  7. Install bolt heads on the same side of each connection and maintain orientation consistently from one connection to another.
  8. Remove weld spatter, slivers, and similar surface discontinuities.
  9. Remove blemishes and surface irregularities resulting from temporary braces or fixtures by filling or grinding, before cleaning, treating, and shop priming.
  10. Grind tack welds smooth unless incorporated into final welds.
  11. Remove backing and runoff tabs, and grind welds smooth.
  12. Limit as-fabricated straightness tolerance to one-half that permitted for structural-steel materials in ANSI/AISC 303.
  13. Limit as-fabricated curved structural steel tolerance to that permitted for structural-steel materials in ANSI/AISC 303.
  14. Limit as-fabricated straightness tolerance of welded built-up members to one-half that permitted by AWS D1.1/D1.1M.
  15. Conceal fabrication and erection markings from view in the completed structure.
  16. Make welds uniform and smooth.
- D. Category AESS 3:
1. Comply with overall profile dimensions of AWS D1.1/D1.1M for welded built-up members. Keep appearance and quality of welds consistent. Maintain true alignment of members without warp exceeding specified tolerances.
  2. Prepare surfaces according to Part 2 "Shop Priming" Article and SSPC-SP 6 (WAB)/NACE WAB-3.
  3. Grind sheared, punched, and flame-cut edges to remove burrs and provide smooth surfaces and eased edges.
  4. Make intermittent welds appear continuous, using filler or additional welding.
  5. Seal weld open ends of hollow structural sections with 3/8-inch closure plates.
  6. Limit butt and plug weld projections to 1/16 inch.
  7. Install bolt heads on the same side of each connection and maintain orientation consistently from one connection to another.
  8. Remove weld spatter, slivers, and similar surface discontinuities.
  9. Remove blemishes and surface irregularities resulting from temporary braces or fixtures by filling or grinding, before cleaning, treating, and shop priming.
  10. Grind tack welds smooth unless incorporated into final welds.
  11. Remove backing and runoff tabs, and grind welds smooth.
  12. Limit as-fabricated straightness tolerance to one-half that permitted for structural-steel materials in ANSI/AISC 303.
  13. Limit as-fabricated curved structural steel tolerance to that permitted for structural-steel materials in ANSI/AISC 303.
  14. Limit as-fabricated straightness tolerance of welded built-up members to one-half that permitted by AWS D1.1/D1.1M.

15. Conceal fabrication and erection markings from view in the completed structure.
  16. Make welds uniform and smooth.
  17. Cut out mill marks from mill material or hide these markings from view in the completed structure. Where neither method is possible, remove mill marks by grinding and filling surfaces as approved by Architect.
  18. Grind butt and plug welds smooth or fill, removing weld splatter exposed to view.
  19. Orient HSS seams as indicated or away from view.
  20. Align and match abutting member cross sections.
  21. At visible open joints of copes, miters, and cuts, maintain uniform clear gaps of 1/8 inch. At closed joints, maintain uniform contact within 1/16 inch.
  22. Fabricate with exposed surfaces smooth, square, and of surface quality approved by Architect.
- E. Category AESS 4:
1. Comply with overall profile dimensions of AWS D1.1/D1.1M for welded built-up members. Keep appearance and quality of welds consistent. Maintain true alignment of members without warp exceeding specified tolerances.
  2. Prepare surfaces according to Part 2 "Shop Priming" Article and SSPC-SP 6 (WAB)/NACE WAB-3.
  3. Grind sheared, punched, and flame-cut edges to remove burrs and provide smooth surfaces and eased edges.
  4. Make intermittent welds appear continuous, using filler or additional welding.
  5. Seal weld open ends of hollow structural sections with 3/8-inch closure plates.
  6. Limit butt and plug weld projections to 1/16 inch.
  7. Install bolt heads on the same side of each connection and maintain orientation consistently from one connection to another.
  8. Remove weld spatter, slivers, and similar surface discontinuities.
  9. Remove blemishes and surface irregularities resulting from temporary braces or fixtures by filling or grinding, before cleaning, treating, and shop priming.
  10. Grind tack welds smooth unless incorporated into final welds.
  11. Remove backing and runoff tabs, and grind welds smooth.
  12. Limit as-fabricated straightness tolerance to one-half that permitted for structural-steel materials in ANSI/AISC 303.
  13. Limit as-fabricated curved structural steel tolerance to that permitted for structural-steel materials in ANSI/AISC 303.
  14. Limit as-fabricated straightness tolerance of welded built-up members to one-half that permitted by AWS D1.1/D1.1M.
  15. Conceal fabrication and erection markings from view in the completed structure.
  16. Make welds uniform and smooth.
  17. Cut out mill marks from mill material or hide these markings from view in the completed structure. Where neither method is possible, remove mill marks by grinding and filling surfaces as approved by Architect.
  18. Grind butt and plug welds smooth or fill, removing weld splatter exposed to view.
  19. Orient HSS seams as indicated or away from view.
  20. Align and match abutting member cross sections.
  21. At visible open joints of copes, miters, and cuts, maintain uniform clear gaps of 1/8 inch. At closed joints, maintain uniform contact within 1/16 inch.
  22. Fabricate with exposed surfaces smooth, square, and of surface quality approved by Architect.
  23. Treat HSS seams to appear seamless.
  24. Contour and blend welds and weld transitions between members, removing splatter exposed to view.
  25. Fill surface imperfections with filler and sand smooth to achieve surface quality approved by Architect.
  26. Minimize weld show-through and distortion on the opposite side of exposed connections by grinding to a smooth profile aligned with adjacent material.
- F. Erection marks, painted marks, and other marks are permitted on galvanized or corrosion-resisting (weathering) steel surfaces of completed structure.

- G. Cleaning Corrosion-Resisting (Weathering) AESS: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 6 (WAB)/NACE WAB-3.

## **2.06 SHOP CONNECTIONS**

- A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using High-Strength Bolts" for type of bolt and type of joint specified.
  - 1. Joint Type: as indicated.
- B. Weld Connections: Comply with AWS D1.1/D1.1M and AWS D1.8/D1.8M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

## **2.07 GALVANIZING**

- A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A123/A123M.
  - 1. Do not quench or apply post-galvanizing treatments that might interfere with paint adhesion.
  - 2. Fill vent and drain holes that are exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.

## **2.08 SHOP PRIMING**

- A. Shop prime steel surfaces, except the following:
  - 1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
  - 2. Surfaces to be field welded.
  - 3. Surfaces to be high-strength bolted with slip-critical connections.
  - 4. Corrosion-resisting (weathering) steel surfaces.
  - 5. Galvanized surfaces unless indicated to be painted.
- B. Preparation for Shop Priming: Clean surfaces to be painted per primer manufacturer's written instructions. Remove loose rust and mill scale and other spatter, slag, flux deposits, and any other potential bond-breaking materials.
- C. Surface Preparation: Clean nongalvanized surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:
  - 1. SSPC-SP 2.
  - 2. SSPC-SP 3.
  - 3. SSPC-SP 7 (WAB)/NACE WAB-4.
  - 4. SSPC-SP 14 (WAB)/NACE WAB-8.
  - 5. SSPC-SP 11.
  - 6. SSPC-SP 6 (WAB)/NACE WAB-3.
  - 7. SSPC-SP 10 (WAB)/NACE WAB-2.
  - 8. SSPC-SP 5 (WAB)/NACE WAB-1.
  - 9. SSPC-SP 8.
- D. Preparing Galvanized Steel for Shop Priming: After galvanizing, thoroughly clean steel of grease, dirt, oil, flux, and other foreign matter, and treat with etching cleaner or according to SSPC-SP 16.
- E. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.
  - 1. Stripe paint corners, crevices, bolts, welds, and eased edges.
  - 2. Apply two coats of shop paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify, with steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with

requirements.

1. Prepare a certified survey of bearing surfaces, anchor rods, bearing plates, and other embedments, showing dimensions, locations, angles, and elevations.
- B. Examine AESS for twists, kinks, warping, gouges, and other imperfections before erecting.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.02 PREPARATION

- A. Provide temporary shores, guys, braces, and other supports during erection to keep AESS secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated.

### 3.03 ERECTION

- A. Take special care during erection to avoid marking or distorting the AESS and to minimize damage to shop painting. Set AESS accurately in locations and to elevations indicated and according to ANSI/AISC 303 and ANSI/AISC 360.
1. Remove welded tabs that were used for attaching temporary bracing and safety cabling and that are exposed to view in the completed Work. Take care to avoid any blemishes, holes, or unsightly surfaces resulting from the use or removal of temporary elements.
  2. Grind tack welds smooth.
  3. Remove backing and runoff tabs, and grind welds smooth.
  4. Orient bolt heads on the same side of each connection and maintain orientation consistently from one connection to another.
  5. Remove erection bolts in Category AESS 4 AESS, fill holes with weld metal or filler, and grind or sand smooth to achieve surface quality approved by Architect.
  6. Fill weld access holes in Category AESS 4 AESS with weld metal or filler and grind, or sand smooth to achieve surface quality as approved by Architect.
  7. Conceal fabrication and erection markings from view in the completed structure.
- B. In addition to ANSI/AISC 303, Section 10 requirements, comply with the following.
1. Erection of Category AESS 1 and Category AESS 2:
    - a. Erect AESS to the standard frame tolerances specified in ANSI/AISC 303 for non-AESS.
    - b. Comply with AWS D1.1/D1.1M. Keep appearance and quality of welds consistent. Maintain true alignment of members without warp exceeding specified tolerances.
    - c. Remove weld spatter, slivers, and similar surface discontinuities.
    - d. Grind off butt and plug weld projections larger than 1/16 inch.
    - e. Continuous welds shall be of uniform size and profile.
    - f. Ream holes that must be enlarged. Use of drift pins or burning is not permitted. Replace misaligned connection plates where holes cannot be aligned with acceptable appearance.
    - g. Splice members only where indicated on Drawings.
    - h. No torch cutting or field fabrication is permitted.
  2. Erection of Category AESS 3:
    - a. Erect AESS to the standard frame tolerances specified in ANSI/AISC 303 for non-AESS.
    - b. Comply with AWS D1.1/D1.1M. Keep appearance and quality of welds consistent. Maintain true alignment of members without warp exceeding specified tolerances.
    - c. Remove weld spatter, slivers, and similar surface discontinuities.
    - d. Grind off butt and plug weld projections larger than 1/16 inch.
    - e. Continuous welds shall be of uniform size and profile.
    - f. Ream holes that must be enlarged. Use of drift pins or burning is not permitted. Replace misaligned connection plates where holes cannot be aligned with acceptable appearance.
    - g. Splice members only where indicated on Drawings.
    - h. No torch cutting or field fabrication is permitted.
    - i. Weld profiles, quality, and finish shall be as approved by Architect.
    - j. Make joint welds, including tack welds, appear continuous by filling intermittent welds.

3. Erection of Category AESS 4:
  - a. Erect AESS to the standard frame tolerances specified in ANSI/AISC 303 for non-AESS.
  - b. Comply with AWS D1.1/D1.1M. Keep appearance and quality of welds consistent. Maintain true alignment of members without warp exceeding specified tolerances.
  - c. Remove weld spatter, slivers, and similar surface discontinuities.
  - d. Grind off butt and plug weld projections larger than 1/16 inch.
  - e. Continuous welds shall be of uniform size and profile.
  - f. Ream holes that must be enlarged. Use of drift pins or burning is not permitted. Replace misaligned connection plates where holes cannot be aligned with acceptable appearance.
  - g. Splice members only where indicated on Drawings.
  - h. No torch cutting or field fabrication is permitted.
  - i. Weld profiles, quality, and finish shall be as approved by Architect.
  - j. Make joint welds, including tack welds, appear continuous by filling intermittent welds.
  - k. Grind welds smooth.
  - l. Minimize weld show-through and distortion on the opposite side of exposed connections by grinding to a smooth profile aligned with adjacent material.
  - m. Oversize welds where ground, contoured, or blended, and grind to provide a smooth transition, matching profile approved by Architect.

#### **3.04 FIELD CONNECTIONS**

- A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using High-Strength Bolts" for type of bolt and type of joint specified.
  1. Joint Type: as indicated.
- B. Weld Connections: Comply with AWS D1.1/D1.1M and AWS D1.8/D1.8M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

#### **3.05 FIELD QUALITY CONTROL**

- A. Testing Agency: Owner will engage a qualified testing agency to inspect AESS as specified in Section 051200 "Structural Steel Framing." The testing agency is not responsible for enforcing requirements relating to aesthetic effect.
- B. Architect will observe AESS in place to determine acceptability relating to aesthetic effect.

#### **3.06 PROTECTION**

- A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas, and touchup galvanizing to comply with ASTM A780/A780M.
- B. Touchup Painting:
  1. Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting, to comply with SSPC-PA 1 for touching up shop-painted surfaces.
    - a. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.
  2. Cleaning and touchup painting are specified in [Section 099113 "Exterior Painting."] [Section 099123 "Interior Painting."]
- C. Touchup Priming: Cleaning and touchup priming are specified in Section 099600 "High-Performance Coatings."

**END OF SECTION**

**SECTION 052100  
STEEL JOIST FRAMING**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Open web steel joists, with bridging, attached seats and anchors.
- B. Loose bearing members, such as plates or angles, and anchor bolts for site placement.
- C. Supplementary framing for roof openings greater than 18 inches (450 mm).

**1.02 RELATED REQUIREMENTS**

- A. Section 05 1200 - Structural Steel Framing: Grouting base plates and bearing plates. Superstructure framing.
- B. Section 05 3100 - Steel Decking: Bearing plates and angles.

**1.03 REFERENCE STANDARDS**

- A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2012.
- B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.
- C. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength; 2012.
- D. AWS D1.1/D1.1M - Structural Welding Code - Steel; American Welding Society; 2010.
- E. SJI (SPEC) - Catalog of Standard Specifications and Load Tables for Steel Joists and Joist Girders; Steel Joist Institute; 2011.
- F. SSPC-Paint 25 - Zinc Oxide, Alkyd, Linseed Oil Primer for Use Over Hand Cleaned Steel, Type I and Type II; Society for Protective Coatings; 1997 (Ed. 2004).
- G. SSPC-SP 2 - Hand Tool Cleaning; Society for Protective Coatings; 1982 (Ed. 2004).

**1.04 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate standard designations, joist coding, configurations, sizes, spacings, cambers, locations of joists, joist leg extensions, bridging, connections, and attachments.
- C. Welders' Certificates: Submit manufacturer's certificates, certifying welders employed on the Work, verifying AWS qualification within the previous 12 months.
- D. Manufacturer's Qualification Statement: Provide documentation showing steel fabricator is accredited under IAS AC172.

**1.05 DELIVERY, STORAGE, AND HANDLING**

- A. Transport, handle, store, and protect products to SJI requirements.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

- A. Steel Joists:
  - 1. Nucor-Vulcraft Group: [www.vulcraft.com](http://www.vulcraft.com).
  - 2. Substitutions: See Section 01 6000 - Product Requirements.

**2.02 MATERIALS**

- A. Open Web Joists: SJI Type K and DLH Joists:
  - 1. Minimum End Bearing on Steel Supports: As shown on the drawings.
  - 2. Minimum End Bearing on Concrete or Masonry Supports: As shown on drawings.
  - 3. Finish: Shop primed.
- B. Anchor Bolts, Nuts and Washers: ASTM A 307, hot-dip galvanized per ASTM A 153/A 153M, Class C.
- C. Structural Steel For Supplementary Framing and Joist Leg Extensions: ASTM A36/A36M.
- D. Welding Materials: AWS D1.1; type required for materials being welded.
- E. Shop and Touch-Up Primer: SSPC-Paint 25, zinc oxide, complying with VOC limitations of authorities having jurisdiction.



### **2.03 FINISH**

- A. Shop prime joists as specified.
- B. Prepare surfaces to be finished in accordance with SSPC-SP 2.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Verify existing conditions prior to beginning work.

#### **3.02 ERECTION**

- A. Erect joists with correct bearing on supports.
- B. Allow for erection loads. Provide sufficient temporary bracing to maintain framing safe, plumb, and in true alignment.
- C. Coordinate the placement of anchors for securing loose bearing members furnished as part of the work of this section.
- D. After joist alignment and installation of framing, field weld joist seats to steel bearing surfaces.
- E. Install supplementary framing for floor and roof openings greater than 18 inches (450 mm).
- F. Do not permit erection of decking until joists are braced bridged, and secured or until completion of erection and installation of permanent bridging and bracing.
- G. Do not field cut or alter structural members without approval of joist manufacturer.

#### **3.03 TOLERANCES**

- A. Maximum Variation From Plumb: 1/4 inch (6 mm).
- B. Maximum Offset From True Alignment: 1/4 inch (6 mm).

#### **3.04 FIELD QUALITY CONTROL**

- A. An independent testing agency will perform field quality control tests, as specified in Section 01 4000.

**END OF SECTION**

## **SECTION 053100 STEEL DECKING**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Acoustical roof deck.
- B. Roof deck.
- C. Supplementary framing for openings up to and including 18 inches (450 mm).
- D. Bearing plates and angles.
- E. Acoustical insulation in roof deck flutes.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 05 1200 - Structural Steel Framing: Support framing for openings larger than 18 inches (450 mm) and shear stud connectors.
- B. Section 05 2100 - Steel Joist Framing: Support framing for openings larger than 18 inches (450 mm) and shear stud connectors.

#### **1.03 REFERENCE STANDARDS**

- A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2012.
- B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2013.
- C. AWS D1.1/D1.1M - Structural Welding Code - Steel; American Welding Society; 2010.
- D. AWS D1.3 - Structural Welding Code - Sheet Steel; American Welding Society; 2008.
- E. SDI (DM) - Publication No.31, Design Manual for Composite Decks, Form Decks, Roof Decks; Steel Deck Institute; 2007.

#### **1.04 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittals procedures.
- B. Shop Drawings: Indicate deck plan, support locations, projections, openings, reinforcement, pertinent details, and accessories.
- C. Product Data: Provide deck profile characteristics, dimensions, structural properties, and finishes.
- D. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification within the previous 12 months.

#### **1.05 QUALITY ASSURANCE**

- A. Design deck layout, spans, fastening, and joints under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located.

### **PART 2 PRODUCTS**

#### **2.01 MANUFACTURERS**

- A. Steel Deck:
  - 1. Cordeck, Inc: [www.cordeck.com](http://www.cordeck.com).
  - 2. Nucor-Vulcraft Group: [www.vulcraft.com](http://www.vulcraft.com).

#### **2.02 STEEL DECK**

- A. Acoustical Roof Deck: Non-composite type, steel sheet with plain vertical flute faces perforated with 1/8 inch (3 mm) diameter holes staggered 3/8 inch (10 mm) on center:
  - 1. Galvanized Steel Sheet: ASTM A653/A653M, Structural Steel (SS) Grade 33/230, with G90/Z275 galvanized coating.
  - 2. Primer: Shop coat of manufacturer's standard primer paint over cleaned and phosphatized substrate.
  - 3. Minimum Metal Thickness, Excluding Finish: 22 gage (0.8 mm).
  - 4. Nominal Height: 1-1/2 inch (38 mm).
  - 5. Profile: Fluted; SDI NR.
  - 6. Side Joints: Lapped, welded.
  - 7. End Joints: Lapped, welded.

- B. Roof Deck: Non-composite type, fluted steel sheet:
  - 1. Galvanized Steel Sheet: ASTM A653/A653M, Structural Steel (SS) Grade 33/230, with G90/Z275 galvanized coating.
  - 2. Minimum Metal Thickness, Excluding Finish: 22 gage (0.8 mm).
  - 3. Nominal Height: 1-1/2 inch (38 mm).
  - 4. Profile: Fluted; SDI NR.
  - 5. Formed Sheet Width: 24 inch (600 mm).
  - 6. Side Joints: Lock seam.
  - 7. End Joints: Lapped, welded.

### **2.03 ACCESSORY MATERIALS**

- A. Bearing Plates and Angles: ASTM A36/A36M steel, unfinished.
- B. Welding Materials: AWS D1.1.
- C. Fasteners: Galvanized hardened steel, self tapping.
- D. Acoustical Insulation: Glass fiber type, minimum 1.1 lb/cu ft (18 kg/cu m) density; profiled to suit deck.

### **2.04 FABRICATED DECK ACCESSORIES**

- A. Sheet Metal Deck Accessories: Metal closure strips, wet concrete stops, and cover plates, 22 gage (0.8 mm) thick sheet steel; of profile and size as indicated; finished same as deck.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify existing conditions prior to beginning work.

### **3.02 INSTALLATION**

- A. On steel supports provide minimum 1-1/2 inch (38 mm) bearing.
- B. Fasten deck to steel support members at ends and intermediate supports at 12 inches (300 mm) on center maximum, parallel with the deck flute and at each transverse flute using methods specified.
  - 1. Welding: Use fusion welds through weld washers.
- C. Clinch lock seam side laps.
- D. At welded male/female side laps weld at 18 inches (450 mm) on center maximum.
- E. Weld deck in accordance with AWS D1.3.
- F. Immediately after welding deck and other metal components in position, coat welds, burned areas, and damaged surface coating, with touch-up primer.

**END OF SECTION**

**SECTION 054000  
COLD-FORMED METAL FRAMING**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Formed steel stud exterior wall and interior wall framing.
- B. Exterior wall sheathing.
- C. Water-resistive barrier over sheathing.

**1.02 RELATED REQUIREMENTS**

- A. Section 04 2001 - Masonry Veneer: Veneer masonry supported by wall stud metal framing.
- B. Section 05 3100 - Steel Decking.

**1.03 REFERENCE STANDARDS**

- A. AISI SG02-1 - North American Specification for the Design of Cold-Formed Steel Structural Members; American Iron and Steel Institute; 2001 with 2004 supplement. (replaced SG-971)
- B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.
- C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2013.
- D. ASTM C955 - Standard Specification for Load-Bearing (Transverse and Axial) Steel Studs, Runners (Tracks), and Bracing or Bridging for Screw Application of Gypsum Panel Products and Metal Plaster Bases; 2011c.
- E. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2013.

**1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Coordinate with work of other sections that is to be installed in or adjacent to the metal framing system, including but not limited to structural anchors, cladding anchors, utilities, insulation, and firestopping.

**1.05 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on standard framing members; describe materials and finish, product criteria, limitations.
- C. Manufacturer's Installation Instructions: Indicate special procedures, conditions requiring special attention.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

- A. Metal Framing:
  - 1. Clarkwestern Dietrich Building Systems LLC: [www.clarkdietrich.com](http://www.clarkdietrich.com).
  - 2. Marino: [www.marinoware.com](http://www.marinoware.com).
  - 3. The Steel Network, Inc: [www.SteelNetwork.com](http://www.SteelNetwork.com).
  - 4. MBA Metal Framing: [www.mbastuds.com](http://www.mbastuds.com)
  - 5. Substitutions: See Section 01 6000 - Product Requirements.
- B. Framing Connectors and Accessories:
  - 1. Simpson Strong Tie: [www.strongtie.com](http://www.strongtie.com).
  - 2. Substitutions: See Section 01 6000 - Product Requirements.

**2.02 FRAMING SYSTEM**

- A. Provide primary and secondary framing members, bridging, bracing, plates, gussets, clips, fittings, reinforcement, and fastenings as required to provide a complete framing system.

**2.03 FRAMING MATERIALS**

- A. Studs and Track: ASTM C955; studs formed to channel, "C", or "Sigma" shape with punched web; U-shaped track in matching nominal width and compatible height.
- B. Framing Connectors: Factory-made, formed steel sheet.

1. Material: ASTM A653/A653M SS Grade 33 and 40 (minimum), with G90/Z275 hot dipped galvanized coating for thicknesses less than 10 gage (0.118 inch) (3 mm), and factory punched holes and slots.
2. Structural Performance: Maintain load and movement capacity required by applicable code, when evaluated in accordance with AISI North American Specification for the Design of Cold Formed Steel Structural Members.
3. Fixed Connections: Provide non-movement connections for tie-down to foundation, floor-to-floor tie-down, roof-to-wall tie-down, joist hangers, gusset plates, and stiffeners.

#### **2.04 ACCESSORIES**

- A. Bracing, Furring, Bridging: Formed sheet steel, thickness determined for conditions encountered; finish to match framing components.
- B. Water-Resistive Barrier: As specified in Section 07 2500.

#### **2.05 FASTENERS**

- A. Self-Drilling, Self-Tapping Screws, Bolts, Nuts and Washers: Hot dip galvanized per ASTM A153/A153M.
- B. Anchorage Devices: Powder actuated.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Verify that substrate surfaces are ready to receive work.
- B. Verify field measurements and adjust installation as required.

#### **3.02 INSTALLATION OF STUDS**

- A. Install components in accordance with manufacturers' instructions and ASTM C1007 requirements.
- B. Align floor and ceiling tracks; locate to wall layout. Secure in place with fasteners at maximum 24 inches (600 mm) on center. Coordinate installation of sealant with floor and ceiling tracks.
- C. Place studs at 16 inches (400 mm) on center; not more than 2 inches (50 mm) from abutting walls and at each side of openings. Connect studs to tracks using clip and tie method.
- D. Construct corners using minimum of three studs. Install double studs at wall openings, door and window jambs.
- E. Install load bearing studs full length in one piece. Splicing of studs is not permitted.
- F. Install load bearing studs, brace, and reinforce to develop full strength and achieve design requirements.

#### **3.03 WALL SHEATHING**

- A. Wall Sheathing: Secure with long dimension perpendicular to wall studs, with ends over firm bearing and staggered, using self-tapping screws.
  1. Place water-resistive barrier horizontally over wall sheathing, weather lapping edges and ends.

**END OF SECTION**

**SECTION 055000  
METAL FABRICATIONS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Shop fabricated steel and aluminum items.
- B. Prefabricated ladders.
- C. Bollards
- D. Downspout boots.
- E. Slotted channel framing.

**1.02 RELATED REQUIREMENTS**

- A. Section 042000 - Unit Masonry: Placement of metal fabrications in masonry.
- B. Section 055100 - Metal Stairs.
- C. Section 055213 - Pipe and Tube Railings.

**1.03 REFERENCE STANDARDS**

- A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2020.
- B. ANSI A14.3 - American National Standard for Ladders -- Fixed -- Safety Requirements; 2008 (Reaffirmed 2018).
- C. ASTM A48/A48M - Standard Specification for Gray Iron Castings; 2022.
- D. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates; 2018.
- E. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength; 2021.
- F. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing; 2021.
- G. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.
- H. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2023.
- I. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.
- J. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric); 2014.
- K. ASTM B210 - Standard Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes; 2012.
- L. ASTM B210M - Standard Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes (Metric); 2012.
- M. ASTM B211 - Standard Specification for Aluminum and Aluminum-Alloy Rolled or Cold Finished Bar, Rod, and Wire; 2012.
- N. ASTM B211M - Standard Specification for Aluminum and Aluminum-Alloy Rolled or Cold-Finished Bar, Rod, and Wire (Metric); 2012.
- O. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.
- P. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.
- Q. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020, with Errata (2023).
- R. AWS D1.2/D1.2M - Structural Welding Code - Aluminum; 2014, with Errata (2020).
- S. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 2004.
- T. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic); 2019.
- U. SSPC-SP 2 - Hand Tool Cleaning; 2018.

**1.04 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.

1. Design data: Submit drawings and supporting calculations, signed and sealed by a qualified professional structural engineer.
  - a. Include the following, as applicable:
    - 1) Design criteria.
    - 2) Engineering analysis depicting stresses and deflections.
    - 3) Member sizes and gages.
    - 4) Details of connections.
    - 5) Support reactions.
    - 6) Bracing requirements.
  - C. Welders' Certificates: Submit certification for welders employed on the project, verifying AWS qualification within the previous 12 months.
  - D. Designer's Qualification Statement.

## **PART 2 PRODUCTS**

### **2.01 MATERIALS - STEEL**

- A. Steel Sections: ASTM A36/A36M.
- B. Steel Tubing: ASTM A501/A501M hot-formed structural tubing.
- C. Plates: ASTM A283/A283M.
- D. Pipe: ASTM A53/A53M, Grade B Schedule 40, black finish.
- E. Slotted Channel Framing: ASTM A653/A653M, Grade 33.
- F. Slotted Channel Fittings: ASTM A1011/A1011M.
- G. Mechanical Fasteners: Same material as or compatible with materials being fastened; type consistent with design and specified quality level.
- H. Bolts, Nuts, and Washers: ASTM A307, Grade A, plain.
- I. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.
- J. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.
- K. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

### **2.02 MATERIALS - ALUMINUM**

- A. Extruded Aluminum: ASTM B221 (ASTM B221M), 6063 alloy, T6 temper.
- B. Sheet Aluminum: ASTM B209 (ASTM B209M), 5052 alloy, H32 or H22 temper.
- C. Aluminum-Alloy Drawn Seamless Tubes: ASTM B210 (ASTM B210M), 6063 alloy, T6 temper.
- D. Aluminum-Alloy Bars: ASTM B211 (ASTM B211M), 6061 alloy, T6 temper.
- E. Bolts, Nuts, and Washers: Stainless steel.
- F. Welding Materials: AWS D1.2/D1.2M; type required for materials being welded.

### **2.03 FABRICATION**

- A. Fit and shop assemble items in largest practical sections, for delivery to site.
- B. Fabricate items with joints tightly fitted and secured.
- C. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.
- D. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

### **2.04 FABRICATED ITEMS**

- A. Bollards: Steel pipe, concrete filled, crowned cap, as detailed; prime paint finish.
- B. Ledge Angles, Shelf Angles, Channels, and Plates Not Attached to Structural Framing: For support of metal decking; prime paint finish.
- C. Lintels: As detailed; prime paint finish.

### **2.05 PREFABRICATED LADDERS**

- A. Prefabricated Ladder: Welded metal unit complying with ANSI A14.3; factory fabricated to greatest degree practical and in the largest components possible.
  1. Components: Manufacturer's standard rails, rungs, treads, handrails, returns, platforms and safety devices complying with the requirements of the MATERIALS article of this

- section.
- 2. Materials: Aluminum; ASTM B221 (ASTM B221M), 6063 alloy, T52 temper.
- 3. Finish: Manufacturer's standard clear anodized coating, comply with AAMA 611, Class 1.
- 4. Products: Basis of Design- Okeeffe's Inc.; Model 503A.
  - a. Industrial Ladder & Scaffolding, Inc.: [www.anyladder.com/sle](http://www.anyladder.com/sle).
  - b. Substitutions: See Section 016000 - Product Requirements.
- B. Prefabricated Ship Ladder: Welded metal unit complying with ANSI A14.3; factory fabricated to greatest degree practical and in the largest components possible.

## **2.06 DOWNSPOUT BOOTS**

- A. Downspout Boots: Smooth interior without boxed corners or choke points; include integral lug slots, integral cleanout, cleanout cover, and tamper proof fasteners.
  - 1. Configuration: Angular.
  - 2. Material: Cast iron; ASTM A48/A48M; casting thickness 3/8 inch (9.5 mm), minimum.
  - 3. Finish: Manufacturer's standard factory applied powder coat finish.
  - 4. Color: To be selected by Architect from manufacturer's standard range.
  - 5. Accessories: Manufacturer's standard stainless steel fasteners, stainless steel building wall anchors, integral neoprene gaskets, and rubber coupling.
  - 6. Manufacturers:
    - a. Downspoutboots.com, a division of J. R. Hoe & Sons:  
[www.downspoutboots.com/#sle](http://www.downspoutboots.com/#sle).
    - b. Substitutions: See Section 016000 - Product Requirements.

## **2.07 FINISHES - STEEL**

- A. Prime paint steel items.
  - 1. Exceptions: Galvanize items to be embedded in concrete and items to be embedded in masonry.
  - 2. Exceptions: Do not prime surfaces in direct contact with concrete, where field welding is required, and items to be covered with sprayed fireproofing.
- B. Prepare surfaces to be primed in accordance with SSPC-SP2.
- C. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.
- D. Prime Painting: One coat.

## **2.08 FINISHES - ALUMINUM**

- A. Exterior Aluminum Surfaces: Class I natural anodized.
- B. Interior Aluminum Surfaces: Class I natural anodized.
- C. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils thick.

## **2.09 FABRICATION TOLERANCES**

- A. Squareness: 1/8 inch maximum difference in diagonal measurements.
- B. Maximum Offset Between Faces: 1/16 inch.
- C. Maximum Misalignment of Adjacent Members: 1/16 inch.
- D. Maximum Bow: 1/8 inch in 48 inches.
- E. Maximum Deviation From Plane: 1/16 inch in 48 inches.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that field conditions are acceptable and are ready to receive work.

### **3.02 PREPARATION**

- A. Clean and strip primed steel items to bare metal where site welding is required.
- B. Supply setting templates to the appropriate entities for steel items required to be cast into concrete or embedded in masonry.

### **3.03 TOLERANCES**

- A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.
- B. Maximum Offset From True Alignment: 1/4 inch.



C. Maximum Out-of-Position: 1/4 inch.

**SECTION 055100  
METAL STAIRS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Stairs with concrete treads.
- B. Stairs with precast terrazzo treads and risers.
- C. Structural steel stair framing and supports.
- D. Handrails and guards.

**1.02 RELATED REQUIREMENTS**

- A. Section 033000 - Cast-in-Place Concrete: Concrete fill in stair pans.
- B. Section 055000 - Metal Fabrications.
- C. Section 099123 - Interior Painting: Paint finish.

**1.03 REFERENCE STANDARDS**

- A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.
- B. AISC 201 - AISC Certification Program for Structural Steel Fabricators, Standard for Steel Building Structures; 2006.
- C. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.
- D. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2022.
- E. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2023.
- F. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing; 2021.
- G. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020, with Errata (2023).

**1.04 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories.
- C. Welders' Certificates.
- D. Fabricator's Qualification Statement: Provide documentation showing steel fabricator is certified under AISC 201.
- E. Delegated-Design Submittal: For stairs and railings, including analysis data signed and sealed by the qualified professional engineer responsible for the preparation.
  - 1. Analysis of metal pans and associated components, stringers, and connections to floor systems or intermediate support columns to meet load and performance criteria indicated.

**1.05 QUALITY ASSURANCE**

- A. Structural Designer Qualifications: Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located, or personnel under direct supervision of such an engineer.
- B. Welder Qualifications: Show certification of welders employed on the Work, verifying AWS qualification within the previous 12 months.

**PART 2 PRODUCTS**

**2.01 METAL STAIRS - GENERAL**

- A. Metal Stairs: Provide stairs of the design specified, complete with landing platforms, vertical and horizontal supports, railings, and guards, fabricated accurately for anchorage to each other and to building structure.
  - 1. Regulatory Requirements: Provide stairs and railings complying with the most stringent requirements of local, state, and federal regulations; where requirements of Contract Documents exceed those of regulations, comply with Contract Documents.
  - 2. Handrails: Comply with applicable accessibility requirements of ADA Standards.
  - 3. Structural Design: Provide complete stair and railing assemblies complying with the following:

- a. Stair Capacity: Uniform live load of 100 lb/sq ft and a concentrated load of 300 lb with deflection of stringer or landing framing not to exceed 1/360 of span.
  - b. Railing Assemblies: Comply with applicable local code.
- 4. Dimensions: As indicated on drawings.
- 5. Shop assemble components; disassemble into largest practical sections suitable for transport and access to site.
- 6. No sharp or rough areas on exposed travel surfaces and surfaces accessible to touch.
- 7. Separate dissimilar metals using paint or permanent tape.
- B. Metal Jointing and Finish Quality Levels:
  - 1. Architectural: All joints as inconspicuous as possible, whether welded or mechanical.
    - a. Welded Joints: Continuously welded and ground smooth and flush.
    - b. Mechanical Joints: Butted tight, flush, and hairline; concealed fastenings only.
    - c. Exposed Edges and Corners: Eased to small uniform radius.
    - d. Metal Surfaces to be Painted: Sanded or ground smooth, suitable for highest quality gloss finish.
- C. Fasteners: Same material or compatible with materials being fastened; type consistent with design and specified quality level.
- D. Anchors and Related Components: Same material and finish as item to be anchored, except where specifically indicated otherwise; provide all anchors and fasteners required.

## 2.02 METAL STAIRS WITH CONCRETE TREADS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 Quality Requirements to design stairs, railings, precast terrazzo treads, epoxy-resin filled treads, including attachment to building construction.
- B. Structural Performance of Stairs: Metal stairs shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
  - 1. Uniform Load: 100 lbf/sqft.
  - 2. Concentrated Load: 300 lbf applied on an area of 4 sq. in..
  - 3. Uniform and concentrated loads need not be assumed to act concurrently.
  - 4. Stair Framing: Capable of withstanding stresses resulting from railing loads in addition to loads specified above.
  - 5. Limit live load of treads, platforms, and associated framing members to L/480 or 1/4 inch whichever is less.
  - 6. Limit live load deflection of stringers to L/600 or 1/4 inch whichever is less.
- C. Structural Performance of Railings: Railings, including attachment to building construction, shall withstand the effects of gravity loads and the following:
  - 1. Handrails and Top Rails of Guards:
    - a. Uniform load of 50 lbf/ft applied in any direction.
    - b. Concentrated load of 200lbf/ft applied in any direction.
    - c. Uniform and concentrated loads need not be assumed to act concurrently.
    - d. Vertical and horizontal deflection with loads listed above shall not exceed 1/4 inch.
  - 2. Infill of Guards:
    - a. Concentrated load of 50 lbf applied on an area of 1 sqft.
    - b. Infill load and other loads need not be assumed to act concurrently.
- D. Jointing and Finish Quality Level: Architectural, as defined above.
- E. Risers: Closed.
- F. Treads: Metal pan with field-installed concrete fill.
  - 1. Concrete Depth: 1-1/2 inches, minimum.
  - 2. Tread Pan Material: Steel sheet.
  - 3. Tread Pan Thickness: As required by design; 14 gage, 0.075 inch minimum.
  - 4. Concrete Reinforcement: None.
  - 5. Concrete Finish: For resilient floor covering.
- G. Risers: Same material and thickness as tread pans.
- H. Stringers: Rolled steel channels.
  - 1. Stringer Depth: As indicated on drawings.

2. End Closure: Sheet steel of same thickness as risers welded across ends.
- I. Railings: Stainless steel.
- J. Finish: Shop- or factory-prime painted.

### **2.03 HANDRAILS AND GUARDS**

- A. Wall-Mounted Rails: Round pipe or tube rails unless otherwise indicated.
  1. Outside Diameter: 1-1/4 inch, minimum, to 1-1/2 inches, maximum.
- B. Guards:
  1. Top Rails: Round pipe or tube rails unless otherwise indicated.
    - a. Outside Diameter: 1-1/4 inch, minimum, to 1-1/2 inches, maximum.
  2. End and Intermediate Posts: Same material and size as top rails.
    - a. Horizontal Spacing: As indicated on drawings.
    - b. Mounting: Welded to top surface of stringer.

### **2.04 MATERIALS**

- A. Steel Sections: ASTM A36/A36M.
- B. Steel Tubing: ASTM A500/A500M or ASTM A501/A501M structural tubing, round and shapes as indicated.
- C. Pipe: ASTM A53/A53M Grade B Schedule 40, black finish.
- D. Ungalvanized Steel Sheet: Hot- or cold-rolled, except use cold-rolled where finished work will be exposed to view.
  1. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, Designation CS (commercial steel).
  2. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Designation CS (commercial steel).
- E. Concrete Fill: Portland cement Type I, 3000 psi 28 day strength, 2 to 3 inch slump.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that field conditions are acceptable and are ready to receive work.

### **3.02 PREPARATION**

- A. When field welding is required, clean and strip primed steel items to bare metal.

### **3.03 INSTALLATION**

- A. Install components plumb and level, accurately fitted, free from distortion or defects.
- B. Allow for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
- C. Provide welded field joints where specifically indicated on drawings. Perform field welding in accordance with AWS D1.1/D1.1M.
- D. Other field joints may be either welded or bolted provided the result complies with the limitations specified for jointing quality levels.
- E. Obtain approval prior to site cutting or creating adjustments not scheduled.
- F. After erection, prime welds, abrasions, and surfaces not shop primed or galvanized, except surfaces to be in contact with concrete.

### **3.04 TOLERANCES**

- A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.
- B. Maximum Offset From True Alignment: 1/4 inch.

**END OF SECTION**

**SECTION 055213  
PIPE AND TUBE RAILINGS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Wall mounted handrails.
- B. Stair railings and guardrails.
- C. Free-standing railings at steps.
- D. Balcony railings and guardrails.

**1.02 RELATED REQUIREMENTS**

- A. Section 033000 - Cast-in-Place Concrete: Placement of anchors in concrete.
- B. Section 055100 - Metal Stairs: Attachment plates for handrails specified in this section.
- C. Section 099000 - Painting and Coating.

**1.03 REFERENCE STANDARDS**

- A. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.
- B. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.
- C. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2022.
- D. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2023.
- E. ASTM B241/B241M - Standard Specification for Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube; 2022.
- F. ASTM B429/B429M - Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube; 2020.
- G. ASTM B483/B483M - Standard Specification for Aluminum and Aluminum-Alloy Drawn Tube and Drawn Pipe for General Purpose Applications; 2021.
- H. ASTM E935 - Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings; 2021.
- I. ASTM E985 - Standard Specification for Permanent Metal Railing Systems and Rails for Buildings; 2000 (Reapproved 2006).
- J. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 2004.

**1.04 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate profiles, sizes, connection attachments, anchorage, size and type of fasteners, and accessories.
- C. Samples: Submit two, 6 inch long samples of handrail. Submit two samples of elbow, wall bracket, and end stop.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

- A. Handrails, Railings, Guardrails and Aluminum Balconies:
  - 1. Alumi-Guard: [www.alumi-guard.com/sle](http://www.alumi-guard.com/sle).
  - 2. C.R. Laurence Company, Inc: [www.crl-arch.com/sle](http://www.crl-arch.com/sle).
  - 3. Kee Safety, Inc: [www.keesafety.com](http://www.keesafety.com).
  - 4. KaneSterling: [www.sterlingdula.com](http://www.sterlingdula.com).
  - 5. The Wagner Companies: [www.wagnercompanies.com](http://www.wagnercompanies.com).
  - 6. Substitutions: See Section 016000 - Product Requirements.

**2.02 RAILINGS - GENERAL REQUIREMENTS**

- A. Design, fabricate, and test railing assemblies in accordance with the most stringent requirements of ASTM E985 and applicable local code.
- B. Distributed Loads: Design railing assembly, wall rails, and attachments to resist distributed force of 75 pounds per linear foot applied to the top of the assembly and in any direction,

- without damage or permanent set. Test in accordance with ASTM E935
- C. Concentrated Loads: Design railing assembly, wall rails, and attachments to resist a concentrated force of 200 pounds applied at any point on the top of the assembly and in any direction, without damage or permanent set. Test in accordance with ASTM E935
  - D. Allow for expansion and contraction of members and building movement without damage to connections or members.
  - E. Dimensions: See drawings for configurations and heights.
  - F. Provide anchors and other components as required to attach to structure, made of same materials as railing components unless otherwise indicated; where exposed fasteners are unavoidable provide flush countersunk fasteners.
  - G. Provide slip-on non-weld mechanical fittings to join lengths, seal open ends, and conceal exposed mounting bolts and nuts, including but not limited to elbows, T-shapes, splice connectors, flanges, escutcheons, and wall brackets.

### **2.03 ALUMINUM MATERIALS**

- A. Aluminum Pipe: Schedule 40; ASTM B429/B429M, ASTM B241/B241M, or ASTM B483/B483M.
- B. Aluminum Tube: Minimum wall thickness of 0.127 inch; ASTM B429/B429M, ASTM B241/B241M, or ASTM B483/B483M.

### **2.04 STEEL RAILING SYSTEM**

- A. Steel Tube: ASTM A500/A500M Grade B cold-formed structural tubing.
- B. Steel Pipe: ASTM A53/A53M Grade B Schedule 80, black finish.
- C. Non-Weld Mechanical Fittings: Slip-on, galvanized malleable iron castings, for Schedule 40 pipe, with flush setscrews for tightening by standard hex wrench, no bolts or screw fasteners.
- D. Welding Fittings: Factory- or shop-welded from matching pipe or tube; seams continuously welded; joints and seams ground smooth.
- E. Exposed Fasteners: No exposed bolts or screws.
- F. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

### **2.05 CABLE RAILING SYSTEM**

- A. Infill at cable railings:
  1. Material: Marine Grade 316 stainless steel.
  2. Size: 5/32" - 3/16"
  3. Hardware: Provide all stainless steel accessories for a complete system.
- B. Wood Top Rail: Hardwood stained to match Architect's sample. See drawings for dimensions.

### **2.06 FABRICATION**

- A. Accurately form components to suit specific project conditions and for proper connection to building structure.
- B. Fit and shop assemble components in largest practical sizes for delivery to site.
- C. Fabricate components with joints tightly fitted and secured. Provide spigots and sleeves to accommodate site assembly and installation.
- D. Welded Joints:
  1. Exterior Components: Continuously seal joined pieces by intermittent welds and plastic filler. Drill condensate drainage holes at bottom of members at locations that will not encourage water intrusion.
  2. Interior Components: Continuously seal joined pieces by intermittent welds and plastic filler.
  3. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

### **2.07 ALUMINUM FINISHES**

- A. High Performance Organic Coating System: AAMA 2604 multiple coat, thermally cured fluoropolymer system.
- B. Color: To be selected by Architect from manufacturer's full line.
- C. Touch-Up Materials: As recommended by coating manufacturer for field application.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that field conditions are acceptable and are ready to receive work.

### **3.02 PREPARATION**

- A. Clean and strip primed steel items to bare metal where site welding is required.
- B. Supply items required to be cast into concrete or embedded in masonry with setting templates, for installation as work of other sections.
- C. Apply one coat of bituminous paint to concealed aluminum surfaces that will be in contact with cementitious or dissimilar materials.

### **3.03 INSTALLATION**

- A. Install in accordance with manufacturer's instructions.
- B. Install components plumb and level, accurately fitted, free from distortion or defects, with tight joints.
- C. Install railings in compliance with ADA Standards for accessible design at applicable locations.
- D. Anchor railings securely to structure.

### **3.04 TOLERANCES**

- A. Maximum Variation From Plumb: 1/4 inch per floor level, non-cumulative.
- B. Maximum Offset From True Alignment: 1/4 inch.
- C. Maximum Out-of-Position: 1/4 inch.

**END OF SECTION**

**SECTION 061000  
ROUGH CARPENTRY**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Rough opening framing for doors, windows, and roof openings.
- B. Sheathing.
- C. Roofing nailers.
- D. Preservative treated wood materials.
- E. Miscellaneous framing and sheathing.
- F. Communications and electrical room mounting boards.
- G. Miscellaneous wood nailers, furring, and grounds.

**1.02 RELATED REQUIREMENTS**

- A. ***Section 019119-Commissioning of Building Enclosure (BECx): Commissioning requirements and procedures.***
- B. ***Section 07276-Fluid-Applied Membrane Air Barriers: Membrane barrier over sheathing.***

**1.03 REFERENCE STANDARDS**

- A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.
- B. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2017.
- C. AWPA U1 - Use Category System: User Specification for Treated Wood; 2023.
- D. PS 20 - American Softwood Lumber Standard; 2021.

**1.04 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide technical data on insulated sheathing, wood preservative materials, and application instructions.
- C. Manufacturer's Certificate: Certify that wood products supplied for rough carpentry meet or exceed specified requirements.
- D. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

**1.05 DELIVERY, STORAGE, AND HANDLING**

- A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.

**PART 2 PRODUCTS**

**2.01 GENERAL REQUIREMENTS**

- A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
  - 1. If no species is specified, provide any species graded by the agency specified; if no grading agency is specified, provide lumber graded by any grading agency meeting the specified requirements.
  - 2. Grading Agency: Any grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee ([www.alsc.org](http://www.alsc.org)) and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.
- B. Lumber fabricated from old growth timber is not permitted.

**2.02 DIMENSION LUMBER FOR CONCEALED APPLICATIONS**

- A. Sizes: Nominal sizes as indicated on drawings, S4S.
- B. Moisture Content: S-dry or MC19.
- C. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
  - 1. Lumber: S4S, No. 2 or Standard Grade.
  - 2. Boards: Standard or No. 3.



## 2.03 CONSTRUCTION PANELS

- A. Roof Sheathing: Wood construction panel laminated to insulation board.
  - 1. Construction Panel: 7/16 inch (11 mm) oriented strand board (OSB).
  - 2. Insulation Board: Polyisocyanurate foam plastic with cellulosic felt facer or glass fiber mat facer on major surface opposite construction panel.
  - 3. Finished Panel: Comply with ASTM C1289, Type V.
  - 4. Manufacturers:
    - a. Basis of Design: ACFoam Nail Base.
    - b. Substitutions: See Section 016000 - Product Requirements.
- B. Wall Sheathing: Glass mat faced gypsum, ASTM C1177/C1177M, 5/8 inch Type X fire resistant.
  - 1. Edges: Square.
  - 2. Manufacturers:
    - a. CertainTeed Corporation; GlasRoc Brand: [www.certainteed.com/#sle](http://www.certainteed.com/#sle).
    - b. Georgia-Pacific Gypsum; DensGlass Sheathing: [www.gpgypsum.com/#sle](http://www.gpgypsum.com/#sle).
    - c. Substitutions: See Section 016000 - Product Requirements.

## 2.04 ACCESSORIES

- A. Fasteners and Anchors:
  - 1. Metal and Finish: Hot-dipped galvanized steel complying with ASTM A153/A153M for high humidity and preservative-treated wood locations, unfinished steel elsewhere.
- B. Water-Resistive Barrier: As specified in Section 072500.

## 2.05 FACTORY WOOD TREATMENT

- A. Treated Lumber and Plywood: Comply with requirements of AWPA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.
  - 1. Preservative-Treated Wood: Provide lumber and plywood marked or stamped by an ALSC-accredited testing agency, certifying level and type of treatment in accordance with AWPA standards.
- B. Preservative Treatment:
  - 1. Manufacturers:
    - a. Lonza Group: [www.wolmanizedwood.com/#sle](http://www.wolmanizedwood.com/#sle).
    - b. Koppers Performance Chemicals, Inc: [www.koppersperformancechemicals.com/#sle](http://www.koppersperformancechemicals.com/#sle).
    - c. Viance, LLC: [www.treatedwood.com](http://www.treatedwood.com).
    - d. Osmose, Inc: [www.osmose.com](http://www.osmose.com).
    - e. Substitutions: See Section 016000 - Product Requirements.
  - 2. Preservative Pressure Treatment of Lumber Above Grade: AWPA U1, Use Category UC3B, Commodity Specification A using waterborne preservative.
    - a. Kiln dry lumber after treatment to maximum moisture content of 19 percent.
    - b. Treat lumber exposed to weather.
    - c. Treat lumber in contact with roofing, flashing, or waterproofing.

## PART 3 EXECUTION

### 3.01 PREPARATION

- A. Where wood framing bears on cementitious foundations, install full width sill flashing continuous over top of foundation, lap ends of flashing minimum of 4 inches and seal.
- B. Coordinate installation of rough carpentry members specified in other sections.

### 3.02 INSTALLATION - GENERAL

- A. Select material sizes to minimize waste.
- B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.

- C. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.

### **3.03 BLOCKING, NAILERS, AND SUPPORTS**

- A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.
- B. In framed assemblies that have concealed spaces, provide solid wood fireblocking as required by applicable local code, to close concealed draft openings between floors and between top story and roof/attic space; other material acceptable to code authorities may be used in lieu of solid wood blocking.
- C. In metal stud walls, provide continuous blocking around door and window openings for anchorage of frames, securely attached to stud framing.
- D. In walls, provide blocking attached to studs as backing and support for wall-mounted items, unless item can be securely fastened to two or more studs or other method of support is explicitly indicated.
- E. Where ceiling-mounting is indicated, provide blocking and supplementary supports above ceiling, unless other method of support is explicitly indicated.

### **3.04 ROOF-RELATED CARPENTRY**

- A. Coordinate installation of roofing carpentry with deck construction, framing of roof openings, and roofing assembly installation.
- B. Provide wood curb at all roof openings except where prefabricated curbs are specified and where specifically indicated otherwise. Form corners by alternating lapping side members.

### **3.05 INSTALLATION OF CONSTRUCTION PANELS**

- A. Wall Sheathing: Secure with long dimension perpendicular to wall studs, with ends over firm bearing and staggered, using nails, screws, or staples.
- B. Communications and Electrical Room Mounting Boards: Secure with screws to studs with edges over firm bearing; space fasteners at maximum 24 inches on center on all edges and into studs in field of board.
  - 1. At fire-rated walls, install board over wall board indicated as part of the fire-rated assembly.
  - 2. Where boards are indicated as full floor-to-ceiling height, install with long edge of board parallel to studs.
  - 3. Install adjacent boards without gaps.

### **3.06 CLEANING**

- A. Do not leave any wood, shavings, sawdust, etc. on the ground or buried in fill.
- B. Prevent sawdust and wood shavings from entering the storm drainage system.

**END OF SECTION**

**SECTION 062000  
FINISH CARPENTRY**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Finish carpentry items.
- B. Wood casings and moldings.
- C. Hardware and attachment accessories.

**1.02 RELATED REQUIREMENTS**

- A. Section 061000 - Rough Carpentry: Support framing, grounds, and concealed blocking.
- B. Section 064100 - Architectural Wood Casework: Shop fabricated custom cabinet work.

**1.03 REFERENCE STANDARDS**

- A. AWI/AWMA/WI (AWS) - Architectural Woodwork Standards, 2nd Edition; 2014, with Errata (2016).
- B. BHMA A156.9 - Cabinet Hardware; 2020.
- C. NHLA G-101 - Rules for the Measurement and Inspection of Hardwood and Cypress; 2023.
- D. PS 1 - Structural Plywood; 2019.
- E. PS 20 - American Softwood Lumber Standard; 2021.

**1.04 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data:
  - 1. Provide manufacturer's product data, storage and handling instructions for factory-fabricated units.
  - 2. Provide instructions for attachment hardware and finish hardware.
- C. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.
  - 1. Provide the information required by AWI/AWMA/WI (AWS) or AWMA/WI (NAAWS).
- D. Samples: Submit two samples of finish wood wall paneling, 12 x 12 inch in size illustrating wood grain and specified finish.
- E. Samples: Submit two samples of wood trim 12 inch long.
- F. Manufacturer's Instructions: Provide manufacturer's installation instructions for factory-fabricated units.

**1.05 QUALITY ASSURANCE**

- A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.

**1.06 WARRANTY**

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. Provide five year warranty for resilient stage floor to include warranty against discoloration due to cleaning, crazing or cracking, and staining.

**1.07 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver factory-fabricated units to project site in original packages, containers or bundles bearing brand name and identification.
- B. Store finish carpentry items under cover, elevated above grade, and in a dry, well-ventilated area not exposed to heat or sunlight.
- C. Protect work from moisture damage.
- D. Handle materials and products to prevent damage to edges, ends, or surfaces.
- E. Place wood flooring materials in stage area at least 7 days in advance of start of installation. Open sealed packages of wood flooring to permit natural adjustment of moisture content.

## **PART 2 PRODUCTS**

### **2.01 FINISH CARPENTRY ITEMS**

- A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.
- B. Surface Burning Characteristics: Provide materials having fire and smoke properties as required by applicable code.
- C. Interior Woodwork Items:
  - 1. Moldings, Bases, Casings, and Miscellaneous Trim; prepare for transparent finish.
  - 2. Wood Wall Paneling.
  - 3. Handrails: White Oak; prepare for stained finish.

### **2.02 LUMBER MATERIALS**

- A. Hardwood Lumber: White Oak species, rift cut, maximum moisture content of 6 percent; with flat grain, of quality suitable for transparent finish.
  - 1. Grading: In accordance with NHLA G-101 Grading Rules; [www.nhla.org](http://www.nhla.org).

### **2.03 SHEET MATERIALS**

- A. Softwood Plywood, Exposed to View: Face species as indicated, plain sawn, medium density fiberboard core; PS 1 Grade A-B, glue type as recommended for application.
  - 1. Grading: Certified by the American Plywood Association.

### **2.04 FASTENINGS**

- A. Adhesive for Purposes Other Than Laminate Installation: Suitable for the purpose; not containing formaldehyde or other volatile organic compounds.
- B. Adhesive for factory-fabricated units: Manufacturer's recommended adhesive for application.
- C. Fasteners: Of size and type to suit application;
- D. Concealed Joint Fasteners: Threaded steel.

### **2.05 ACCESSORIES**

- A. Adhesive: Type recommended by fabricator to suit application.
- B. Lumber for Shimming and Blocking: Softwood lumber of pine species.
- C. Primer: Alkyd primer sealer.
- D. Wood Filler: Solvent base, tinted to match surface finish color.

### **2.06 HARDWARE**

- A. Hardware: Comply with BHMA A156.9.

### **2.07 FABRICATION**

- A. Shop assemble work for delivery to site, permitting passage through building openings.
- B. Fit exposed sheet material edges with 3/8 inch matching hardwood edging. Use one piece for full length only.
- C. Shop prepare and identify components for book match grain matching during site erection.
- D. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting.

### **2.08 FIELD FINISHING**

- A. Sand work smooth and set exposed nails and screws.
- B. Apply wood filler in exposed nail and screw indentations.
- C. On items to receive transparent finishes, use wood filler that matches surrounding surfaces and is of type recommended for the applicable finish.
- D. Prime paint surfaces in contact with cementitious materials.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify adequacy of backing and support framing.
- B. Verify mechanical, electrical, and building items affecting work of this section are placed and ready to receive this work.

### **3.02 INSTALLATION**

- A. Install work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade indicated.
- B. Install factory-fabricated units in accordance with manufacturer's printed installation instructions.
- C. Set and secure materials and components in place, plumb and level.
- D. Carefully scribe work abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim to conceal larger gaps.

### **3.03 PREPARATION FOR SITE FINISHING**

- A. Set exposed fasteners. Apply wood filler in exposed fastener indentations. Sand work smooth.

### **3.04 TOLERANCES**

- A. Maximum Variation from True Position: 1/16 inch.
- B. Maximum Offset from True Alignment with Abutting Materials: 1/32 inch.

**END OF SECTION**

**SECTION 064100  
ARCHITECTURAL WOOD CASEWORK**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Specially fabricated cabinet units.
- B. Cabinet hardware.
- C. Preparation for installing utilities.

**1.02 RELATED REQUIREMENTS**

- A. Section 061000 - Rough Carpentry: Support framing, grounds, and concealed blocking.

**1.03 REFERENCE STANDARDS**

- A. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards; 2021, with Errata.
- B. BHMA A156.9 - Cabinet Hardware; 2020.
- C. HPVA HP-1 - American National Standard for Hardwood and Decorative Plywood; 2020.
- D. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.
- E. BHMA A156.9 - American National Standard for Cabinet Hardware; Builders Hardware Manufacturers Association; 2010 (ANSI/BHMA A156.9).
- F. NEMA LD 3 - High-Pressure Decorative Laminates; National Electrical Manufacturers Association; 2005.

**1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Preinstallation Meeting: Convene a preinstallation meeting not less than one week before starting work of this section; require attendance by all affected installers.

**1.05 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.
  - 1. Scale of Drawings: 1-1/2 inch to 1 foot, minimum.
- C. Product Data: Provide data for hardware accessories.
- D. Samples: Submit actual samples of architectural cabinet construction, minimum 12 inches square, illustrating proposed cabinet, countertop, and shelf unit substrate and finish.
- E. Samples: Submit actual sample items of proposed pulls, hinges, shelf standards, and locksets, demonstrating hardware design, quality, and finish.

**1.06 QUALITY ASSURANCE**

- A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.

**1.07 DELIVERY, STORAGE, AND HANDLING**

- A. Protect units from moisture damage.

**1.08 FIELD CONDITIONS**

- A. During and after installation of custom cabinets, maintain temperature and humidity conditions in building spaces at same levels planned for occupancy.

**PART 2 PRODUCTS**

**2.01 CABINETS**

- A. Wood Veneer Faced Cabinet:
  - 1. Exposed Surfaces: HPVA HP-1 Grade A, White Oak, rift cut and comb grain, random-matched.
  - 2. Semi-Exposed Surfaces: HPVA HP-1 Grade B, White Oak, rift cut and comb grain, random-matched.
  - 3. Concealed Surfaces: Manufacturer's option.
- B. Plastic Laminate Faced Cabinets: Custom grade.

- C. Cabinets:
  - 1. Finish - Exposed Exterior Surfaces: Wood and decorative laminate. See Drawings for locations..
  - 2. Finish - Concealed Surfaces: Manufacturer's option.
  - 3. Door and Drawer Front Edge Profiles: 3 mm edge band at decorative laminate.
  - 4. Adjustable Shelf Loading: 50 lbs. per sq. ft.
  - 5. Cabinet Style: Flush overlay.
  - 6. Drawer Side Construction: Multiple-dovetailed.
  - 7. Drawer Construction Technique: Dovetail joints.

## **2.02 WOOD-BASED COMPONENTS**

- A. Wood fabricated from old growth timber is not permitted.
- B. Hardwood Edgebanding: Use solid hardwood edgebanding matching species, color, grain, and grade for exposed portions of cabinetry.

## **2.03 LAMINATE MATERIALS**

- A. Manufacturers:
  - 1. Formica Corporation: [www.formica.com/#sle](http://www.formica.com/#sle).
  - 2. Substitutions: See Section 016000 - Product Requirements.
- B. High Pressure Decorative Laminate (HPDL): NEMA LD 3, types as recommended for specific applications.

## **2.04 COUNTERTOPS**

- A. Countertops are specified in Section 123600.

## **2.05 ACCESSORIES**

- A. Adhesive: Type recommended by fabricator to suit application.
- B. Plastic Edge Banding: Extruded PVC, flat shaped; smooth finish; self locking serrated tongue; of width to match component thickness.
  - 1. Color: As selected by Architect from manufacturer's standard range.
- C. Fasteners: Size and type to suit application.
- D. Bolts, Nuts, Washers, Lags, Pins, and Screws: Of size and type to suit application; galvanized or chrome-plated finish in concealed locations and chrome-plated finish in exposed locations.
- E. Concealed Joint Fasteners: Threaded steel.
- F. Grommets: Standard plastic grommets for cut-outs, in color to match adjacent surface.

## **2.06 HARDWARE**

- A. Hardware: BHMA A156.9, types as recommended by fabricator for quality grade specified.
- B. Adjustable Shelf Supports: Standard back-mounted system using surface mounted metal shelf standards and coordinated cantilevered shelf brackets, satin chrome, painted, or painted finish, for nominal 1 inch spacing adjustments.
- C. Countertop Supports:
  - 1. Material: Aluminum
  - 2. Finish/Color: Black powdercoat.
  - 3. Manufacturers:
    - a. Rakks/Rangine Corporation; Sill Supports: [www.rakks.com/#sle](http://www.rakks.com/#sle)
- D. Drawer and Door Pulls: \_\_\_\_\_.
  - 1. Product: 128mm manufactured by City Scape Collection Pull.
- E. Cabinet Locks: Keyed cylinder, two keys per lock, master keyed, steel with chrome finish.
- F. Catches: Magnetic.
- G. Drawer Slides:
  - 1. Type: Extension types as scheduled.
  - 2. Static Load Capacity: Commercial grade.
  - 3. Mounting: Side mounted.
  - 4. Stops: Integral type.
  - 5. Manufacturers
    - a. Accuride International, Inc: [www.accuride.com](http://www.accuride.com).

- b. Grass America Inc: [www.grassusa.com](http://www.grassusa.com).
  - c. Hettich America, LP: [www.hettichamerica.com](http://www.hettichamerica.com).
  - d. Knappe & Vogt Manufacturing Company: [www.knappeandvogt.com](http://www.knappeandvogt.com).
  - e. Substitutions: See Section 016000 - Product Requirements.
- H. Hinges: European style concealed self-closing type, steel with polished finish.
- 1. Manufacturers:
    - a. Grass America Inc: [www.grassusa.com](http://www.grassusa.com).
    - b. Hardware Resources: [www.hardwareresources.com](http://www.hardwareresources.com).
    - c. Hettich America, LP; Sensys: [www.hettichamerica.com/#sle](http://www.hettichamerica.com/#sle).
    - d. Julius Blum, Inc: [www.blum.com](http://www.blum.com).
    - e. Substitutions: See Section 016000 - Product Requirements.
- I. Soft Close Adapter: Concealed, frame-mounted, screw-adjustable damper ; steel with polished finish.

## 2.07 FABRICATION

- A. Assembly: Shop assemble cabinets for delivery to site in units easily handled and to permit passage through building openings.
- B. Edging: Fit shelves, doors, and exposed edges with specified edging. Do not use more than one piece for any single length.
- C. Fitting: When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide matching trim for scribing and site cutting.
- D. Plastic Laminate: Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners.
  - 1. Cap exposed plastic laminate finish edges with material of same finish and pattern.
- E. Matching Wood Grain: Comply with requirements of quality standard for specified Grade and as follows:
  - 1. Provide sequence matching across each elevation.
  - 2. Carry figure of cabinet fronts to toe kicks.
- F. Mechanically fasten back splash to countertops as recommended by laminate manufacturer at 16 inches on center.
- G. Provide cutouts for plumbing fixtures. Verify locations of cutouts from on-site dimensions. Prime paint cut edges.

## 2.08 SHOP FINISHING

- A. Sand work smooth and set exposed nails and screws.
- B. On items to receive transparent finishes, use wood filler matching or blending with surrounding surfaces and of types recommended for applied finishes.
- C. Finish work in accordance with AWI/AWMA/MI (AWS) or AWMA/MI (NAAWS), Section 5 - Finishing for grade specified and as follows:
  - 1. Transparent:
    - a. System - 1, Lacquer, Nitrocellulose.
    - b. Stain: As selected by Architect.
    - c. Sheen: Flat.

## PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Verify adequacy of backing and support framing.
- B. Verify location and sizes of utility rough-in associated with work of this section.

### 3.02 INSTALLATION

- A. Set and secure custom cabinets in place, assuring that they are rigid, plumb, and level.
- B. Use fixture attachments in concealed locations for wall mounted components.
- C. Use concealed joint fasteners to align and secure adjoining cabinet units.
- D. Carefully scribe casework abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim for this purpose.



- E. Countersink anchorage devices at exposed locations. Conceal with solid wood plugs of species to match surrounding wood; finish flush with surrounding surfaces.

**3.03 ADJUSTING**

- A. Adjust installed work.
- B. Adjust moving or operating parts to function smoothly and correctly.

**3.04 CLEANING**

- A. Clean casework, counters, shelves, hardware, fittings, and fixtures.

**END OF SECTION**

**SECTION 071300  
SHEET WATERPROOFING**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Sheet Waterproofing:
  - 1. Self-adhered polymeric sheet membrane.

**1.02 RELATED REQUIREMENTS**

- A. ***Section 019119-Commissioning of Building Enclosure (BECx): Commissioning requirements and procedures.***
- B. Section 033000 - Cast-in-Place Concrete: Concrete substrate.
- C. Section 076200 - Sheet Metal Flashing and Trim: Metal parapet, coping, and counterflashing.
- D. Section 079200 - Joint Sealants: Sealing moving joints in waterproofed surfaces that are not required to be treated in this section.

**1.03 REFERENCE STANDARDS**

- A. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers--Tension; 2016 (Reapproved 2021).
- B. ASTM D570 - Standard Test Method for Water Absorption of Plastics; 2022.
- C. ASTM D882 - Standard Test Method for Tensile Properties of Thin Plastic Sheet; 2018.
- D. ASTM D903 - Standard Test Method for Peel or Stripping Strength of Adhesive Bonds; 1998 (Reapproved 2017).
- E. ASTM D1876 - Standard Test Method for Peel Resistance of Adhesives (T-Peel Test); 2008 (Reapproved 2023).
- F. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection; 2021.
- G. ASTM D5385/D5385M - Standard Test Method for Hydrostatic Pressure Resistance of Waterproofing Membranes; 2020.
- H. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2022a, with Editorial Revision (2023).

**1.04 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data for membrane.
- C. Shop Drawings: Indicate special joint or termination conditions and conditions of interface with other materials.
- D. Certificate: Certify that products meet or exceed specified requirements.
- E. Manufacturer's Installation Instructions: Indicate special procedures.
- F. Manufacturer's Qualification Statement.
- G. Installer's Qualification Statement.
- H. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

**1.05 QUALITY ASSURANCE**

- A. Membrane Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than five years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least five years of documented experience.

**1.06 FIELD CONDITIONS**

- A. Product not intended for uses subject to abuse or permanent exposure to the elements.
- B. Protect rolls from direct sunlight until ready for use.
- C. Do not apply standard membrane when air or surface temperatures are below 40 degrees F.
- D. Do not apply to frozen concrete.

**1.07 WARRANTY**

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

## **PART 2 PRODUCTS**

### **2.01 MEMBRANE MATERIALS**

- A. Self-Adhered Sheet Waterproofing Membrane:
  - 1. Thickness: 60 mils, 0.060 inch, minimum. Carrier Film: 4mils, Polymeric Membrane: 56 mils.
  - 2. Tensile Strength:
    - a. Film: 5900 pounds per square inch , minimum, measured according to ASTM D882 and at grip-separation rate of 2 inches per minute.
    - b. Membrane: 460 pounds per square inch, minimum, measured according to ASTM D412 Method A, using die C and at spindle-separation rate of 2 inches per minute.
  - 3. Elongation at Break: Membrane 971 percent, minimum, measured according to ASTM D412.
  - 4. Water Vapor Permeance: 0.036 perm, maximum, measured in accordance with ASTM E96/E96M.
  - 5. Peel Strength: 11.8 pounds per inch, minimum, when tested according to ASTM D903.
  - 6. Lap Adhesion Strength: 8.62 pounds per inch, minimum, when tested according to ASTM D1876.
  - 7. Puncture Resistance: 48.2 pounds, minimum, measured in accordance with ASTM E154/E154M.
  - 8. Water Absorption: 0.1 percent increase in weight, maximum, measured in accordance with ASTM D570, 72 hour immersion.
  - 9. Hydrostatic Resistance: Resists the weight of 230.9 feet when tested according to ASTM D5385/D5385M.
  - 10. Adhesives, Sealants, Tapes, and Accessories: As recommended by membrane manufacturer.
  - 11. Manufacturers: Basis of Design: MEL-ROL Waterproofing System by W.R. Meadows.
    - a. Carlisle Coatings & Waterproofing Inc: [www.carlisleccw.com/#sle](http://www.carlisleccw.com/#sle).
    - b. CETCO, a division of Minerals Technologies Inc: [www.mineralstech.com/#sle](http://www.mineralstech.com/#sle).
    - c. Mar-flex Waterproofing & Building Products: [www.mar-flex.com/#sle](http://www.mar-flex.com/#sle).
    - d. Polyguard Products, Inc: [www.polyguardproducts.com/#sle](http://www.polyguardproducts.com/#sle).
    - e. Substitutions: See Section 016000 - Product Requirements.

### **2.02 ACCESSORIES**

- A. Seaming Materials: As recommended by membrane manufacturer.
- B. Membrane Sealant: As recommended by membrane manufacturer.
- C. Primer: Solvent-based, ready to use adhesive. Basis of Design: Mel-Prime by WR Meadows.
- D. Sealant for Cracks and Joints In Substrates: Resilient elastomeric joint sealant compatible with substrates and waterproofing materials.
- E. Protection Board: Provide type capable of preventing damage to waterproofing due to backfilling and construction traffic.
  - 1. Multi-layer internally-reinforced asphaltic panels, 1/8 inch thick, nominal, complying with ASTM D6506/D6506M.
  - 2. Manufacturers:
    - a. W.R. Meadows, Inc; PC-2 Protection Course: [www.wrmeadows.com/#sle](http://www.wrmeadows.com/#sle).
- F. Drainage Panel: Drainage layer with geotextile filter fabric on earth side.
  - 1. Composition: Dimpled polystyrene, polyethylene, or polypropylene core; polypropylene filter fabric.
  - 2. Manufacturers:
    - a. W.R. Meadows, Inc; Mel-Drain: [www.wrmeadows.com/#sle](http://www.wrmeadows.com/#sle).
    - b. Substitutions: See Section 016000 - Product Requirements.
- G. Cant Strips: Premolded composition material.
- H. Preformed Flashing Shapes: Injected or vacuum molded one piece shapes used for detailing of inside and outside corners, protrusions, and transitions.
  - 1. Color: Black.
- I. Flexible Flashings: Type recommended by membrane manufacturer.

- J. Termination Bars: Aluminum; compatible with membrane and adhesives.
- K. Termination Sealant: Pointing Mastic.
- L. Adhesives: As recommended by membrane manufacturer.
- M. Thinner and Cleaner: As recommended by adhesive manufacturer, compatible with sheet membrane.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify existing conditions are acceptable prior to starting this work.
- B. Verify substrate surfaces are durable; free of matter detrimental to adhesion or application of waterproofing system.
- C. Verify items that penetrate surfaces to receive waterproofing are securely installed.

### **3.02 PREPARATION**

- A. Protect adjacent surfaces from damage not designated to receive waterproofing.
- B. Clean and prepare surfaces to receive waterproofing in accordance with manufacturer's instructions; vacuum substrate clean.
- C. Do not apply waterproofing to surfaces unacceptable to membrane manufacturer.
- D. Fill non-moving joints and cracks with a filler compatible with waterproofing materials.
- E. Seal moving cracks with sealant and non-rigid filler, using procedures recommended by sealant and waterproofing manufacturers.
- F. Surfaces for Adhesive Bonding: Apply surface conditioner at a rate recommended by manufacturer, and protect conditioner from rain or frost until dry.

### **3.03 INSTALLATION - MEMBRANE**

- A. Install membrane waterproofing in accordance with manufacturer's instructions.
- B. Roll out membrane, and minimize wrinkles and bubbles.
- C. Self-Adhering Membrane: Remove release paper layer, and roll out onto substrate with a mechanical roller to provide full contact bond.
- D. Overlap edges and ends, minimum 3 inches, seal permanently waterproof by method recommended by manufacturer, and apply uniform bead of sealant to joint edge.
- E. Reinforce membrane with multiple thickness of membrane material over joints, whether joints are static or dynamic.
- F. Weather lap joints on sloped substrate in direction of drainage, and seal joints and seams.
- G. Flexible Flashings: Seal items watertight that penetrate through waterproofing membrane with flexible flashings.
- H. Seal membrane and flashings to adjoining surfaces.
  - 1. Install termination bar along edges.

### **3.04 INSTALLATION - DRAINAGE PANEL AND PROTECTION BOARD**

- A. Place drainage panel directly against membrane, butt joints, place to encourage drainage downward. Scribe and cut boards around projections, penetrations, and interruptions.
- B. Place protection board directly against drainage panel; butt joints. Scribe and cut boards around projections, penetrations, and interruptions.

### **3.05 FIELD QUALITY CONTROL**

- A. Upon completion of horizontal membrane installation, dam installation area in preparation for flood testing.
  - 1. Flood to minimum depth of 1 inch with clean water, and after 48 hours inspect for leaks.
  - 2. If leaking is found, remove water, repair leaking areas with new waterproofing materials as directed by Architect; repeat flood test, and repair damage to building.
  - 3. When area is proven watertight, drain water and remove dam.

### **3.06 PROTECTION**

- A. Do not permit traffic over unprotected or uncovered membrane.

**END OF SECTION**

**SECTION 072100  
THERMAL INSULATION**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Board insulation at cavity wall construction, perimeter foundation wall, and underside of floor slabs.
- B. Mineral fiber insulation.
- C. Batt insulation for filling perimeter window and door shim spaces and crevices in exterior wall and roof.

**1.02 RELATED REQUIREMENTS**

- A. ***Section 019119-Commissioning of Building Enclosure (BECx): Commissioning requirements and procedures.***
- B. Section 033000 - Cast-in-Place Concrete: Field-applied termiticide for concrete slabs and foundations.
- C. Section 042723 - Cavity Wall Unit Masonry: Masonry walls enclosing insulation.
- D. Section 061000 - Rough Carpentry: Supporting construction for batt insulation.

**1.03 REFERENCE STANDARDS**

- A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023b.
- B. ASTM E136 - Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750 °C; 2022.

**1.04 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on product characteristics, performance criteria, and product limitations.
- C. Manufacturer's Installation Instructions: Include information on special environmental conditions required for installation and installation techniques.

**1.05 FIELD CONDITIONS**

- A. Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

**2.02 APPLICATIONS**

- A. Insulation Under Concrete Slabs: Extruded polystyrene (XPS) board.
- B. Insulation at Perimeter of Foundation: Extruded polystyrene (XPS) board.
- C. Insulation Inside Masonry Cavity Walls: Extruded polystyrene (XPS) carbon black board.
- D. Insulation at Floor Line: Mineral Wool.
- E. Insulation at Spandrel Glazing: Mineral Wool.
- F. Insulation in Metal Framed Walls: Batt insulation with no vapor retarder.

**2.03 FOAM BOARD INSULATION MATERIALS**

- A. Extruded Polystyrene Board Insulation: Extruded polystyrene board; ASTM C578; with either natural skin or cut cell surfaces, and the following characteristics:
  - 1. Flame Spread Index: 25 or less, when tested in accordance with ASTM E84.
  - 2. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E84.
  - 3. R-value; 1 inch of material at 72 degrees F: 5, minimum.
  - 4. Complies with fire resistance requirements shown on the drawings as part of an exterior non-load-bearing exterior wall assembly when tested in accordance with NFPA 285.
  - 5. Board Edges: Square.
  - 6. Water Absorption, Maximum: 0.3 percent, by volume.
  - 7. Manufacturers:
    - a. Dow Chemical Co: [www.dow.com](http://www.dow.com).

- b. Owens Corning Corporation; FOAMULAR Extruded Polystyrene (XPS) Insulation: [www.ocbuildingspec.com](http://www.ocbuildingspec.com).
  - c. Substitutions: See Section 016000 - Product Requirements.
- B. Extruded Polystyrene (XPS) Cavity Wall Insulation Board: Complies with ASTM C578, and manufactured using carbon black technology.
  - 1. Type and Thermal Resistance, R-value: Type IV, 5.0 (0.88), minimum, per 1 inch thickness at 75 degrees F mean temperature.
  - 2. Manufacturers:
    - a. Basis of Design: DuPont de Nemours, Inc: [www.building.dupont.com/#sle](http://www.building.dupont.com/#sle).
    - b. Substitutions: See Section 016000 - Product Requirements.

## 2.04 BATT INSULATION MATERIALS

- A. Glass Fiber Batt Insulation: Flexible preformed batt or blanket, complying with ASTM C665; friction fit.
  - 1. Flame Spread Index: 75 or less, when tested in accordance with ASTM E84.
  - 2. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E84.
  - 3. Formaldehyde Content: Zero.
  - 4. Manufacturers:
    - a. CertainTeed Corporation: [www.certainteed.com/#sle](http://www.certainteed.com/#sle).
    - b. Johns Manville: [www.jm.com/#sle](http://www.jm.com/#sle).
    - c. Owens Corning Corporation: [www.ocbuildingspec.com/#sle](http://www.ocbuildingspec.com/#sle).
  - 5. Substitutions: See Section 016000 - Product Requirements.
- B. Mineral Fiber Batt Insulation: Flexible or semi-rigid preformed batt or blanket, complying with ASTM C665; friction fit; unfaced flame spread index of 0 (zero) when tested in accordance with ASTM E84.
  - 1. Flame Spread Index: 25 or less, when tested in accordance with ASTM E84.
  - 2. Smoke Developed Index: 0 (zero), when tested in accordance with ASTM E84.
  - 3. Provide foil facing on one side, at locations indicated on drawings.
  - 4. Manufacturers:
    - a. Johns Manville: [www.jm.com/#sle](http://www.jm.com/#sle).
    - b. Knauf Insulation: [www.knaufinsulation.com/#sle](http://www.knaufinsulation.com/#sle).
    - c. ROCKWOOL (ROXUL, Inc): [www.rockwool.com/#sle](http://www.rockwool.com/#sle).
    - d. Thermafiber, Inc: [www.thermafiber.com/#sle](http://www.thermafiber.com/#sle).
    - e. Substitutions: See Section 016000 - Product Requirements.

## 2.05 ACCESSORIES

- A. Interior Vapor Retarder: Modified polyethylene/polyacrylate (PE/PA) film reinforced with polyethylene terephthalate (PET) fibers, 12 mils, 0.012 inch thick.
- B. Nails or Staples: Steel wire; electroplated or galvanized; type and size to suit application.
- C. Wire Mesh: Galvanized steel, hexagonal wire mesh.

## PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation.
- B. Verify substrate surfaces are flat, free of honeycomb, fins, irregularities, or materials or substances that may impede adhesive bond.

### 3.02 BOARD INSTALLATION AT FOUNDATION PERIMETER

- A. Install boards horizontally on foundation perimeter.
  - 1. Butt edges and ends tightly to adjacent boards and to protrusions.
- B. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

### 3.03 BOARD INSTALLATION AT CAVITY WALLS

- A. Install boards to fit snugly between wall ties.
- B. Install boards horizontally on walls.
- C. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

### **3.04 BOARD INSTALLATION UNDER CONCRETE SLABS**

- A. Place insulation under slabs on grade after base for slab has been compacted.
- B. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.
- C. Prevent insulation from being displaced or damaged while placing vapor retarder and placing slab.

### **3.05 BATT INSTALLATION**

- A. Install insulation in accordance with manufacturer's instructions.
- B. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.

### **3.06 PROTECTION**

- A. Do not permit installed insulation to be damaged prior to its concealment.

**END OF SECTION**

**SECTION 072119  
FOAMED-IN-PLACE INSULATION**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Foamed-in-place insulation.
  - 1. In exterior framed walls.
  - 2. In exterior wall crevices.
  - 3. At junctions of dissimilar wall and roof materials.

**1.02 REFERENCE STANDARDS**

- A. ASTM D2842 - Standard Test Method for Water Absorption of Rigid Cellular Plastics; 2019.
- B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023b.
- C. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2004 (Reapproved 2012).

**1.03 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide product description, insulation properties, overcoat properties, and preparation requirements.
- C. Manufacturer Qualification: Submit documentation of current evaluation of proposed manufacturer and materials.

**1.04 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section, with not less than three years of documented experience.

**1.05 FIELD CONDITIONS**

- A. Do not install insulation when ambient temperature is lower than 70 degrees F.
- B. Do not apply foam when temperature is below that specified by the manufacturer for ambient air and substrate.
- C. Do not apply foam when temperature is within 5 degrees F of dew point.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

- A. Foamed-In-Place Insulation:
  - 1. BASF Corporation; WALLTITE US Series Closed Cell: [www.spf.basf.com/#sle](http://www.spf.basf.com/#sle).
  - 2. Bayer MaterialScience; EcoBay CC : [www.spf.bayermaterialscience.com](http://www.spf.bayermaterialscience.com).
  - 3. Demilec LLC; DEMILEC APX: [www.demilec.com/#sle](http://www.demilec.com/#sle).
  - 4. Henry Company; PERMAX 0.5: [www.henry.com](http://www.henry.com).
  - 5. Icynene Inc; Icynene Classic LD-C-50: [www.icynene.com/#sle](http://www.icynene.com/#sle).
  - 6. Johns Manville; JM Corbond III Closed Cell Spray Polyurethane Foam: [www.jm.com/#sle](http://www.jm.com/#sle).

**2.02 MATERIALS**

- A. Foamed-In-Place Insulation: Medium-density, rigid or semi-rigid, closed cell polyurethane foam; foamed on-site, using blowing agent of water or non-ozone-depleting gas.
  - 1. Aged Thermal Resistance: R-value of 5 (deg F hr sq ft)/Btu, minimum, when tested at 1 inch thickness in accordance with ASTM C518 after aging for 180 days at 41 degrees F.
  - 2. Water Vapor Permeance: Vapor retarder; 2 perm, maximum, when tested at intended thickness in accordance with ASTM E96/E96M, desiccant method.
  - 3. Water Absorption: Less than 2 percent by volume, maximum, when tested in accordance with ASTM D2842.
  - 4. Air Permeance: 0.004 cfm/sq ft, maximum, when tested at intended thickness in accordance with ASTM E2178 or ASTM E283 at 1.5 psf.
  - 5. Closed Cell Content: At least 90 percent.



6. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/450, maximum, when tested in accordance with ASTM E84.
7. Products:
  - a. Bayer MaterialScience; EcoBay CC: [www.spf.bayermaterialscience.com](http://www.spf.bayermaterialscience.com).
  - b. Demilec LLC;; HEATLOK SOY 200 Plus: [www.demilec.com/#sle](http://www.demilec.com/#sle).
  - c. Henry Company; PERMAX 2.0: [www.henry.com](http://www.henry.com).
  - d. Icynene Inc; Icynene ProSeal Eco MD-R-210: [www.icynene.com](http://www.icynene.com).
  - e. Johns Manville; JM Corbond III Closed Cell Spray Polyurethane Foam: [www.jm.com/#sle](http://www.jm.com/#sle).
  - f. Rhino Linings Corporation; DuraTite 2.0: [www.biobased.rhino linings.com/#sle](http://www.biobased.rhino linings.com/#sle).
  - g. Substitutions: See Section 016000 - Product Requirements.

### **2.03 ACCESSORIES**

- A. Primer: As required by insulation manufacturer.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify work within construction spaces or crevices is complete prior to insulation application.
- B. Verify that surfaces are clean, dry, and free of matter that may inhibit insulation or overcoat adhesion.

### **3.02 PREPARATION**

- A. Mask and protect adjacent surfaces from over spray or dusting.
- B. Apply primer in accordance with manufacturer's instructions.

### **3.03 APPLICATION**

- A. Apply insulation in accordance with manufacturer's instructions.
- B. Apply insulation by spray method, to a uniform monolithic density without voids.
- C. Apply to a minimum cured thickness of 3 inch.
- D. Patch damaged areas.
- E. Where applied to voids and gaps assure space for expansion to avoid pressure on adjacent materials that may bind operable parts.
- F. Trim excess away for applied trim or remove as required for continuous sealant bead.

### **3.04 PROTECTION**

- A. Do not permit subsequent construction work to disturb applied insulation.

**END OF SECTION**

**SECTION 072400  
EXTERIOR INSULATION AND FINISH SYSTEMS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Finish coating applied directly to soffits.

**1.02 RELATED REQUIREMENTS**

- A. Section 061000 - Rough Carpentry: Sheathing on wood framing.
- B. Section 072500 - Weather Barriers.
- C. Section 076200 - Sheet Metal Flashing and Trim: Perimeter flashings.
- D. Section 079200 - Joint Sealants: Sealing joints between EIFS and adjacent construction and penetrations through EIFS.

**1.03 REFERENCE STANDARDS**

- A. ASTM B117 - Standard Practice for Operating Salt Spray (Fog) Apparatus; 2019.
- B. ASTM C1397 - Standard Practice for Application of Class PB Exterior Insulation and Finish Systems (EIFS) and EIFS with Drainage; 2013 (Reapproved 2019).
- C. ASTM D968 - Standard Test Methods for Abrasion Resistance of Organic Coatings by Falling Abrasive; 2022.
- D. ASTM D2247 - Standard Practice for Testing Water Resistance of Coatings in 100 % Relative Humidity; 2015 (Reapproved 2020).
- E. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2021.
- F. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2023).
- G. ASTM E2273 - Standard Test Method for Determining the Drainage Efficiency of Exterior Insulation and Finish Systems (EIFS) Clad Wall Assemblies; 2018.
- H. ASTM E2486/E2486M - Standard Test Method for Impact Resistance of Class PB and PI Exterior Insulation and Finish Systems (EIFS); 2022.
- I. ASTM G153 - Standard Practice for Operating Enclosed Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials; 2013 (Reapproved 2021).
- J. ASTM G155 - Standard Practice for Operating Xenon Arc Lamp Apparatus for Exposure of Materials; 2021.
- K. ICC-ES AC219 - Acceptance Criteria for Exterior Insulation and Finish Systems; 2009, with Editorial Revision (2022).
- L. ICC-ES AC235 - Acceptance Criteria for EIFS Clad Drainage Wall Assemblies; 2015, with Editorial Revision (2022).
- M. NFPA 259 - Standard Test Method for Potential Heat of Building Materials; 2023, with Errata.
- N. NFPA 268 - Standard Test Method for Determining Ignitability of Exterior Wall Assemblies Using a Radiant Heat Energy Source; 2022.
- O. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Wall Assemblies Containing Combustible Components; 2023.

**1.04 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on system materials, product characteristics, performance criteria, and system limitations.
- C. Shop Drawings: Indicate soffit joint patterns, joint details, and molding profiles.
- D. Selection Samples: Submit manufacturer's standard range of samples illustrating available coating colors and textures.
- E. Verification Samples: Submit actual samples of selected coating on specified substrate, minimum 12 inches square, illustrating project colors and textures.
- F. Installer's qualification statement.

**1.05 QUALITY ASSURANCE**

- A. Maintain copy of specified installation standard and manufacturer's installation instructions at project site during installation.

- B. Installer Qualifications: Company specializing in the type of work specified and with at least three years of documented experience.

#### **1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Delivery: Deliver materials to project site in manufacturer's original, unopened containers with labels intact. Inspect materials and notify manufacturer of any discrepancies.
- B. Storage: Store materials as directed by manufacturer's written instructions.
  - 1. Protect adhesives and finish materials from freezing, temperatures below 40 degrees F and temperatures in excess of 90 degrees F.
  - 2. Protect Portland cement based materials from moisture and humidity. Store under cover off the ground in a dry location.

#### **1.07 FIELD CONDITIONS**

- A. Do not prepare materials or apply EIFS under conditions other than those described in the manufacturer's written instructions.
- B. Do not prepare materials or apply EIFS during inclement weather unless areas of installation are protected. Protect installed EIFS areas from inclement weather until dry.
- C. Do not install coatings or sealants when ambient temperature is below 40 degrees F.
- D. Do not leave installed insulation board exposed to sunlight for extended periods of time.

#### **1.08 WARRANTY**

- A. See Section 017800 - Closeout Submittals for additional warranty requirements.
- B. Provide manufacturer's standard material warranty, covering a period of not less than 10 years.

### **PART 2 PRODUCTS**

#### **2.01 MANUFACTURERS**

- A. Basis of Design:
  - 1. Sto Corp; StoTherm ci: [www.stocorp.com/#sle](http://www.stocorp.com/#sle).

#### **2.02 EXTERIOR INSULATION AND FINISH SYSTEM**

- A. Fire Characteristics:
  - 1. Flammability: Pass, when tested in accordance with NFPA 285.
  - 2. Ignitibility: No sustained flaming when tested in accordance with NFPA 268.
  - 3. Potential Heat of Foam Plastic Insulation Tested Independently of Assembly: No portion of the assembly having potential heat that exceeds that of the insulation sample tested for flammability (above), when tested in accordance with NFPA 259 with results expressed in Btu per square foot.
- B. Water Penetration Resistance: No water penetration beyond the plane of the base coat/insulation board interface after 15 minutes, when tested in accordance with ASTM E331 at 6.24 psf differential pressure with tracer dye in the water spray; include in tested sample at least two vertical joints and one horizontal joint of same type to be used in construction; disassemble sample if necessary to determine extent of water penetration.
- C. Drainage Efficiency: Average minimum efficiency of 90 percent, when tested in accordance with ASTM E2273 for 75 minutes.
- D. Salt Spray Resistance: No cracking, checking, crazing, erosion, blistering, peeling, delamination, or corrosion of finish coating after 300 hours exposure in accordance with ASTM B117, using at least three samples matching intended assembly, at least 4 by 6 inches in size.
- E. Freeze-Thaw Resistance: No cracking, checking, crazing, erosion, blistering, peeling, delamination, or corrosion of finish coating when viewed under 5x magnification after 10 cycles, when tested in accordance with ICC-ES AC219 or ICC-ES AC235.
- F. Weathering Resistance: No cracking, checking, crazing, erosion, blistering, peeling, delamination, or corrosion of finish coating when viewed under 5x magnification after 2000 hours of accelerated weathering conducted in accordance with ASTM G153 Cycle 1 or ASTM G155 Cycles 1, 5, or 9.
- G. Water Degradation Resistance: No cracking, checking, crazing, erosion, blistering, peeling, delamination, or corrosion of finish coating after 14 days exposure, when tested in accordance with ASTM D2247.

- H. Mildew Resistance: No growth supported on finish coating during 28 day exposure period, when tested in accordance with ASTM D3273.
- I. Abrasion Resistance Of Finish: No cracking, checking or loss of film integrity when tested in accordance with ASTM D968 with 113.5 gallons of sand.
- J. Impact Resistance: Construct system to provide the following impact resistance without exposure of broken reinforcing mesh, when tested in accordance with ASTM E2486/E2486M:
  - 1. Standard: 25 to 49 in-lb, for areas not indicated as requiring higher impact resistance.

### **2.03 MATERIALS**

- A. Finish Coating Top Coat: Water-based, air curing, acrylic or polymer-based finish with integral color and texture.
  - 1. Texture: Sto Corp; Dirt Pick-up Resistance Fine Essence DPR: [www.stocorp.com/#sle](http://www.stocorp.com/#sle).
  - 2. Color: As selected by Architect from manufacturer's full range.
- B. Base Coat: Fiber-reinforced, acrylic or polymer-based product compatible with insulation board and reinforcing mesh, Class PB.
- C. Reinforcing Mesh: Balanced, open weave glass fiber fabric, treated for compatibility and improved bond with coating, weight, strength, and number of layers as required to meet required system impact rating.
- D. Water-Resistive Barrier: See Section 072500.
- E. Water-Resistant Transition Membrane: Water-based polymer material used with reinforcing fabric to seal around openings and penetrations, and to protect edges.
- F. Fluid-Applied Flashing: Flexible water based polymer material suitable for use with reinforcing mesh and, if used with water-resistive barrier sheet, certified compatible with sheet material.
- G. Flashing Tape: Self-adhering rubberized asphalt tape with polyethylene backing or other material and surface conditioner furnished or approved by EIFS manufacturer.

### **2.04 ACCESSORIES**

- A. Trim: EIFS manufacturer's standard PVC or galvanized steel trim accessories, as required for a complete project and including starter track and drainage accessories.
- B. Sealant Materials: Compatible with EIFS materials and as recommended by EIFS manufacturer.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that substrate is sound and free of oil, dirt, other surface contaminants, efflorescence, loose materials, or protrusions that could interfere with EIFS installation and is of a type and construction that is acceptable to EIFS manufacturer. Do not begin work until substrate and adjacent materials are complete and thoroughly dry.
- B. If paper-faced gypsum sheathing has been exposed to weather for more than 30 days, check for integrity of surface using method specified in ASTM C1397 Annex A2, at minimum of two locations or once every 5000 sq ft, whichever is greater; if any test fails, notify Architect and do not begin installation.
- C. Verify that substrate surface is flat, with no deviation greater than 1/4 in when tested with a 10 ft straightedge.

### **3.02 PREPARATION**

- A. Apply primer to substrate as recommended by EIFS manufacturer for project conditions.

### **3.03 INSTALLATION - GENERAL**

- A. Install in accordance with EIFS manufacturer's instructions and ASTM C1397.
  - 1. Where different requirements appear in either document, comply with the most stringent.
  - 2. Neither of these documents supercedes provisions of Contract Documents that defines contractual relationships between parties or scope of this work.

### **3.04 INSTALLATION - CLASS PB FINISH**

- A. Base Coat: Apply in thickness as necessary to fully embed reinforcing mesh, wrinkle free, including back-wrap at terminations of EIFS. Install reinforcing fabric as recommended by EIFS manufacturer.

1. Lap reinforcing mesh edges and ends a minimum of 2-1/2 inches.
  2. Allow base coat to dry a minimum of 24 hours before next coating application.
- B. Apply finish coat after base coat has dried not less than 24 hours, embed finish aggregate, and finish to a uniform texture and color.
  - C. Finish Coat Thickness: As recommended by manufacturer.
  - D. Seal control and expansion joints within the field of exterior finish and insulation system, using procedures recommended by sealant and finish system manufacturers.

**3.05 CLEANING**

- A. See Section 017000 - Execution and Closeout Requirements for additional requirements.
- B. Clean EIFS surfaces and work areas of foreign materials resulting from EIFS operations.

**3.06 PROTECTION**

- A. Protect completed work from damage and soiling by subsequent work.

**END OF SECTION**

**SECTION 072726  
FLUID-APPLIED MEMBRANE AIR BARRIERS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Fluid-applied membrane air barriers.

**1.02 RELATED REQUIREMENTS**

- A. Section 019119-Commissioning of Building Enclosure (BECx): Commissioning requirements and procedures.
- B. Section 042000 - Unit Masonry: Concrete masonry.
- C. Section 061000 - Rough Carpentry: Exterior sheathing.
- D. Section 079200 - Joint Sealants: Sealants applied to adjacent work.

**1.03 REFERENCE STANDARDS**

- A. ASTM C719 - Standard Test Method for Adhesion and Cohesion of Elastomeric Joint Sealants Under Cyclic Movement (Hockman Cycle); 2022.
- B. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.
- C. ASTM C1248 - Standard Test Method for Staining of Porous Substrate by Joint Sealants; 2022.
- D. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-- Tension; 2016 (Reapproved 2021).
- E. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection; 2021.
- F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023b.
- G. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2022a, with Editorial Revision (2023).
- H. ASTM E2178 - Standard Test Method for Determining Air Leakage Rate and Calculation of Air Permeance of Building Materials; 2021a.
- I. ASTM E2357 - Standard Test Method for Determining Air Leakage Rate of Air Barrier Assemblies; 2018.
- J. ASTM G154 - Standard Practice for Operating Fluorescent Ultraviolet (UV) Lamp Apparatus for Exposure of Nonmetallic Materials; 2023.

**1.04 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on material characteristics, performance criteria, and limitations.
- C. Shop Drawings: Provide drawings of special joint conditions.
- D. Manufacturer's Installation Instructions: Indicate preparation, installation methods, and storage and handling criteria.
- E. Manufacturer's qualification statement.
- F. Installer's qualification statement.
- G. Warranty Documentation: Submit manufacturer's warranty and ensure that forms have been completed in Owner's name and are registered with manufacturer.

**1.05 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than five years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least five years of documented experience.

**1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver materials to project site in original packaging with seals unbroken and properly labeled.
- B. Store materials in their original undamaged packaging within clean, dry, and protected location at a temperature less than 90 degrees F.

## 1.07 FIELD CONDITIONS

- A. Maintain temperature and humidity recommended by materials manufacturer before, during, and after installation.
  - 1. Do not apply air barrier products when air or substrate temperatures are above 100 degrees F or below 20 degrees F.
  - 2. Allow wet substrates to dry prior to applying air barrier products.

## 1.08 WARRANTY

- A. See Section 017800 - Closeout Submittals for additional warranty requirements.
- B. Warranty: Include coverage to repair or replace air barrier coatings and accessory products that demonstrate deterioration or failure within a 10-year period after Date of Substantial Completion due to material failure under normal use; failure includes water or air penetration through air barrier assembly.

## PART 2 PRODUCTS

### 2.01 MANUFACTURERS

- A. Fluid-Applied Membrane Air Barrier:
  - 1. Carlisle: [www.carlisleccw.com#sle](http://www.carlisleccw.com#sle).
  - 2. Dow Chemical Company: [www.dow.com/#sle](http://www.dow.com/#sle).
  - 3. Tremco: [www.tremcosealants.com#sle](http://www.tremcosealants.com#sle).
  - 4. W.R. Meadows, Inc.: [www.wrmeadows.com#sle](http://www.wrmeadows.com#sle).
  - 5. Substitutions: See Section 016000 - Product Requirements.

### 2.02 FLUID-APPLIED MEMBRANE AIR BARRIER ASSEMBLY

- A. Fluid-Applied Membrane Air Barrier: Single-component, vapor permeable, 100 percent silicone elastomeric air barrier.
  - 1. Dry Film Thickness (DFT): 30 mils, .03 inch, minimum.
  - 2. Air Permeance: 0.004 cfm/sq ft maximum leakage when tested at 1.57 psf pressure difference in accordance with ASTM E2178.
  - 3. Vapor Permeance: 10 perms, minimum, when tested in accordance with ASTM E96/E96M using Desiccant Method at 73.4 degrees F.
  - 4. Air Barrier Leakage: Not greater than 0.04 cfm/sq ft of surface area at pressure of 1.57 psf when tested in accordance with ASTM E2357.
  - 5. Ultraviolet (UV) Exposure: Rated for up to 5,000 hours of exposure in accordance with ASTM G154; not less than 12 months.
  - 6. Elongation: Greater than 1300 percent, when tested in accordance with ASTM D412.
  - 7. Surface Burning Characteristics: Flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E84.
  - 8. Nail Sealability: Pass head of water test in accordance with ASTM D1970/D1970M.
  - 9. Sealants, Tapes, and Accessories: As recommended by coating manufacturer.
- B. Primer: Water-based silicone adhesion promoter.
- C. Preformed Transition Strips and Molded Corners: Semi-rigid silicone elastomer extrusion, tear resistant, with tapered edges; applied and adhered with sealant.
- D. Preformed Flashing and Transition Seals: Factory formed silicone extrusion profile for adhered application to overlay face of joint.
  - 1. Profile Width: 3-1/2 inches wide, minimum.
- E. Weatherproofing Silicone Sealant: ASTM C920, Type S, Grade NS, Class 50, Uses NT, M, G, and A; not expected to withstand continuous water immersion or traffic.
  - 1. Joint Movement Capability: Plus or minus 50 percent, minimum, when tested in accordance with ASTM C719.
  - 2. Staining: None to concrete, brick, granite, or limestone when tested in accordance with ASTM C1248.
- F. Liquid Flashing: One part, neutral-cure silicone sealant, trowelable liquid flashing.
  - 1. Applied Thickness: 40 mils, nominal.

## **2.03 ACCESSORIES**

- A. Thinners and Cleaners: As recommended by material manufacturer.
- B. Crack Fillers: Provide substrate manufacturer's recommended crack fillers or sealants compatible with air barrier assembly components and adjacent materials.
- C. Block Filler: Provide air barrier coating manufacturer's recommended latex block filler compatible with substrate and adjacent materials.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that surfaces and conditions are ready to accept work of this section.
- B. Verify that surfaces are clean, dry, and free of frost, dust, dirt, grease, oil, curing compounds, form release agents, laitance, efflorescence, mildew, excess alkalinity, and other conditions affecting performance of this work.
- C. Proceed with work once conditions comply with air barrier coating manufacturer's recommendations.

### **3.02 PREPARATION**

- A. Protect work of other trades against damage from application of air barrier coatings.
- B. Protect adjacent surfaces not designated to receive air barrier coatings; provide protection for pedestrians, vehicles, landscaping, and surrounding areas to prevent contact with coating materials.
- C. Clean substrates to remove contaminants and foreign material by pressure cleaning, wire brushing, grinding or other method recommended by air barrier coatings manufacturer.
- D. Prepare substrates in accordance with air barrier coating manufacturer's written instructions.
- E. Repair deteriorated or damaged substrates, repair masonry joints, and fill cracks, voids, honeycombs, and other defects using materials as recommended by air barrier coating manufacturer, and allow patching materials to fully cure.
  - 1. Remove projections, protruding fasteners, and loose or foreign matter that might interfere with proper installation.
  - 2. Fill cracks larger than 1/16 inch wide using applicable joint sealant, and fill cracks larger than 1 inch wide using joint sealant and compatible bond breaker where movement is expected.
- F. Primer: Apply primer to substrates where required based upon preinstallation testing and air barrier coating manufacturer's recommendations, using application methods and rate of application recommended by manufacturer; allow primer to fully dry prior to application of air barrier coating.
  - 1. Apply block filler as primer on concrete masonry unit (CMU) substrates where required to fill pores and provide smooth application of air barrier coating.

### **3.03 APPLICATION**

- A. Apply air barrier system materials in accordance with manufacturer's instructions.
- B. Transition Strips and Silicone Sealants: Install with approved sealants in accordance with manufacturer's written instructions.
  - 1. Form sealed joints to windows, wall framing systems, door and louver frames, roofing system perimeters, and at interface with other adjacent materials utilizing compatible components that form air barrier assembly.
  - 2. Ensure laps and bonds are adhered to substrates.
- C. Air Barrier Coating: Apply air barrier coating using application methods and rate of application recommended by manufacturer, using nap roller or airless sprayer, in accordance with requirements of authorities having jurisdiction (AHJ).
  - 1. Provide wet application not less than 50 mils, 0.050 inch thick, or more as required by substrate conditions, with dry film thickness (DFT) not less than 30 mils, 0.030 inch thick.
  - 2. Apply additional coats as required to provide uniform, continuously cured, airtight and watertight film.



### **3.04 FIELD QUALITY CONTROL**

- A. See Section 014000 - Quality Requirements for additional requirements.
- B. Do not cover installed air barriers until required inspections have been completed.
- C. Owner may retain testing agency to perform the following tests:
  - 1. ASTM D4541 - Pull-off strength of air barrier membranes.
  - 2. AAMA 501.2 Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtain Walls, and Sloped Glazing Systems.
  - 3. E779 Standard Test Method for Determining Air Leakage Rate by Fan Pressurization.
  - 4. ASTM E283: Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
  - 5. ASTM E 1105 Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Wall by Uniform or Cyclic Static Air Pressure
- D. If testing indicates products or current installation does not meet requirements, Owner may have materials removed from substrates that are not in compliance, and have other necessary corrections made to ensure application meets designated requirements.

### **3.05 CLEANING**

- A. During completion of this work, remove overspray and excess material, using materials and methods approved by manufacturer that will not damage adjacent materials.
- B. Clean and repair adjacent surfaces damaged by air barrier coating application.

### **3.06 PROTECTION**

- A. Do not leave materials exposed to weather longer than recommended by manufacturer.
- B. Allow air barrier coatings to fully cure before exposure to traffic or other construction operations.
- C. Prevent damage to coatings from construction operations or other causes.
- D. Replace damaged air barrier coatings prior to concealment behind subsequent construction.

**END OF SECTION**

**SECTION 073116  
METAL SHINGLES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Steel shingles.
- B. Underlayment.
- C. Wood attachment members.
- D. Metal roof flashing and counterflashing.

**1.02 RELATED REQUIREMENTS**

- A. Section 019119-Commissioning of Building Enclosure (BECx): Commissioning requirements and procedures.
- B. Section 061000 - Rough Carpentry: Wood attachment members (battens, nailers, etc.).
- C. Section 076200 - Sheet Metal Flashing and Trim: Roof flashing.
- D. Section 077200 - Roof Accessories: Snow guards.

**1.03 REFERENCE STANDARDS**

- A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.
- B. ASTM A792/A792M - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process; 2022.
- C. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection; 2021.
- D. ASTM D3019/D3019M - Standard Specification for Lap Cement Used with Asphalt Roll Roofing, Non-Fibred, and Fibred; 2017.
- E. ASTM D4479/D4479M - Standard Specification for Asphalt Roof Coatings - Asbestos-Free; 2007 (Reapproved 2018).
- F. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2022a, with Editorial Revision (2023).
- G. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.
- H. UL 580 - Standard for Tests for Uplift Resistance of Roof Assemblies; Current Edition, Including All Revisions.
- I. UL 790 - Standard for Standard Test Methods for Fire Tests of Roof Coverings; Current Edition, Including All Revisions.
- J. UL 1897 - Uplift Tests for Roof-Covering Systems; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

**1.04 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Submit manufacturer's data sheets on shingles and underlayment, indicating material characteristics, installation instructions, limitations and precautions.
- C. Shop Drawings: For metal flashings and counterflashings, indicate overall configurations and thicknesses, details at complex intersections, jointing methods and locations, and fastening details.
- D. Selection Samples: Submit color chips representing manufacturer's full range of available shingle colors and finishes.
- E. Verification Samples: Set of shingles representing actual product in color, finish, and style, including special shapes and fittings.
- F. Manufacturer's Certificates: Certify that shingles supplied for project meet or exceed specified requirements.
- G. Manufacturer's qualification statement.
- H. Installer's qualification statement.
- I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 016000 - Product Requirements for additional provisions.
  - 2. Extra Shingles: Provide one box, including appropriate quantities for each color, size, and shape.

## 1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacture of roofing systems similar to those required for this project, with not less than 5 years of documented experience.
- B. Installer Qualifications: Company specializing in installing metal shingles, with at least 3 years of documented experience.

## 1.06 MOCK-UPS

- A. See Section 014000 - Quality Requirements for additional requirements.
- B. Provide a mock-up of selected style and color for evaluation of shingle installation workmanship, including typical eave, rake, valley, and ridge details.
  - 1. Minimum mock-up size: 4 by 4 feet.
- C. Locate where directed.
- D. Mock-up may remain as part of work.

## 1.07 DELIVERY, STORAGE, AND HANDLING

- A. See Section 017419 - Construction Waste Management and Disposal for packaging waste requirements.
- B. Deliver and store materials with labels intact in manufacturer's unopened packaging until ready for installation.
- C. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

## 1.08 FIELD CONDITIONS

- A. Do not install shingles, eave protection membrane or underlayment when surface, ambient air, or wind chill temperatures are below 45 degrees F.
- B. Protect surrounding areas and adjacent surfaces during execution of this work.

## 1.09 WARRANTY

- A. See Section 017800 - Closeout Submittals for additional warranty requirements.
- B. Provide manufacturer's standard 50 -year warranty against deterioration of shingle finish.
  - 1. Wind: Resist blow-off in wind speed up to 120 mph.
  - 2. Hail: Resist hail stone penetration, cracks, and splits. Hail stone size limit: 2.5".
- C. Extended Installer's Correction Period: Correct defective work within 5-year period commencing on Date of Substantial Completion.

## PART 2 PRODUCTS

### 2.01 METAL SHINGLES

- A. Steel Shingles: Comply with ASTM A653/A653M for hot-dip galvanized steel sheet or ASTM A792/A792M for hot-dip aluminum-zinc alloy coated steel sheet.
  - 1. Finish: Ceramic-coated, colored-stone chip finish.
  - 2. Fire Rating: UL 790, Class A.
  - 3. Wind Uplift Resistance: 20 psf, minimum, when tested in accordance with UL 1897 and UL 580.
  - 4. Warranted Wind Speed: Not less than the tested wind resistance.
  - 5. Thickness: 26 gauge, .0179 inch, nominal.
  - 6. Weight: 150 lb/100 sq ft, nominal.
  - 7. Profile: As indicated on drawings.
  - 8. Shingle Size: As selected from manufacturer's standards.
  - 9. Color: As selected by Architect from manufacturer's full range.
  - 10. Products: Basis of Design: Pacific Tile by Unified Steel.
    - a. Substitutions: See Section 016000 - Product Requirements.
- B. Special Shapes and Fittings: Supply special shapes and fittings of same material and finish as adjacent shingles, factory-formed, as indicated on drawings or as required for specific project conditions, including but not limited to hip caps, ridge caps, rake edges, eave edges, and termination caps.

## 2.02 SHEET MATERIALS

- A. Underlayment: Synthetic non-asphaltic sheet, intended by manufacturer for mechanically fastened roofing underlayment without sealed seams.
  - 1. Type: Woven polypropylene with anti-slip polyolefin coating on both sides.
  - 2. Self Sealability: Passing nail sealability test specified in ASTM D1970/D1970M.
  - 3. Low Temperature Flexibility: Passing test specified in ASTM D1970/D1970M.
  - 4. Fasteners: Provide as required by manufacturer and in accordance with local building code requirements.
  - 5. Products:
    - a. Certainteed Roofing: [www.certainteed.com/#sle](http://www.certainteed.com/#sle).
    - b. System Components Corporation, Inc: [www.systemcomponents.net/#sle](http://www.systemcomponents.net/#sle).
    - c. Substitutions: See Section 016000 - Product Requirements.
- B. Eave Protection Membrane and Flexible Flashing: Self-adhering polymer-modified asphalt sheet complying with ASTM D1970/D1970M; minimum thickness of 40 mil, 0.040 inch; with strippable release paper and slip-resistant embossed polyethylene sheet top surface.

## 2.03 METAL FLASHING

- A. Provide metal roof flashings as indicated and as required for watertight roofing system, including eave edge, gable edge, ridge vent, open valley, and chimney flashing.
  - 1. Form flashings to profiles indicated, or as required to shed water and protect building from water damage.
  - 2. Form sections square, flat, and accurate to profile, in maximum possible lengths, free from distortion or other defects detrimental to function or appearance.
  - 3. Hem exposed edges of flashings minimum 1/4 inch on underside.
  - 4. Coat concealed surfaces of flashings with bituminous paint.
- B. Galvanized Steel Flashing: ASTM A653/A653M, with G90/Z275 zinc coating; minimum 0.018-inch thick base metal.

## 2.04 ACCESSORIES

- A. Fasteners:
  - 1. Underlayment Fasteners: Hot-dip galvanized steel roofing nails, 11 gauge, 0.12 inch minimum diameter, sharp pointed with barbed shanks, minimum 3/8 inch diameter head, and of length sufficient to penetrate 3/4 inch into solid substrate or completely through roof sheathing.
  - 2. Shingle Fasteners: Stainless steel ring shank nails, 10 gauge, 0.134 inch minimum diameter, with 3/8 inch minimum diameter head, and of sufficient length to penetrate 3/4 inch into solid substrate or completely through roof sheathing.
- B. Bituminous Paint: Asphaltic mastic, ASTM D4479/D4479M, Type I.
- C. Attachment Members:
  - 1. Material: Wood; pressure preservative treated.
  - 2. Nailers: Nominal 2-inch thick members, height as required for specific conditions.
- D. Wind Locks: Formed copper, brass, galvanized steel, or stainless steel wire clips designed to prevent wind uplift of lower shingle edge; length and thickness as recommended by manufacturer for specific project conditions.
- E. Snow Guards: See Section 077200.

## PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Examine structural roof deck for compliance with specified requirements, and verify that roof penetrations and roof openings are correctly installed in proper locations.
- B. Do not begin installation of shingle roofing until substrates have been properly prepared. If substrate preparation is responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

### 3.02 PREPARATION

- A. Broom clean deck surface prior to installation of underlayment or eave protection.
- B. Prepare roof deck surfaces using methods recommended by shingle manufacturer for achieving best results under project conditions.
- C. Seal roof deck joints wider than 1/16 inch as recommended by shingle manufacturer.
- D. Install eave edge and gable edge flashings tight with fascia, in accordance with SMACNA (ASMM) recommendations, lap joints minimum 2 inches and seal with roof cement.

### 3.03 INSTALLATION

- A. Install metal shingle roofing system in accordance with manufacturer's instructions.
- B. Eave Protection: Install from eave edge to minimum 2 feet up-slope beyond projected interior face of exterior wall.
  - 1. Install eave protection membrane in accordance with manufacturer's installation instructions for project substrate.
- C. Underlayment:
  - 1. Roof Slopes of 4:12 to 20:12: Install one layer of synthetic underlayment over entire roof area, perpendicular to roof slope, with ends and edges weather lapped a minimum of 4 inches; stagger end laps of each layer, and nail in place.
- D. Valley Protection Membrane: Install full width Self-adhering polymer-modified asphalt sheet centered at valleys, in accordance with manufacturer's installation instructions for project substrate. Weather lap joints a minimum of 12 inches.
- E. Metal Valley Flashings:
  - 1. Open Valleys: Install minimum 24-inch wide flashing over valley protection membrane, centered over valley and crimped to guide water; fasten to deck with cleats. Overlap end joints minimum 8 inches, blind nailing upper end of each sheet;
    - a. Lap underlayment over edges of flashing a minimum of 4 inches.
- F. Sheet Metal Flashing: Install flashing at other locations as indicated and as required by project conditions.
  - 1. Install flashing at all locations where metal shingles intersect other roofs, walls, parapets, chimneys, ventilators, and similar projections.
  - 2. Install drip edge flashing at eaves prior to installing underlayment.
  - 3. Install drip edge flashing on downslope roof edges after installation of underlayment.
- G. Flexible Flashing: Apply flexible flashing in concealed locations where metal flashing would be difficult to apply effectively.
- H. Attachment Members:
  - 1. Nailers: Install nailers at ridge and hips, directly over underlayment, and protect with additional layer of underlayment before installing ridge and hip shingles and accessories.
- I. Metal Shingles:
  - 1. Install first row of shingles at eaves with minimum projection as recommended by shingle manufacturer.
  - 2. Lay shingles square with building lines and parallel with roof slope, and install filler, closure, and mitered pieces as required.
  - 3. Stagger joints between courses.
  - 4. Nail shingles by driving nails to point where nail heads just clear surface of shingle, so shingles hang on nails; do not overdrive nails, putting pressure on underlying shingles, and do not underdrive nails, putting strain on overlying shingles.
  - 5. Cut and fit shingles neatly around vents, pipes, and other projections.
  - 6. Set ridge and hip shingles as recommended by shingle manufacturer.
  - 7. Install accessories in accordance with manufacturer's details and recommendations.

### 3.04 CLEANING

- A. Clean exposed work upon completion of installation; remove grease and oil films, excess joint sealer, handling marks, and debris from installation, leaving work clean and unmarked, free from dents, creases, waves, scratch marks, or other damage to finish.

### **3.05 PROTECTION**

- A. Minimize traffic over finished roof surface, and where walking on roof is absolutely necessary, wear soft-soled shoes and walk on butt of shingles to avoid denting, deformation, and other damage.
- B. Remove and replace damaged, dented, or deformed shingles before Date of Substantial Completion.

**END OF SECTION**

**SECTION 074213  
METAL WALL PANELS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Manufactured metal panels for walls and soffits, with related flashings and accessory components.

**1.02 RELATED REQUIREMENTS**

- A. Section 019119-Commissioning of Building Enclosure (BECx): Commissioning requirements and procedures.
- B. Section 072100 - Thermal Insulation.
- C. Section 07276-Fluid-Applied Membrane Air Barriers: Membrane barrier over sheathing.
- D. Section 092116 - Gypsum Board Assemblies: Wall panel substrate.

**1.03 REFERENCE STANDARDS**

- A. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.
- B. AAMA 609 & 610 - Cleaning and Maintenance Guide for Architecturally Finished Aluminum (Combined Document); 2015.
- C. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.
- D. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric); 2014.
- E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023b.

**1.04 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Show layout and elevations, dimensions and thickness of panels, connections, details and location of joints, sealants and gaskets, method of anchorage, support clips, exposed fasteners, number of anchors, supports, reinforcement, trim, flashings, and accessories.
  - 1. Indicate panel numbering system.
  - 2. Differentiate between shop and field fabrication.
  - 3. Indicate substrates and adjacent work with which the wall system must be coordinated.
  - 4. Include large-scale details of anchorages and connecting elements.
  - 5. Include large-scale details or schematic, exploded or isometric diagrams to fully explain flashing at a scale of not less than 3 inches.
  - 6. Include design engineer's stamp or seal on shop drawings for attachments and anchors.
- C. Samples: Submit one samples of wall panel, 12 inch by 24 inch in size illustrating finish color, sheen, and texture.
- D. Manufacturer's Qualification Statement.
- E. Installer's Qualification Statement.

**1.05 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.
- B. Installer Qualifications: Company specializing in installing the products specified in this section with minimum three years of documented experience.

**1.06 MOCK-UP**

- A. Construct mock-up, 8 feet long by 4 feet wide; include panel and soffit system, glazing, attachments to building frame, associated vapor retarder and air seal materials, weep drainage system, sealants and seals, related insulation in mock-up.
- B. Locate where directed.
- C. Mock-up may remain as part of the Work.

## 1.07 DELIVERY, STORAGE, AND HANDLING

- A. Protect panels from accelerated weathering by removing or venting sheet plastic shipping wrap.
- B. Store prefinished material off ground and protected from weather. Prevent twisting, bending, or abrasion, and provide ventilation to stored materials. Slope metal sheets to ensure drainage.

## 1.08 WARRANTY

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. Special Warranty: Provide 2-year warranty covering water tightness and integrity of seals of wall panels. Complete forms in Owner's name and register with warrantor.
- C. Finish Warranty: Provide 20-year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking. Complete forms in Owner's name and register with warrantor.

## PART 2 PRODUCTS

### 2.01 MANUFACTURERS

- A. Metal Wall Panels - Concealed Fasteners:
  - 1. Basis of Design: Morin Corporation; Concealed Fasteners Z-12 and F-12-S:  
[www.morincorp.com/#sle](http://www.morincorp.com/#sle).
  - 2. Substitutions: See Section 016000 - Product Requirements.

### 2.02 MANUFACTURED METAL PANELS

- A. Wall Panel System: Factory fabricated prefinished metal panel system, site assembled.
  - 1. Provide exterior panels, interior liner panels, soffit panels, and subgirt framing assembly.
  - 2. Design and size components to withstand dead and live loads caused by positive and negative wind pressure acting normal to plane of wall.
  - 3. Maximum Allowable Deflection of Panel: 1/90 of span.
  - 4. Movement: Accommodate movement within system without damage to components or deterioration of seals, movement within system; movement between system and perimeter components when subject to seasonal temperature cycling; dynamic loading and release of loads; and deflection of structural support framing.
  - 5. Drainage: Provide positive drainage to exterior for moisture entering or condensation occurring within panel system.
  - 6. Fabrication: Formed true to shape, accurate in size, square, and free from distortion or defects; pieces of longest practical lengths.
  - 7. Corners: Factory-fabricated in one continuous piece with minimum 18 inch returns.
  - 8. Provide continuity of air barrier and vapor retarder seal at building enclosure elements in accordance with materials specified in Section 072500.
- B. Exterior Panels: MP-1
  - 1. Profile: Morin F-10-2.
  - 2. Material: Precoated aluminum, .032 minimum thickness.
  - 3. Panel Width: 12"
  - 4. Color: Dark Bronze.
- C. Exterior Panels: MP-2
  - 1. Profile: Morin F-8-0
  - 2. Material: Precoated aluminum, .032 minimum thickness.
  - 3. Panel Width: 12"
  - 4. Color: Dark Bronze.
- D. Internal and External Corners: Same material, thickness, and finish as exterior sheets; profile to suit system; shop cut and factory mitered to required angles.
- E. Trim: Same material, thickness and finish as exterior sheets; brake formed to required profiles. Provide trim to cover back-up framing where occurs- coordinate with drawings.
- F. Anchors: Galvanized steel or Stainless steel.

### 2.03 MATERIALS

- A. Precoated Aluminum Sheet: ASTM B209 (ASTM B209M); continuous-coil-coated on exposed surfaces with specified finish coating and on panel back with specified panel back coating.



## **2.04 FINISHES**

- A. Exposed Surface Finish: Panel manufacturer's standard polyvinylidene fluoride (PVDF) coating, top coat over epoxy primer.

## **2.05 ACCESSORIES**

- A. Gaskets: Manufacturer's standard type suitable for use with system, permanently resilient; ultraviolet and ozone resistant.
- B. Concealed Sealants: Non-curing butyl sealant or tape sealant.
- C. Support for Cladding and Continuous Insulation: Thermal clip and rail. Basis of Design: ISO Clip by Northern Facades Ltd.
  - 1. Clip Material: 14ga ASTM A792 Galvalume or ASTM A653 Galvanized, steel.
  - 2. Thermal Isolator Pad: Glass fiber reinforced polyimide.
  - 3. Thickness: To accommodate specified insulation. Adjustable up to plus or minus 1/2".
  - 4. Fasteners: Provide support system and cladding attachment fasteners as recommended by system manufacturer in accordance with requirements.
  - 5. Manufacturers:
    - a. Advanced Architectural Products; Green Girt. [www.greengirt.com](http://www.greengirt.com).
    - b. Knight Wall Systems; MFI System. [www.knightwallsystems.com](http://www.knightwallsystems.com).
  - 6. Substitutions: See Section 016000-Product Requirements.
- D. Fasteners: Manufacturer's standard type to suit application; with soft neoprene washers, steel, hot dip galvanized. Fastener cap same color as exterior panel.
  - 1. Metal-to-Metal Fasteners: Self-drilling, self-tapping screws.
- E. Touch-up Paint: As recommended by panel manufacturer.
- F. Bituminous Paint: Asphalt base.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that building framing members are ready to receive panels.
- B. Verify that weather barrier has been installed over substrate completely and correctly.

### **3.02 PREPARATION**

- A. Install subgirts perpendicular to panel length, securely fastened to substrates and shimmed and leveled to uniform plane. Space at intervals indicated.

### **3.03 INSTALLATION**

- A. Install panels on walls in accordance with manufacturer's instructions.
- B. Protect surfaces in contact with cementitious materials and dissimilar metals with bituminous paint. Allow to dry prior to installation.
- C. Fasten panels to structural supports; aligned, level, and plumb.
- D. Locate joints over supports.
- E. Lap panel ends minimum 2 inches.
- F. Provide expansion joints where indicated.
- G. Use concealed fasteners unless otherwise approved by Architect.
- H. Seal and place gaskets to prevent weather penetration. Maintain neat appearance.

### **3.04 TOLERANCES**

- A. Maximum Offset From True Alignment Between Adjacent Members Butting or In Line: 1/16 inch.
- B. Maximum Variation from Plane or Location Indicated on Drawings: 1/4 inch.

### **3.05 CLEANING**

- A. Remove site cuttings from finish surfaces.
- B. Remove protective material from wall panel surfaces.
- C. Clean and wash prefinished surfaces with mild soap and water; rinse with clean water.

**END OF SECTION**

**SECTION 075423  
THERMOPLASTIC POLYOLEFIN (TPO) MEMBRANE ROOFING**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Adhered system with thermoplastic polyolefin (TPO) roofing membrane.
- B. Insulation, flat and tapered.
- C. Deck sheathing.
- D. Roofing cant strips, stack boots, roofing expansion joints, and walkway pads.

**1.02 RELATED REQUIREMENTS**

- A. Section 076200 - Sheet Metal Flashing and Trim: Counterflashings, reglets.

**1.03 REFERENCE STANDARDS**

- A. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; 2023.
- B. ASTM D6878/D6878M - Standard Specification for Thermoplastic Polyolefin-Based Sheet Roofing; 2021.
- C. FM (AG) - FM Approval Guide; Current Edition.
- D. FM DS 1-28 - Wind Design; 2015, with Editorial Revision (2022).
- E. FM DS 1-29 - Roof Deck Securement and Above-Deck Roof Components; 2016, with Editorial Revision (2022).
- F. NRCA (RM) - The NRCA Roofing Manual; 2024.
- G. UL 790 - Standard for Standard Test Methods for Fire Tests of Roof Coverings; Current Edition, Including All Revisions.

**1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Preinstallation Meeting: Convene one week before starting work of this section.
  - 1. Review preparation and installation procedures and coordinating and scheduling required with related work.

**1.05 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide manufacturer's written information listed below.
  - 1. Product data indicating membrane materials, flashing materials, insulation, vapor retarder, surfacing, and fasteners.
  - 2. Preparation instructions and recommendations.
  - 3. Storage and handling requirements.
- C. Shop Drawings: Indicate joint or termination detail conditions, conditions of interface with other materials, setting plan for tapered insulation, and mechanical fastener layout.
- D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- E. Manufacturer's Installation Instructions: Indicate membrane seaming precautions and perimeter conditions requiring special attention.
- F. Warranty:
  - 1. Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
  - 2. Submit installer's certification that installation complies with all warranty conditions for the waterproof membrane.
- G. Manufacturer's Qualification Statement.
- H. Installer's Qualification Statement.

**1.06 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum twenty (20) years of documented experience.
- B. Installer Qualifications: Company specializing in performing the work of this section:
  - 1. With minimum five (5) years documented experience.
  - 2. Approved by membrane manufacturer.

### **1.07 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver products in manufacturer's original containers, dry, undamaged, with seals and labels intact.
- B. Protect products in weather protected environment, clear of ground and moisture.
- C. Protect foam insulation from direct exposure to sunlight.
- D. Provide Safety Data Sheets (SDS) at the project site at all times during transportation, storage, and installation of materials.
- E. Comply with requirements from Owner to prevent overloading or disturbance of the structure when loading materials onto the roof.

### **1.08 FIELD CONDITIONS**

- A. Do not apply roofing membrane during unsuitable weather. Refer to manufacturer's written instructions.
- B. Do not apply roofing membrane when ambient temperature is below 40 degrees F or above 100 degrees F.
- C. Do not apply roofing membrane to damp or frozen deck surface or when precipitation is expected or occurring.
- D. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed the same day.
- E. Proceed with work so new roofing materials are not subject to construction traffic as work progresses.
- F. Do not allow grease, oil, fats, or other contaminants to come into direct contact with membrane.

### **1.09 WARRANTY**

- A. See Section 017800 - Closeout Submittals for additional warranty requirements.
- B. Material Warranty: Provide membrane manufacturer's warranty agreeing to replace material that shows manufacturing defects within 10 years after installation.
- C. System Warranty: Provide manufacturer's system warranty agreeing to repair or replace roofing that leaks or is damaged due to wind or other natural causes.
  - 1. Warranty Term: 20 years.
  - 2. For repair and replacement include costs of both material and labor in warranty.
  - 3. Include accidental punctures according to the manufacturer's standard warranty terms.
  - 4. Include hail damage according to the manufacturer's standard warranty terms.
  - 5. Exceptions NOT Permitted:
    - a. Damage due to roof traffic.
    - b. Damage due to wind of speed greater than 56 mph but less than 90 mph.

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURER**

- A. Basis of Design: GAF EverGuard Extreme
- B. Carlisle SynTec Systems: [www.carlisle-syntec.com/#sle](http://www.carlisle-syntec.com/#sle).
- C. Versico Roofing Systems: [www.versico.com/#sle](http://www.versico.com/#sle).
- D. Mule-Hide Products Co, Inc: [www.mulehide.com/#sle](http://www.mulehide.com/#sle).
- E. Substitutions: See Section 016000 - Product Requirements.

### **2.02 ROOFING APPLICATIONS**

- A. TPO Membrane Roofing: One ply membrane, fully adhered, over insulation.
- B. Roofing Assembly Performance Requirements and Design Criteria:
  - 1. Factory Mutual Classification: Class 1 and windstorm resistance of 1-90, in accordance with FM DS 1-28.

### **2.03 ROOFING MEMBRANE AND ASSOCIATED MATERIALS**

- A. Membrane:
  - 1. Material: Thermoplastic Polyolefin (TPO) complying with ASTM D6878/D6878M.
  - 2. Thickness: 60 mil (0.060 inch), minimum.
  - 3. Color: White.
- B. Seaming Materials: As recommended by membrane manufacturer.

- C. Flexible Flashing Material: Same material as membrane.
- D. Base Flashing: Provide waterproof, fully adhered base flashing system at all penetrations, plane transitions, and terminations.

#### **2.04 COVER BOARDS**

- A. Cover Board: Polyisocyanurate (ISO) thermal board, complying with ASTM C1289; Type II - Faced with coated-glass facer on both major surfaces of core foam, Class 4 with thickness of 1/2 inch, and Grade 1 with 109 psi, maximum, compressive strength.
  - 1. Product: GAF EnergyGuard HD Plus Polyiso.

#### **2.05 INSULATION**

- A. Polyisocyanurate (ISO) Board Insulation: Complies with ASTM C1289, Type II, Class 1 - Faced with glass-reinforced felt on both surfaces of core foam.
  - 1. Tapered Board: Slope as indicated; minimum thickness 1/2 inch; fabricate of fewest layers possible.
  - 2. Grade and Compressive Strength: Grade 2, 20 psi, minimum.
  - 3. Board Thickness: To meet R-30 minimum.
  - 4. Product: BOD- EnergyGuard Polyiso Insulation by GAF.

#### **2.06 ACCESSORIES**

- A. Prefabricated Roofing Expansion Joint Flashing: Sheet butyl over closed-cell foam backing seamed to galvanized steel flanges.
- B. Prefabricated Flashing Accessories:
  - 1. Corners and Seams: Same material as membrane, in manufacturer's standard thicknesses.
  - 2. Penetrations: Same material as membrane, with manufacturer's standard cut-outs, rigid inserts, clamping rings, and flanges.
  - 3. Sealant Pockets: Same material as membrane, with manufacturer's standard accessories, in manufacturer's standard configuration.
  - 4. Pressure Sensitive Cover Strips: 6 inches wide, 45 mil, 0.045 inch thick, non-reinforced TPO membrane laminated to 35 mil, 0.035 inch thick cured synthetic rubber with pressure sensitive adhesive.
  - 5. Pressure Sensitive Cover Strips: 6 inches wide, 45 mil, 0.045 inch thick, non-reinforced TPO membrane laminated to 35 mil, 0.035 inch thick cured synthetic rubber with pressure sensitive adhesive.
  - 6. Miscellaneous Flashing: Non-reinforced TPO membrane; 80 mil, 0.080 inch thick, in manufacturer's standard lengths and widths.
- C. Insulation Fasteners: Appropriate for purpose intended and approved by roofing manufacturer.
  - 1. Length as required for thickness of insulation material and penetration of deck substrate, with metal washers.
- D. Membrane Adhesive: As recommended by membrane manufacturer.
- E. Surface Conditioner for Adhesives: Compatible with membrane and adhesives.
- F. Sealants: As recommended by membrane manufacturer.
- G. Cleaner: Manufacturer's standard, clear, solvent-based cleaner.
  - 1. Product: Carlisle Weathered Membrane Cleaner.
- H. Edgings and Terminations: Manufacturer's standard edge and termination accessories.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Verify that surfaces and site conditions are ready to receive work.
- B. Verify deck is supported and secure.
- C. Verify deck is clean and smooth, flat, free of depressions, waves, or projections, properly sloped and suitable for installation of roof system.
- D. Verify deck surfaces are dry and free of snow or ice.
- E. Verify that roof openings, curbs, and penetrations through roof are solidly set, and cant strips are in place.

### **3.02 PREPARATION, GENERAL**

- A. Clean substrate thoroughly prior to roof application.
- B. Do not begin work until other work that requires foot or equipment traffic on roof is complete.

### **3.03 INSTALLATION - GENERAL**

- A. Perform work in accordance with manufacturer's instructions and NRCA (RM) applicable requirements.
- B. Do not apply roofing membrane during unsuitable weather.
- C. Do not apply roofing membrane when ambient temperature is outside the temperature range recommended by manufacturer.
- D. Do not apply roofing membrane to damp or frozen deck surface or when precipitation is expected or occurring.
- E. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed the same day.

### **3.04 INSULATION APPLICATION**

- A. Attachment of Insulation:
  - 1. Mechanically fasten insulation to deck in accordance with roofing manufacturer's instructions and Factory Mutual requirements.
- B. Lay subsequent layers of insulation with joints staggered minimum 6 inch from joints of preceding layer.
- C. Place tapered insulation to the required slope pattern in accordance with manufacturer's instructions.
- D. On metal deck, place boards parallel to flutes with insulation board edges bearing on deck flutes.
- E. Lay boards with edges in moderate contact without forcing, and gap between boards no greater than 1/4 inch. Cut insulation to fit neatly to perimeter blocking and around penetrations through roof.
- F. At roof drains, use factory-tapered boards to slope down to roof drains over a distance of 18 inches.
- G. Do not apply more insulation than can be completely waterproofed in the same day.

### **3.05 MEMBRANE APPLICATION**

- A. Roll out membrane, free from wrinkles or tears. Place sheet into place without stretching.
- B. Shingle joints on sloped substrate in direction of drainage.
- C. Fully Adhered Application: Apply adhesive at manufacturer's recommended rate. Fully embed membrane in adhesive except in areas directly over or within 3 inches of expansion joints. Fully adhere one roll before proceeding to adjacent rolls.
- D. Seam Welding:
  - 1. Seam Welding: Overlap edges and ends and seal seams by heat welding, minimum 2 inches.
  - 2. Cover seams with manufacturer's recommended joint covers.
  - 3. Probe seams once welds have thoroughly cooled, in approximately 30 minutes.
  - 4. Repair deficient seams within the same day.
  - 5. Seal cut edges of reinforced membrane after seam probe is complete.
- E. At intersections with vertical surfaces:
  - 1. Extend membrane over cant strips and up a minimum of 4 inches onto vertical surfaces.
  - 2. Fully adhere flexible flashing over membrane and up to nailing strips.
- F. Install roofing expansion joints where indicated. Make joints watertight.
- G. Install prefabricated joint components in accordance with manufacturer's instructions.
- H. Coordinate installation of roof drains and sumps and related flashings. Locate all field splices away from low areas and roof drains. Lap upslope sheet over downslope sheet.
- I. Daily Seal: Install daily seal per manufacturers instructions at the end of each work day. Prevent infiltration of water at incomplete flashings, terminations, and at unfinished membrane edges.

### **3.06 CLEANING**

- A. Remove wrappings, empty containers, paper, and other debris from the roof daily. Dispose of debris in compliance with local, State, and Federal regulations.
- B. Remove bituminous markings from finished surfaces.
- C. In areas where finished surfaces are soiled by work of this section, consult manufacturer of surfaces for cleaning advice and conform to their documented instructions.
- D. Repair or replace defaced or damaged finishes caused by work of this section.

### **3.07 PROTECTION**

- A. Protect installed roofing and flashings from construction operations.
- B. Where traffic must continue over finished roof membrane, protect surfaces using durable materials.

**END OF SECTION**

**SECTION 076200  
SHEET METAL FLASHING AND TRIM**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Fabricated sheet metal items, including flashings, counterflashings, gutters, and downspouts.
- B. Sealants for joints within sheet metal fabrications.
- C. Accessories.
- D. Precast concrete splash pads.

**1.02 RELATED REQUIREMENTS**

- A. ***Section 019119-Commissioning of Building Enclosure (BECx): Commissioning requirements and procedures.***
- B. Section 061000 - Rough Carpentry: Wood nailers for sheet metal work.
- C. Section 079200 - Joint Sealants: Sealing non-lap joints between sheet metal fabrications and adjacent construction.

**1.03 REFERENCE STANDARDS**

- A. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.
- B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.
- C. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.
- D. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric); 2014.
- E. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.
- F. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement, Asbestos-Free; 2007 (Reapproved 2018).
- G. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.
- H. ANSI/SPRI ES-1 - Wind Design Standard for Edge Systems.

**1.04 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Documentation that submitted materials meet ANSI/SPRI ES-1.
- C. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.
- D. Samples: Submit one samples 12x12 inch in size illustrating metal finish color.

**1.05 QUALITY ASSURANCE**

- A. Perform work in accordance with CDA A4050, SMACNA (ASMM), CDA A4050, and SMACNA (ASMM) requirements and standard details, except as otherwise indicated.
- B. Fabricator and Installer Qualifications: Company specializing in sheet metal work with 5 years of documented experience.

**1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.
- B. Prevent contact with materials that could cause discoloration or staining.

**PART 2 PRODUCTS**

**2.01 SHEET MATERIALS \*COLOR TO MATCH METAL PANEL COLOR- COLOR VARIES WITH LOCATION\***

- A. Galvanized Steel: ASTM A653/A653M, with G90/Z275 zinc coating; minimum 24 gage (0.0239 inch) thick base metal.
- B. Pre-Finished Aluminum: ASTM B209 (ASTM B209M); 20 gage (0.032 inch) thick; plain finish shop pre-coated with modified silicone coating.

1. Modified Silicone Polyester Coating: Pigmented Organic Coating System, AAMA 2603; baked enamel finish system.

## **2.02 ACCESSORIES**

- A. Fasteners: Galvanized steel , with soft neoprene washers.
- B. Primer: Zinc chromate type.
- C. Protective Backing Paint: Zinc molybdate alkyd.
- D. Sealant to be Concealed in Completed Work: Non-curing butyl sealant.
- E. Sealant to be Exposed in Completed Work: ASTM C920; elastomeric sealant, 100 percent silicone with minimum movement capability of plus/minus 25 percent and recommended by manufacturer for substrates to be sealed; clear.
- F. Sealant: specified in Section 07 9005.
- G. Plastic Cement: ASTM D4586, Type I.

## **2.03 FABRICATION**

- A. Form sections true to shape, accurate in size, square, and free from distortion or defects.
- B. Form pieces in longest possible lengths.
- C. Hem exposed edges on underside 1/2 inch; miter and seam corners.
- D. Form material with flat lock seams, except where otherwise indicated. At moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.
- E. Fabricate corners from one piece with minimum 18 inch long legs; seam for rigidity, seal with sealant.
- F. Fabricate flashings to allow toe to extend 2 inches over roofing gravel. Return and brake edges.

## **2.04 GUTTER AND DOWNSPOUT FABRICATION**

- A. Downspouts: Rectangular profile. Color to match roof assembly.
- B. Accessories: Profiled to suit gutters and downspouts.
  1. Anchorage Devices: In accordance with SMACNA requirements.
  2. Gutter Supports: Brackets.
  3. Downspout Supports: Brackets.
- C. Splash Pads: Precast concrete type, of size and profiles indicated; minimum 3000 psi at 28 days, with minimum 5 percent air entrainment.
- D. Downspout Boots: Steel.
- E. Seal metal joints.

## **2.05 ACCESSORIES**

- A. Fasteners: Galvanized steel, with soft neoprene washers.
- B. Primer: Zinc chromate type.
- C. Concealed Sealants: Non-curing butyl sealant.
- D. Exposed Sealants: ASTM C920; elastomeric sealant, with minimum movement capability as recommended by manufacturer for substrates to be sealed; color to match adjacent material.
- E. Plastic Cement: ASTM D4586/D4586M, Type I.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.
- B. Verify roofing termination and base flashings are in place, sealed, and secure.

### **3.02 PREPARATION**

- A. Install starter and edge strips, and cleats before starting installation.
- B. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil.

### **3.03 INSTALLATION**

- A. Secure flashings in place using concealed fasteners. Use exposed fasteners only where permitted.



- B. Apply plastic cement compound between metal flashings and felt flashings.
- C. Fit flashings tight in place. Make corners square, surfaces true and straight in planes, and lines accurate to profiles.
- D. Seal metal joints watertight.
- E. Secure gutters and downspouts in place with concealed fasteners.
- F. Connect downspouts to downspout boots, and seal connection watertight.
- G. Set splash pads under downspouts.

#### **3.04 FIELD QUALITY CONTROL**

- A. Inspection will involve surveillance of work during installation to ascertain compliance with specified requirements.

**END OF SECTION**

**SECTION 077200  
ROOF ACCESSORIES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Roof hatches, manual and automatic operation, including smoke vents.
- B. Snow guards.

**1.02 RELATED REQUIREMENTS**

- A. Section 053100 - Steel Decking.
- B. Section 073116 - Metal Shingles.

**1.03 REFERENCE STANDARDS**

- A. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.
- B. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.
- C. FM (AG) - FM Approval Guide; Current Edition.
- D. UL (DIR) - Online Certifications Directory; Current Edition.

**1.04 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's data sheets on each product to be used.
  - 1. Preparation instructions and recommendations.
  - 2. Storage and handling requirements and recommendations.
  - 3. Installation methods.
  - 4. Maintenance requirements.
  - 5. For smoke hatches, submit evidence of approval by evaluation agency specified.
- C. Shop Drawings: Submit detailed layout developed for this project and provide dimensioned location and number for each type of roof accessory.
- D. Certificate: For smoke hatches, provide certificate of approval from authority having jurisdiction.
- E. Warranty Documentation:
  - 1. Submit manufacturer warranty.
  - 2. Ensure that forms have been completed in Owner's name and registered with manufacturer.
  - 3. Submit documentation that roof accessories are acceptable to roofing manufacturer, and do not limit the roofing warranty.

**1.05 DELIVERY, STORAGE, AND HANDLING**

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Store products under cover and elevated above grade.

**1.06 WARRANTY**

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within a five year period after Date of Substantial Completion.

**PART 2 PRODUCTS**

**2.01 ROOF HATCHES, MANUAL AND AUTOMATIC OPERATION**

- A. Roof Hatch Manufacturers:
  - 1. Activar Construction Products Group - JL Industries: [www.activarcpg.com/#sle](http://www.activarcpg.com/#sle).
  - 2. Babcock-Davis: [www.babcockdavis.com/#sle](http://www.babcockdavis.com/#sle).
  - 3. Bilco Company: [www.bilco.com/#sle](http://www.bilco.com/#sle).
  - 4. Milcor, Inc: [www.milcorinc.com/#sle](http://www.milcorinc.com/#sle).
- B. Smoke and Heat Vent Manufacturers: Basis of Design: BILCO Company - ACDSH Acoustically Sound Rated.
  - 1. Acudor Products Inc: [www.acudor.com/#sle](http://www.acudor.com/#sle).

2. Babcock-Davis: [www.babcockdavis.com/#sle](http://www.babcockdavis.com/#sle).
  3. Kingspan Light + Air, LLC; formerly Bristolite Daylighting Systems, Inc: [www.bristolite.com/#sle](http://www.bristolite.com/#sle).
  4. Nystrom, Inc: [www.nystrom.com/#sle](http://www.nystrom.com/#sle).
  5. Substitutions: See Section 016000 - Product Requirements.
- C. Roof Hatches and Smoke Vents, General: Factory-assembled steel frame and cover, complete with operating and release hardware.
1. Style: Provide flat metal covers unless otherwise indicated.
  2. Mounting: Provide frames and curbs suitable for mounting conditions indicated on the drawings.
  3. For Ladder Access: Single leaf; 30x36 inches.
- D. Smoke and Heat Vents: Where "smoke" or "smoke/heat" operation is indicated, provide following additional features and omit manual operation for access.
1. Smoke Release Mechanism: Automatic opening on melting of replaceable UL (DIR) listed fusible link at 165 deg F.
  2. UL (DIR) or FM (AG) listed as automatically operated smoke and heat vent.
  3. Fire Alarm Connection: Provide separate resettable electrical link release mechanism and connection point for fire alarm system.
  4. Size: 48 by 96 inches.
- E. Frames and Curbs: One-piece curb and frame with integral cap flashing to receive roof flashings; extended bottom flange to suit mounting.
1. Material: Mill finished aluminum, 11 gage, 0.0907 inch thick.
  2. Insulation: Manufacturer's standard; 1 inch rigid glass fiber, located on outside face of curb.
  3. Curb Height: 12 inches from finished surface of roof, minimum.
- F. Metal Covers: Flush, insulated, hollow metal construction.
1. Capable of supporting 40 psf live load.
  2. Material: Mill finished aluminum; outer cover 11 gage, 0.0907 inch thick, liner 0.04 inch thick.
  3. Insulation: Manufacturer's standard 1 inch rigid glass fiber.
  4. Gasket: Neoprene, continuous around cover perimeter.
- G. Safety Railing System: Manufacturer's standard accessory safety rail system mounted directly to curb.
1. Posts and Rails: Aluminum tube.
  2. Gate: Same material as railing; automatic closing with latch.
  3. Finish: Manufacturer's standard, factory applied finish.
  4. Gate Hinges and Post Guides: ASTM B221 (ASTM B221M), 6063 alloy, T5 temper aluminum.
  5. Mounting Brackets: Hot dipped galvanized steel, 1/4 inch thick, minimum.
  6. Fasteners: Stainless steel, Type 316.
  7. Manufacturers:
    - a. BILCO Company; Bil-Guard 2.0: [www.bilco.com/#sle](http://www.bilco.com/#sle).
    - b. Substitutions: See Section 016000 - Product Requirements.
  8. Smoke Hatches: Manual release operation not to disturb automatic release mechanisms; easy resetting by Owner's maintenance personnel; provide latch designed to prevent relatching unless automatic release mechanism has been properly reset for automatic operation.

## 2.02 SNOW GUARDS

- A. Unit Snow Guards: Individual projecting polycarbonate shapes, set between roofing shingles/tiles, and mechanically fastened to roof deck.
1. Projecting Polycarbonate Shapes: Clear polycarbonate plastic with UV stabilizers, semi-circular design.
  2. Placement: As indicated on drawings.
  3. Manufacturers:

- a. Berger Building Products: [www.bergerbp.com/#sle](http://www.bergerbp.com/#sle).
- b. Rocky Mountain Snow Guards, Inc: [www.rockymountainsnowguards.com/#sle](http://www.rockymountainsnowguards.com/#sle).
- c. TRA Snow and Sun: [www.trasnowandsun.com/#sle](http://www.trasnowandsun.com/#sle).
- d. Substitutions: See Section 016000 - Product Requirements.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

#### **3.02 PREPARATION**

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

#### **3.03 INSTALLATION**

- A. Install in accordance with manufacturer's instructions, in manner that maintains roofing weather integrity.

#### **3.04 CLEANING**

- A. Clean installed work to like-new condition.

#### **3.05 PROTECTION**

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

**END OF SECTION**

## **SECTION 078400 FIRESTOPPING**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Firestopping systems.
- B. Firestopping of all joints and penetrations in fire resistance rated and smoke resistant assemblies, whether indicated on drawings or not, and other openings indicated.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 092116 - Gypsum Board Assemblies: Gypsum wallboard fireproofing.

#### **1.03 REFERENCE STANDARDS**

- A. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2022.
- B. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2023a.
- C. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems; 2015 (Reapproved 2019).
- D. ASTM E2307 - Standard Test Method for Determining Fire Resistance of Perimeter Fire Barriers Using Intermediate-Scale, Multi-story Test Apparatus; 2023b.
- E. ASTM E2837 - Standard Test Method for Determining the Fire Resistance of Continuity Head-of-Wall Joint Systems Installed between Rated Wall Assemblies and Nonrated Horizontal Assemblies; 2023a.
- F. UL 2079 - Standard for Tests for Fire Resistance of Building Joint Systems; Current Edition, Including All Revisions.
- G. UL (FRD) - Fire Resistance Directory; Current Edition.

#### **1.04 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on product characteristics, performance ratings, and limitations.
- C. Manufacturer's Installation Instructions: Indicate preparation and installation instructions.
- D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

#### **1.05 QUALITY ASSURANCE**

- A. Fire Testing: Provide firestopping assemblies of designs that provide the scheduled fire ratings when tested in accordance with methods indicated.

#### **1.06 FIELD CONDITIONS**

- A. Comply with firestopping manufacturer's recommendations for temperature and conditions during and after installation; maintain minimum temperature before, during, and for three days after installation of materials.
- B. Provide ventilation in areas where solvent-cured materials are being installed.

### **PART 2 PRODUCTS**

#### **2.01 MATERIALS**

- A. Manufacturers:
  - 1. A/D Fire Protection Systems Inc.: [www.adfire.com](http://www.adfire.com).
  - 2. 3M Fire Protection Products: [www.3m.com/firestop](http://www.3m.com/firestop).
  - 3. Hilti, Inc: [www.us.hilti.com/#sle](http://www.us.hilti.com/#sle).
  - 4. Nelson FireStop Products: [www.nelsonfirestop.com](http://www.nelsonfirestop.com).
  - 5. Specified Technologies, Inc.: [www.stifirestop.com](http://www.stifirestop.com).
- B. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Provide type of materials as required for tested firestopping assembly.
- C. Fire Ratings: Refer to drawings for required systems and ratings.

#### **2.02 FIRESTOPPING ASSEMBLY REQUIREMENTS**

- A. Perimeter Fire Containment Firestopping: Use system that has been tested according to ASTM E2307 to have fire resistance F Rating equal to required fire rating of floor assembly.

- B. Head-of-Wall Joint System Firestopping at Joints Between Fire-Rated Wall Assemblies and Non-Rated Horizontal Assemblies: Use system that has been tested according to ASTM E2837 to have fire resistance F Rating equal to required fire rating of floor or wall, whichever is greater.
- C. Floor-to-Floor, Wall-to-Wall, and Wall-to-Floor Joints, Except Perimeter, Where Both Are Fire-Rated: Use system that has been tested according to ASTM E1966 or UL 2079 to have fire resistance F Rating equal to required fire rating of the assembly in which the joint occurs.
- D. Through Penetration Firestopping: Use system that has been tested according to ASTM E814 to have fire resistance F Rating equal to required fire rating of penetrated assembly.

### **2.03 FIRESTOPPING FOR FLOOR-TO-FLOOR, WALL-TO-FLOOR, AND WALL-TO-WALL JOINTS**

- A. Gypsum Board Walls:
  - 1. Wall to Wall Joints That Have Movement Capabilities (Dynamic):
    - a. 1 Hour Construction: UL System WW-D-0067; Hilti CP 606 Flexible Firestop Sealant.

### **2.04 FIRESTOPPING PENETRATIONS THROUGH GYPSUM BOARD WALLS**

- A. Blank Openings:
  - 1. 1 Hour Construction: UL System W-L-3334; Hilti CP 653 Speed Sleeve.
- B. Penetrations By:
  - 1. Multiple Penetrations in Large Openings:
    - a. 1 Hour Construction: UL System W-L-1408; Hilti FS-ONE MAX Intumescent Firestop Sealant.
    - b. 1 Hour Construction: UL System W-L-8013; Hilti CFS-BL Firestop Block.
  - 2. Uninsulated Metallic Pipe, Conduit, and Tubing:
    - a. 1 Hour Construction: UL System W-L-1054; Hilti FS-ONE MAX Intumescent Firestop Sealant.
  - 3. Uninsulated Non-Metallic Pipe, Conduit, and Tubing:
    - a. 1 Hour Construction: UL System W-L-2128; Hilti FS-ONE MAX Intumescent Firestop Sealant.
  - 4. Electrical Cables Not In Conduit:
    - a. 1 Hour Construction: UL System W-L-3065; Hilti FS-ONE MAX Intumescent Firestop Sealant, CP 606 Flexible Firestop Sealant, CD 601S Elastomeric Firestop Sealant, or CP 618 Firestop Putty Stick.
  - 5. Insulated Pipes:
    - a. 1 Hour Construction: UL System W-L-5028; Hilti FS-ONE MAX Intumescent Firestop Sealant.

### **2.05 FIRESTOPPING SYSTEMS**

- A. Firestopping: Any material meeting requirements.
  - 1. Fire Ratings: See drawings for required systems and ratings.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify openings are ready to receive the work of this section.

### **3.02 PREPARATION**

- A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other materials that could adversely affect bond of firestopping material.
- B. Remove incompatible materials that could adversely affect bond.

### **3.03 INSTALLATION**

- A. Install materials in manner described in fire test report and in accordance with manufacturer's instructions, completely closing openings.

### **3.04 CLEANING**

- A. Clean adjacent surfaces of firestopping materials.

**3.05 PROTECTION**

- A. Protect adjacent surfaces from damage by material installation.

**END OF SECTION**

## SECTION 079005 JOINT SEALERS

### PART 1 GENERAL

#### 1.01 SECTION INCLUDES

- A. Sealants and joint backing.
- B. Precompressed foam sealers.

#### 1.02 RELATED REQUIREMENTS

- A. ***Section 019119-Commissioning of Building Enclosure (BECx): Commissioning requirements and procedures.***

#### 1.03 REFERENCE STANDARDS

- A. AAMA 503 - Voluntary Specification for Field Testing of Newly Installed Storefronts, Curtain Walls and Sloped Glazing Systems; 2014.
- B. ASTM C834 - Standard Specification for Latex Sealants; 2017 (Reapproved 2023).
- C. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications; 2022.
- D. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.
- E. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2016 (Reapproved 2023).
- F. ASTM D1667 - Standard Specification for Flexible Cellular Materials—Poly (Vinyl Chloride) Foam (Closed-Cell); 2022.
- G. ASTM D2240 - Standard Test Method for Rubber Property--Durometer Hardness; 2015 (Reapproved 2021).
- H. ASTM E783 - Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors; 2002 (Reapproved 2018).
- I. ASTM E1105 - Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference; 2015 (Reapproved 2023).

#### 1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate the work with other sections referencing this section.
- B. Perform compatibility and adhesion testing of exterior sealant with all substrates which sealant will meet.

#### 1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data indicating sealant chemical characteristics.
- C. Samples: Submit two samples, 1/2 x 1/2 inch in size illustrating sealant colors for selection.
- D. Manufacturer's Installation Instructions: Indicate special procedures.

#### 1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
- B. Applicator Qualifications: Company specializing in performing the work of this section with minimum three years documented experience and approved by manufacturer.

#### 1.07 FIELD CONDITIONS

- A. Maintain temperature and humidity recommended by the sealant manufacturer during and after installation.

#### 1.08 WARRANTY

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective work within a five year period after Date of Substantial Completion.
- C. Warranty: Include coverage for installed sealants and accessories which fail to achieve airtight seal, exhibit loss of adhesion or cohesion, or do not cure.



## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Gunnable and Pourable Sealants:
  - 1. Adhesives Technology Corporation: [www.atc.ws](http://www.atc.ws).
  - 2. BASF Construction Chemicals-Building Systems: [www.buildingsystems.basf.com](http://www.buildingsystems.basf.com).
  - 3. Bostik Inc: [www.bostik-us.com](http://www.bostik-us.com).
  - 4. ARDEX Engineered Cements: [www.ardexamericas.com](http://www.ardexamericas.com).
  - 5. Dow Corning Corporation: [www.dowcorning.com](http://www.dowcorning.com).
  - 6. Hilti, Inc: [www.us.hilti.com](http://www.us.hilti.com).
  - 7. Momentive Performance Materials, Inc (formerly GE Silicones): [www.momentive.com](http://www.momentive.com).
  - 8. Pecora Corporation: [www.pecora.com](http://www.pecora.com).
  - 9. The QUIKRETE Companies: [www.quikrete.com](http://www.quikrete.com).
  - 10. Red Devil: [www.reddevil.com](http://www.reddevil.com).
  - 11. Tremco Global Sealants: [www.tremcosealants.com](http://www.tremcosealants.com).
  - 12. Sherwin-Williams Company: [www.sherwin-williams.com](http://www.sherwin-williams.com).
  - 13. Sika Corporation: [www.usa-sika.com](http://www.usa-sika.com).
  - 14. W.R. Meadows, Inc: [www.wrmeadows.com](http://www.wrmeadows.com).
  - 15. Substitutions: See Section 016000 - Product Requirements.
- B. Preformed Compressible Foam Sealers:
  - 1. EMSEAL Joint Systems, Ltd: [www.emseal.com](http://www.emseal.com).
  - 2. Sandell Manufacturing Company, Inc: [www.sandellmfg.com](http://www.sandellmfg.com).
  - 3. Dayton Superior Corporation: [www.daytonsuperior.com](http://www.daytonsuperior.com).
  - 4. Tremco Global Sealants: [www.tremcosealants.com](http://www.tremcosealants.com).
  - 5. Substitutions: See Section 016000 - Product Requirements.

### **2.02 SEALANTS**

- A. General Purpose Exterior Sealant: Silicone; ASTM C920, Grade NS, Class 50 minimum; Uses M, G, and A; single component.
  - 1. Color: To be selected by Architect from manufacturer's standard range.
  - 2. Applications: Use for:
    - a. Control, expansion, and soft joints in masonry.
    - b. Joints between concrete and other materials.
    - c. Joints between metal frames and other materials.
    - d. Other exterior joints for which no other sealant is indicated.
- B. Exterior Metal Lap Joint Sealant: Butyl or polyisobutylene, nondrying, nonskinning, noncuring.
  - 1. Applications: Use for:
    - a. Concealed sealant bead in sheet metal work.
    - b. Concealed sealant bead in siding overlaps.
- C. General Purpose Interior Sealant: Acrylic emulsion latex; ASTM C834, Type OP, Grade NF single component, paintable.
  - 1. Color: To be selected by Architect from manufacturer's full range.
  - 2. Applications: Use for:
    - a. Interior wall and ceiling control joints.
    - b. Joints between door and window frames and wall surfaces.
    - c. Other interior joints for which no other type of sealant is indicated.
- D. Bathtub/Tile Sealant: White silicone; ASTM C920, Uses I, M and A; single component, mildew resistant.
  - 1. Applications: Use for:
    - a. Joints between plumbing fixtures and floor and wall surfaces.
  - 2. Products:
    - a. Bostik Inc: [www.bostik-us.com](http://www.bostik-us.com).
    - b. BASF Construction Chemicals-Building Systems: [www.buildingsystems.basf.com](http://www.buildingsystems.basf.com).
    - c. Pecora Corporation; 898NST Sanitary Silicone Sealant - Class 50: [www.pecora.com](http://www.pecora.com).
    - d. Tremco Global Sealants: [www.tremcosealants.com](http://www.tremcosealants.com).

- e. Substitutions: See Section 016000 - Product Requirements.
- E. Acoustical Sealant for Concealed Locations:
  - 1. Composition: Acrylic latex emulsion sealant.
  - 2. Applications: Use for concealed locations only:
    - a. Sealant bead between top stud runner and structure and between bottom stud track and floor.
  - 3. Products:
    - a. Bostik Inc: [www.bostik-us.com](http://www.bostik-us.com).
    - b. Pecora Corporation; AIS-919 Acoustical and Insulation Latex Sealant: [www.pecora.com](http://www.pecora.com).
    - c. BASF Construction Chemicals-Building Systems: [www.buildingsystems.basf.com](http://www.buildingsystems.basf.com).
    - d. Tremco Global Sealants: [www.tremcosealants.com](http://www.tremcosealants.com).
    - e. Hilti, Inc.; CP 506 Smoke and Acoustical Sealant: [www.us.hilti.com](http://www.us.hilti.com).
    - f. Substitutions: See Section 016000 - Product Requirements.
- F. Polyurea Concrete Floor Joint Filler: Self-leveling, pourable, semi-rigid sealant intended for filling cracks and control joints not subject to significant movement; rigid enough to support concrete edges under traffic.
  - 1. Composition: Single or multi-part, 100 percent solids by weight.
  - 2. Hardness: 75, minimum, after 7 days, when tested in accordance with ASTM D2240 Shore A.

### 2.03 ACCESSORIES

- A. Primer: Non-staining type, recommended by sealant manufacturer to suit application.
- B. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.
- C. Joint Backing: Round foam rod compatible with sealant; bi-cellular (Type B); oversized 30 to 50 percent larger than joint width.
- D. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.

## PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Verify that substrate surfaces are ready to receive work.
- B. Verify that joint backing and release tapes are compatible with sealant.

### 3.02 PREPARATION

- A. Remove loose materials and foreign matter that could impair adhesion of sealant.
- B. Clean and prime joints in accordance with manufacturer's instructions.
- C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.
- D. Protect elements surrounding the work of this section from damage or disfigurement.

### 3.03 INSTALLATION

- A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.
- B. Perform installation in accordance with ASTM C1193.
- C. Perform acoustical sealant application work in accordance with ASTM C919.
- D. Install bond breaker where joint backing is not used.
- E. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.
- F. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.
- G. Tool joints concave.
- H. Concrete Floor Joint Filler: Install concrete floor joint filler per manufacturer's written instructions. After floor joint filler is fully cured, shave joint filler flush with top of concrete slab.

### 3.04 TESTING

### 3.05 CLEANING

- A. Clean adjacent soiled surfaces.

**3.06 PROTECTION**

- A. Protect sealants until cured.

**END OF SECTION**

**SECTION 079513  
EXPANSION JOINT COVER ASSEMBLIES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Expansion joint cover assemblies for floor, wall, ceiling, and soffit surfaces.

**1.02 RELATED REQUIREMENTS**

- A. Section 042000 - Unit Masonry: Placement of joint cover assembly frames in masonry.
- B. Section 079200 - Joint Sealants: Sealing expansion and control joints using gunnable and pourable sealants.
- C. Section 092116 - Gypsum Board Assemblies: Gypsum board control joint trim.
- D. Section 092116 - Gypsum Board Assemblies: Placement of expansion joint assemblies in gypsum board walls and ceilings.
- E. Section 095100 - Acoustical Ceilings: Expansion joint assemblies in suspended ceiling grids.

**1.03 REFERENCE STANDARDS**

- A. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.
- B. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.
- C. ASTM B308/B308M - Standard Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles; 2020.
- D. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems; 2015 (Reapproved 2019).
- E. UL 2079 - Standard for Tests for Fire Resistance of Building Joint Systems; Current Edition, Including All Revisions.

**1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Installation Templates: For frames and anchors to be embedded in concrete or masonry, furnish templates to relevant installers; include installation instructions and tolerances.

**1.05 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide joint assembly profiles, profile dimensions, anchorage devices and available colors and finish.
- C. Shop Drawings: Indicate joint and splice locations, miters, layout of the work, affected adjacent construction and anchorage locations.
- D. Samples: Submit two samples 6" inch long, illustrating profile, dimension, color, and finish selected.
- E. Manufacturer's Installation Instructions: Indicate rough-in sizes and required tolerances for item placement.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

- A. Expansion Joint Cover Assemblies: Basis of Design: Inpro
  1. Architectural Art Mfg, Inc: [www.archart.com/#sle](http://www.archart.com/#sle).
  2. Construction Specialties, Inc: [www.c-sgroup.com/#sle](http://www.c-sgroup.com/#sle).
  3. EMSEAL Joint Systems, Ltd: [www.emseal.com/#sle](http://www.emseal.com/#sle).
  4. Inpro: [www.inprocorp.com/#sle](http://www.inprocorp.com/#sle).
  5. MM Systems Corp: [www.mmsystemscorp.com/#sle](http://www.mmsystemscorp.com/#sle).
  6. Nystrom, Inc: [www.nystrom.com/#sle](http://www.nystrom.com/#sle).
  7. Pecora Corporation: [www.pecora.com/#sle](http://www.pecora.com/#sle).
  8. Watson Bowman Acme Corporation: [www.watsonbowmanacme.com/#sle](http://www.watsonbowmanacme.com/#sle).
  9. Substitutions: See Section 016000 - Product Requirements.

**2.02 EXPANSION JOINT COVER ASSEMBLY APPLICATIONS**

- A. Interior Floor Joints Subject to Thermal Movement: Inpro 801 Series

- B. Interior Wall/Ceiling Joints Subject to Thermal Movement:
- C. Interior Fire-Rated Wall/Ceiling/Floor Joints Subject to Thermal Movement:
- D. Exterior Wall Joints Subject to Thermal Movement: Inpro 615 Series
- E. Exterior Roof Expansion Joint Covers: Inpro 672 Series

### **2.03 EXPANSION JOINT COVER ASSEMBLIES**

- A. Expansion Joint Cover Assemblies - General: Factory-fabricated and assembled; designed to completely fill joint openings, sealed to prevent passage of air, dust, water, smoke; suitable for traffic expected.
  - 1. Joint Dimensions and Configurations: As indicated on drawings.
  - 2. Joint Cover Sizes: Selected to suit joint width and configuration, based on manufacturer's published recommendations and limitations.
  - 3. Lengths: Provide covers in full lengths required; avoid splicing wherever possible.
  - 4. Anchors, Fasteners, and Fittings: Provided by cover manufacturer.
- B. Floor Joint Covers: Coordinate with indicated floor coverings.
  - 1. If floor covering is not indicated, obtain instructions from Architect before proceeding.
  - 2. If style is not indicated, provide extruded aluminum frame both sides, resilient seals, and minimize exposed metal.
- C. Sliding Cover Plate Type Covers: Provide plate with beveled edges and neat fit that does not collect dirt.
- D. Covers in Gypsum Board Assemblies: Provide style with anchoring wings that can be completely covered by joint compound.
- E. Covers in Fire Rated Assemblies: Provide cover assembly having fire rating equivalent to that of assembly into which it is installed.

### **2.04 MATERIALS**

- A. Extruded Aluminum: ASTM B221 (ASTM B221M), 6063 alloy, T6 temper; or ASTM B308/B308M, 6061 alloy, T6 temper.
  - 1. Exposed Finish Outdoors: Natural anodized.
  - 2. Exposed Finish at Floors: Mill finish or natural anodized.
  - 3. Exposed Finish at Walls and Ceilings: Natural anodized.
- B. Backing Paint for Aluminum Components in Contact with Cementitious Materials: Asphaltic type.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that joint preparation and dimensions are acceptable and in accordance with manufacturer's requirements.
- B. Verify that frames and anchors installed by others are in correct locations and suitable for installation of remainder of assembly.

### **3.02 INSTALLATION**

- A. Install components and accessories in accordance with manufacturer's instructions.
- B. Align work plumb and level, flush with adjacent surfaces.
- C. Rigidly anchor to substrate to prevent misalignment.

### **3.03 PROTECTION**

- A. Do not permit traffic over unprotected floor joint surfaces.
- B. Provide strippable coating to protect finish surface.

**END OF SECTION**

**SECTION 081113  
HOLLOW METAL DOORS AND FRAMES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Non-fire-rated hollow metal doors and frames.
- B. Hollow metal frames for wood doors.
- C. Fire-rated hollow metal doors and frames.
- D. Thermally insulated hollow metal doors with frames.
- E. Hollow metal borrowed lites glazing frames.

**1.02 RELATED REQUIREMENTS**

- A. ***Section 019119-Commissioning of Building Enclosure (BECx): Commissioning requirements and procedures.***
- B. Section 087100 - Door Hardware.
- C. Section 088000 - Glazing: Glass for doors and borrowed lites.

**1.03 REFERENCE STANDARDS**

- A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.
- B. ANSI/ICC A117.1 - American National Standard for Accessible and Usable Buildings and Facilities; International Code Council; 2009.
- C. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors; 2022.
- D. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100); 2023.
- E. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames; 2020.
- F. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.
- G. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable; 2021a.
- H. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2023.
- I. ASTM C1363 - Standard Test Method for Thermal Performance of Building Assemblies by Means of a Hot Box Apparatus; 2011.
- J. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.
- K. NAAMM HMMA 840 - Guide Specifications For Receipt, Storage and Installation of Hollow Metal Doors and Frames; 2017.

**1.04 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes; and one copy of referenced standards/guidelines.
- C. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and any indicated finish requirements.

**1.05 QUALITY ASSURANCE**

- A. Maintain at project site copies of reference standards relating to installation of products specified.

**1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Comply with NAAMM HMMA 840 or ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
- B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion and adverse effects on factory applied painted finish.

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Hollow Metal Doors and Frames:
  - 1. Curries, an Assa Abloy Group company: [www.assaabloydss.com/#sle](http://www.assaabloydss.com/#sle).
  - 2. De La Fontaine Inc: [www.delafontaine.com/#sle](http://www.delafontaine.com/#sle).
  - 3. De La Fontaine Inc: [www.delafontaine.com](http://www.delafontaine.com).
  - 4. De La Fontaine Inc: [www.delafontaine.com](http://www.delafontaine.com).
  - 5. Republic Doors: [www.republicdoor.com](http://www.republicdoor.com).
  - 6. Steelcraft, an Allegion brand: [www.allegion.com/#sle](http://www.allegion.com/#sle).
  - 7. Substitutions: See Section 016000 - Product Requirements.

### **2.02 PERFORMANCE REQUIREMENTS**

- A. Requirements for Hollow Metal Doors and Frames:
  - 1. Steel Sheet: Comply with one or more of the following requirements; galvanized steel complying with ASTM A653/A653M, cold-rolled steel complying with ASTM A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel complying with ASTM A1011/A1011M, commercial steel (CS) Type B, for each.
  - 2. Accessibility: Comply with ICC A117.1 and ADA Standards.
  - 3. Finish: Factory primed, for field finishing.
- B. Energy Efficient Exterior Openings: Comply with minimum thermal ratings, based on ASTM C1363. Openings to be fabricated and tested as fully operable, thermal insulating door and frame assemblies.
  - 1. Thermal Performance (Exterior Openings): Independent testing laboratory certification for exterior door assemblies being tested in accordance with ASTM C1363 and meet or exceed the following requirements:
    - a. Door Assembly Operable U-Factor and R-Value Ratings: U-Factor 0.395, R-Value 2.53, including insulated door, thermal-break frame and threshold.
  - 2. Air Infiltration (Exterior Openings): Independent testing laboratory certification for exterior door assemblies being tested in accordance with ASTM E283 to meet or exceed the following requirements:
    - a. Rate of leakage of the door assembly shall not exceed 0.25 cfm per square foot of static differential air pressure of 1.567 psf (equivalent to 25 mph wind velocity).
- C. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with the specified requirements for each type; for instance, an exterior door that is also indicated as being sound-rated must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.

### **2.03 HOLLOW METAL DOORS**

- A. Exterior Doors: Thermally insulated.
  - 1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
    - a. Level 1 - Standard-duty.
    - b. Physical Performance Level C, 250,000 cycles; in accordance with ANSI/SDI A250.4.
    - c. Model 1 - Full Flush.
    - d. Door Face Metal Thickness: 20 gage, 0.032 inch, minimum.
  - 2. Door Thickness: 1-3/4 inch, nominal.
  - 3. Galvanizing: Components hot-dipped zinc-iron alloy-coated (galvanized) in accordance with ASTM A653/A653M, with manufacturer's standard coating thickness.
  - 4. Insulating Value: U-value of 0.50, when tested in accordance with ASTM C1363.
- B. Interior Doors, Non-Fire-Rated:
  - 1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
  - 2. Door Thickness: 1-3/4 inch, nominal.

## **2.04 HOLLOW METAL FRAMES**

- A. Comply with standards and/or custom guidelines as indicated for corresponding door in accordance with applicable door frame requirements.
- B. General:
  - 1. Comply with the requirements of grade specified for corresponding door, except:
    - a. Frames for Wood Doors: Comply with frame requirements in accordance with ANSI/SDI A250.8 (SDI-100), Level 1, 18 gage, 0.042 inch, minimum thickness.
  - 2. Finish: Same as for door.
  - 3. Provide mortar guard boxes for hardware cut-outs in frames to be installed in masonry or to be grouted.
- C. Exterior Door Frames: Full profile/continuously welded type.
  - 1. Weatherstripping: Separate, see Section 087100.
- D. Interior Door Frames, Non-Fire Rated: Full profile/continuously welded type.
- E. Frames for Wood Doors: Comply with frame requirements in accordance with corresponding door.
- F. Mullions for Pairs of Doors: Fixed, with profile similar to jambs.
- G. Borrowed Lites Glazing Frames: Construction and face dimensions to match door frames, and as indicated on drawings.

## **2.05 FINISHES**

- A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.

## **2.06 ACCESSORIES**

- A. Glazing: As specified in Section 088000, factory installed.
- B. Grout for Frames: Portland cement grout with maximum 4 inch slump for hand troweling; thinner pumpable grout is prohibited.
- C. Silencers: Resilient rubber, fitted into drilled hole; provide three on strike side of single door, three on center mullion of pairs, and two on head of pairs without center mullions.
- D. Temporary Frame Spreaders: Provide for factory- or shop-assembled frames.

## **2.07 FINISHES**

- A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.
- B. Bituminous Coating: Asphalt emulsion or other high-build, water-resistant, resilient coating.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify existing conditions before starting work.
- B. Verify that opening sizes and tolerances are acceptable.
- C. Verify that finished walls are in plane to ensure proper door alignment.

### **3.02 PREPARATION**

- A. Coat inside of frames to be installed in masonry or to be grouted, with bituminous coating, prior to installation.

### **3.03 INSTALLATION**

- A. Comply with glazing installation requirements of Section 088000.

### **3.04 TOLERANCES**

- A. Maximum Diagonal Distortion: 1/16 inch measured with straight edge, corner to corner.

### **3.05 ADJUSTING**

- A. Adjust for smooth and balanced door movement.

### **3.06 SCHEDULE**

- A. Refer to Door and Frame Schedule on the drawings.

**END OF SECTION**



**SECTION 081416  
FLUSH WOOD DOORS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Flush wood doors; flush and flush glazed configuration; fire rated.

**1.02 RELATED REQUIREMENTS**

- A. Section 081113 - Hollow Metal Doors and Frames.
- B. Section 087100 - Door Hardware.
- C. Section 088000 - Glazing.

**1.03 REFERENCE STANDARDS**

- A. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2018.
- B. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition; 2014, with Errata (2016).
- C. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards; 2021, with Errata.
- D. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2022.

**1.04 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Indicate door core materials and construction; veneer species, type and characteristics.
- C. Shop Drawings: Show doors and frames, elevations, sizes, types, swings, undercuts, beveling, blocking for hardware, factory machining, factory finishing, cutouts for glazing and other details.
- D. Specimen warranty.
- E. Samples: Submit two samples of door veneer, 6 by 6 inch in size illustrating wood grain, stain color, and sheen.
- F. Manufacturer's Installation Instructions: Indicate special installation instructions.
- G. Warranty, executed in Owner's name.

**1.05 QUALITY ASSURANCE**

- A. Maintain one copy of the specified door quality standard on site for review during installation and finishing.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section, with not less than three years of documented experience.

**1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Package, deliver and store doors in accordance with specified quality standard.
- B. Accept doors on site in manufacturer's packaging. Inspect for damage.
- C. Protect doors with resilient packaging sealed with heat shrunk plastic. Do not store in damp or wet areas; or in areas where sunlight might bleach veneer. Seal top and bottom edges with tinted sealer if stored more than one week. Break seal on site to permit ventilation.

**1.07 WARRANTY**

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. Interior Doors: Provide manufacturer's warranty for the life of the installation.
- C. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

- A. Wood Veneer Faced Doors:
  - 1. Graham Wood Doors: [www.grahamdoors.com](http://www.grahamdoors.com).
  - 2. VT Industries.

## **2.02 DOORS AND PANELS**

- A. Doors: Refer to drawings for locations and additional requirements.
  - 1. Quality Standard: Custom Grade, Heavy Duty performance, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.
  - 2. Wood Veneer Faced Doors: 5-ply unless otherwise indicated.
- B. Interior Doors: 1-3/4 inches thick unless otherwise indicated; flush construction.
  - 1. Provide solid core doors at each location, \_\_\_\_\_.
  - 2. Wood veneer facing with factory transparent finishmatching sample provided by Architect.

## **2.03 DOOR AND PANEL CORES**

- A. Non-Rated Solid Core and 20 Minute Rated Doors: Type particleboard core (PC), plies and faces as indicated.

## **2.04 DOOR FACINGS**

- A. Veneer Facing for Transparent Finish: White oak, veneer grade in accordance with quality standard indicated, rift cut (only red and white oak), with book match between leaves of veneer, running match of spliced veneer leaves assembled on door or panel face.

## **2.05 ACCESSORIES**

- A. Glazed Openings:
  - 1. Heat-Strengthened and Fully Tempered Glass: {rs\#1}.
  - 2. Glazing: Single vision units, 1/4 inch glass.
  - 3. Tint: Clear.
- B. Glazing Stops: Wood, of same species as door facing, butted corners; prepared for countersink style tamper proof screws.
- C. Astragals for Non-Rated Double Doors: Steel, T shaped, overlapping and recessed at face edge.

## **2.06 DOOR CONSTRUCTION**

- A. Fabricate doors in accordance with door quality standard specified.
- B. Cores Constructed with stiles and rails:
  - 1. Provide solid blocks at lock edge for hardware reinforcement.
  - 2. Provide solid blocking for other throughbolted hardware.
- C. Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions.
- D. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.
- E. Provide edge clearances in accordance with the quality standard specified.

## **2.07 FACTORY FINISHING - WOOD VENEER DOORS**

- A. Finish work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 5 - Finishing for grade specified and as follows:
  - 1. Transparent:
    - a. System - 1, Lacquer, Nitrocellulose.
    - b. Sheen: Flat.
- B. Factory finish doors in accordance with sample to be provided.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify existing conditions before starting work.
- B. Verify that opening sizes and tolerances are acceptable.
- C. Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.

### **3.02 INSTALLATION**

- A. Install doors in accordance with manufacturer's instructions and specified quality standard.

- B. Factory-Finished Doors: Do not field cut or trim; if fit or clearance is not correct, replace door.
- C. Use machine tools to cut or drill for hardware.
- D. Coordinate installation of doors with installation of frames and hardware.
- E. Coordinate installation of glazing.

**3.03 TOLERANCES**

- A. Comply with specified quality standard for fit and clearance tolerances.
- B. Comply with specified quality standard for telegraphing, warp, and squareness.

**3.04 ADJUSTING**

- A. Adjust doors for smooth and balanced door movement.
- B. Adjust closers for full closure.

**3.05 SCHEDULE**

- A. Refer to Door and Frame Schedule appended to this section.

**END OF SECTION**

**SECTION 083100  
ACCESS DOORS AND PANELS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Wall access door and frame units.
- B. Ceiling access door and frame units.

**1.02 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide sizes, types, finishes, hardware, scheduled locations, and details of adjoining work.

**PART 2 PRODUCTS**

**2.01 ACCESS DOOR AND PANEL APPLICATIONS**

- A. Walls in Wet Areas:
  - 1. Size: 18 by 18 inch, unless otherwise indicated.
- B. Fire Rated Walls: See drawings for wall fire ratings.
  - 1. Size: 24 by 24 inch, unless otherwise indicated.
- C. Ceilings, Unless Otherwise Indicated:
  - 1. Material: Steel.
  - 2. Size in Other Ceilings: 12 by 12 inch, unless otherwise indicated.
  - 3. Standard duty, hinged door.
  - 4. Tool-operated spring or cam lock; no handle.
- D. Fire Rated Ceilings: See drawings for ceiling fire ratings.
  - 1. Size: 12 by 12 inch, unless otherwise indicated.

**2.02 WALL AND CEILING UNITS**

- A. Manufacturers:
  - 1. ACUDOR Products Inc: [www.acudor.com/#sle](http://www.acudor.com/#sle).
    - a. Units in Walls, Unless Otherwise Indicated: ACUDOR ADWT.
    - b. Units in Fire-Rated Walls Rated 2 Hours and Less: ACUDOR FW-5015.
  - 2. Babcock-Davis; \_\_\_\_\_: [www.babcockdavis.com/#sle](http://www.babcockdavis.com/#sle).
  - 3. Cendrex, Inc: [www.cendrex.com/#sle](http://www.cendrex.com/#sle).
    - a. Units in Fire-Rated Ceilings: Cendrex PFI series, downward opening.
  - 4. Karp Associates, Inc: [www.karpinc.com](http://www.karpinc.com).
  - 5. Milcor by Commercial Products Group of Hart & Cooley, Inc: [www.milcorinc.com](http://www.milcorinc.com).
  - 6. Substitutions: See Section 016000 - Product Requirements.
- B. Access Doors: Factory fabricated door and frame units, fully assembled units with corner joints welded, filled, and ground flush; square and without rack or warp; coordinate requirements with assemblies that units are to be installed in.
  - 1. Heavy Duty Single Thickness Steel Door Panels: 14 gage, 0.0747 inch, minimum.
  - 2. Units in Fire Rated Assemblies: Fire rating as required by applicable code for the fire rated assembly that access doors are being installed.
  - 3. Size: As indicated on the drawings.
    - a. Hardware for Fire Rated Units: As required for listing.

**PART 3 EXECUTION**

**3.01 EXAMINATION**

- A. Verify that rough openings are correctly sized and located.

**3.02 INSTALLATION**

- A. Install units in accordance with manufacturer's instructions.
- B. Install frames plumb and level in openings. Secure rigidly in place.

C. Position units to provide convenient access to the concealed work requiring access.

**END OF SECTION**

**SECTION 083323  
OVERHEAD COILING DOORS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Exterior coiling doors.
- B. Electric operators and control stations.
- C. Wiring from electric circuit disconnect to operators and control stations.

**1.02 RELATED REQUIREMENTS**

- A. Section 079200 - Joint Sealants: Sealing joints between frames and adjacent construction.
- B. Section 260583 - Wiring Connections: Power to disconnect.

**1.03 REFERENCE STANDARDS**

- A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.
- B. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.
- C. ITS (DIR) - Directory of Listed Products; Current Edition.
- D. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2020.
- E. NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts; 2008 (Reaffirmed 2020).
- F. NEMA MG 1 - Motors and Generators; 2021.
- G. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- H. UL (DIR) - Online Certifications Directory; Current Edition.
- I. UL 325 - Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems; Current Edition, Including All Revisions.

**1.04 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide general construction, electrical equipment, and component connections and details.
- C. Shop Drawings: Indicate pertinent dimensioning, anchorage methods, hardware locations, and installation details.
- D. Samples: Two slats, \_\_\_ by \_\_\_ inches in size illustrating shape, color and finish texture.

**1.05 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of type specified and with at least three years documented experience.
- C. Products Requiring Electrical Connection: Listed and classified by ITS (DIR), UL (DIR), or testing firm acceptable to authorities having jurisdiction as suitable for purpose specified and indicated.

**1.06 WARRANTY**

- A. See Section 017800 - Closeout Submittals for additional warranty requirements.
- B. Manufacturer Warranty: Provide 5-year manufacturer warranty for roller shaft counterbalance assembly. Complete forms in Owner's name and register with manufacturer.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

- A. Overhead Coiling Metal Doors: Basis of Design C.H.I. Overhead Doors Model 6242
  - 1. Clopay Building Products: [www.clopaydoor.com/#sle](http://www.clopaydoor.com/#sle).
  - 2. Cornell Iron Works, Inc: [www.cornelliron.com/#sle](http://www.cornelliron.com/#sle).
  - 3. Overhead Door Corporation: [www.overheaddoor.com/#sle](http://www.overheaddoor.com/#sle).
  - 4. Raynor Garage Doors: [www.raynor.com/#sle](http://www.raynor.com/#sle).
  - 5. The Cookson Company: [www.cooksondoor.com/#sle](http://www.cooksondoor.com/#sle).

6. Wayne-Dalton, a Division of Overhead Door Corporation: [www.wayne-dalton.com/#sle](http://www.wayne-dalton.com/#sle).
7. Substitutions: See Section 016000 - Product Requirements.

## 2.02 COILING DOORS

- A. Exterior Coiling Doors: Galvanized steel slat curtain.
  1. Capable of withstanding positive and negative wind loads of 20 psf without undue deflection or damage to components.
  2. Sandwich Slats: Manufacturer's standard, with core of foamed-in-place urethane insulation; minimum R-value of 7.2.
  3. Nominal Slat Size: 2 inches wide by required length.
  4. Finish: Factory painted powder coat, custom color from manufacturer's custom range.
  5. Guide, Angles: Galvanized steel.
  6. Hood Enclosure: Manufacturer's standard; primed steel.
  7. Electric operation.
  8. Mounting: Face mounted.

## 2.03 MATERIALS

- A. Metal Curtain Construction: Interlocking slats.
  1. Slat Ends: Alternate slats fitted with end locks to act as wearing surface in guides and to prevent lateral movement.
  2. Curtain Bottom for Slat Curtains: Fitted with angles to provide reinforcement and positive contact in closed position.
  3. Weatherstripping for Exterior Doors: Moisture and rot proof, resilient type, located at jamb edges, bottom of curtain, and where curtain enters hood enclosure of exterior doors.
- B. Guide Construction: Continuous, of profile to retain door in place, mounting brackets of same metal.
- C. Guides - Angle: ASTM A36/A36M metal angles, size as required for wind loading.
  1. Hot-dip galvanized in compliance with ASTM A123/A123M.
- D. Hood Enclosure and Trim: Internally reinforced to maintain rigidity and shape.

## 2.04 ELECTRIC OPERATION

- A. Operator, Controls, Actuators, and Safeties: Comply with UL 325; provide products listed by ITS (DIR), UL (DIR), or testing agency acceptable to authorities having jurisdiction.
  1. Provide interlock switches on motor operated units.
- B. Electric Operators:
  1. Mounting: Side mounted.
  2. Motor Enclosure:
    - a. Exterior Coiling Doors: NEMA MG 1, Type 4; open drip proof.
  3. Motor Rating: 1/3 HP; continuous duty.
  4. Motor Voltage: 120 volts, single phase, 60 Hz.
  5. Motor Controller: NEMA ICS 2, full voltage, reversing magnetic motor starter.
  6. Controller Enclosure: NEMA 250, Type 4.
  7. Opening Speed: 12 inches per second.
  8. Brake: Manufacturer's standard type, activated by motor controller.
  9. Manual override in case of power failure.
  10. See Section 260583 for electrical connections.
- C. Control Station: Provide standard three button, 'Open-Close-Stop' momentary-contact control device for each operator complying with UL 325.
  1. 24 volt circuit.
  2. Surface mounted, at interior door jamb.
  3. Entrapment Protection Devices: Provide sensing devices and safety mechanisms complying with UL 325.
    - a. Primary Device: Provide electric sensing edge, wireless sensing, NEMA 1 photo eye sensors, or NEMA 4X photo eye sensors as required with momentary-contact control device.

- D. Safety Edge: Located at bottom of coiling door, full width, electro-mechanical sensitized type, wired to stop and reverse door direction upon striking object, hollow neoprene covered.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Verify that adjacent construction is suitable for door installation.
- B. Verify that electrical services have been installed and are accessible.
- C. Verify that door opening is plumb, header is level, and dimensions are correct.
- D. Notify Architect of any unacceptable conditions or varying dimensions.
- E. Commencement of installation indicates acceptance of substrate and door opening conditions.

#### **3.02 INSTALLATION**

- A. Install units in accordance with manufacturer's instructions.
- B. Use anchorage devices to securely fasten assembly to wall construction and building framing without distortion or stress.
- C. Securely and rigidly brace components suspended from structure. Secure guides to structural members only.
- D. Fit and align assembly including hardware; level and plumb, to provide smooth operation.
- E. Coordinate installation of electrical service with Section 260583.
- F. Complete wiring from disconnect to unit components.
- G. Install enclosure and perimeter trim.

#### **3.03 TOLERANCES**

- A. Maintain dimensional tolerances and alignment with adjacent work.
- B. Maximum Variation From Plumb: 1/16 inch.
- C. Maximum Variation From Level: 1/16 inch.
- D. Longitudinal or Diagonal Warp: Plus or minus 1/8 inch per 10 feet straight edge.

#### **3.04 ADJUSTING**

- A. Adjust operating assemblies for smooth and noiseless operation.

#### **3.05 CLEANING**

- A. Clean installed components.
- B. Remove labels and visible markings.

**END OF SECTION**



**SECTION 084126  
ALL-GLASS ENTRANCES AND STOREFRONTS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. All-glass entrances.
- B. All-glass storefronts.
- C. Swinging doors.

**1.02 RELATED REQUIREMENTS**

- A. Section 054000 - Cold-Formed Metal Framing: Supplementary supports.
- B. Section 087100 - Door Hardware.
- C. Section 092116 - Gypsum Board Assemblies.

**1.03 REFERENCE STANDARDS**

- A. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2023.
- B. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.
- C. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.
- D. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.
- E. ASTM C1036 - Standard Specification for Flat Glass; 2021.
- F. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2018.

**1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Preinstallation Meeting: Convene at project site seven calendar days prior to scheduled beginning of construction activities of this section to review section requirements.
  - 1. Require attendance by representatives of installer and entities effected by adjacent or other work related to this section.

**1.05 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's descriptive literature for each component in all-glass entrance assembly.
- C. Shop Drawings: Drawings showing layout, dimensions, identification of components, and interface with adjacent construction.
  - 1. Include field measurements of openings.
  - 2. Include elevations showing:
    - a. Appearance of all-glass entrance layouts.
    - b. Locations and identification of manufacturer-supplied door hardware and fittings.
    - c. Locations and sizes of cut-outs and drilled holes for other door hardware.
  - 3. Include details of:
    - a. Requirements for support and bracing at openings.
    - b. Installation details.
    - c. Appearance of manufacturer-supplied door hardware and fittings.
  - 4. Schedule: Listing of each type component in all-glass entrance assemblies, cross-referenced to shop drawing plans, elevations, and details.
- D. Selection Samples: Two sets, representing manufacturer's full range of available metal materials and finishes.
- E. Verification Samples: Two samples, minimum size 6 inches long/square, representing actual material and finish of exposed metal.
- F. Certificates: Contractor's certification that installer of entrance assemblies meets specified qualifications.
- G. Design Data: Design calculations, bearing seal and signature of structural engineer licensed to practice in the State in which the Project is located, documenting compliance of exterior

- assemblies with wind pressure criteria.
- H. Operation and Maintenance Data: For manufacturer-supplied operating hardware.

### **1.06 QUALITY ASSURANCE**

- A. Designer Qualifications: Design under direct supervision of a Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located.
- B. Installer Qualifications: Minimum five of experience installing entrance assemblies similar to those specified in this section.

### **1.07 DELIVERY, STORAGE, AND HANDLING**

- A. Store products in manufacturer's unopened packaging until installation.

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. All-Glass Entrances and Storefronts:
1. Basis of Design: Avanti Systems USA; Solare single-glazed, frameless, acoustic system: [www.avantisystemsusa.com/#sle](http://www.avantisystemsusa.com/#sle).
  2. Substitutions: See Section 016000 - Product Requirements.

### **2.02 ALL-GLASS ENTRANCES AND STOREFRONTS ASSEMBLIES**

- A. Entrances and Storefronts: Factory fabricated assemblies consisting of frameless glass panels fastened with metal structural fittings in configuration indicated on drawings.
1. Operational Loads: Designed to withstand door operation under normal traffic without damage, racking, sagging, or deflection.
  2. Prepared for all specified hardware whether specified in this section or not.
  3. Finished metal surfaces protected with strippable film.
  4. Factory assembled to greatest extent practicable; may be disassembled to accommodate shipping constraints.

### **2.03 MATERIALS**

- A. Glass: Flat glass meeting requirements of ASTM C1036, Type I - Transparent Flat Glass, Quality Q3, and Kind FT, fully tempered, in accordance with ASTM C1048, and as follows:
1. Thickness: 3/8 inch.
  2. Color: Class 1, Clear.
  3. Temper glass materials horizontally; visible tong marks or tong mark distortions are not permitted.
- B. Aluminum Components: Comply with ASTM B221 (ASTM B221M), Alloy 6063, Temper T5.
- C. Stainless Steel Components: Comply with ASTM A666, Type 304.
- D. Sealant: One-part silicone sealant, comply with ASTM C920, clear.

### **2.04 ACCESSORIES**

- A. Exposed Fittings and Hardware: Extruded aluminum, clear anodized finish.
- B. Fixed Glazed Panel Fittings: Sufficient to structurally support glazing and doors under specified loads; including but not limited to cover caps for door hardware, glazing mullions, clamp fittings, and panel corner patches.
- C. Sidelight and Transom Fittings: No rails; provide extruded aluminum channels, for recessed installation in construction above and below glazing panels for frameless appearance.
- D. Swinging Door Fittings with Pivots: Patch fitting at top pivot corner of door; continuous rail with pivot at bottom of door.
1. Rail Cross-Section: 1-3/4 inches wide by 3-1/2 inches high.
  2. Rail Profile: Tapered.
- E. Latching Hardware: Manufacturer's standard flush bolt assemblies, concealed within bottom rail of indicated panels, prepared for lock cylinders specified in 087100; recessed dustproof bolt keeper.
- F. Additional Door Hardware: Specified in Section 087100.
- G. Anodized Aluminum Protective Coatings:

1. Hydrophobic Coatings: Coatings that repel water causing it to bead up with a very large contact angle on surface being protected.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Verify that openings are acceptable.
- B. Do not begin installation until substrates and openings have been properly prepared.
- C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

#### **3.02 PREPARATION**

- A. Clean substrates thoroughly prior to installation.
- B. Prepare substrates using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

#### **3.03 INSTALLATION**

- A. Installation of cold-formed metal framing for openings as specified in Section 054000.
- B. Installation of metal framing for openings as specified in Section 092116.
- C. Install in accordance with manufacturer's installation instructions.
- D. Tolerances:
  1. Horizontal Components and Sight Lines: Not more than 1/8 inch in 10 feet variation from level, non-cumulative.
  2. Vertical Components and Sight Lines: Not more than 1/8 inch in 10 feet variation from plumb, non-cumulative.
  3. Variation from Plane or Indicated Location: Not more than 1/16 inch.
- E. Installation of door hardware not supplied by entrance/storefront manufacturer as specified in Section 087100.

#### **3.04 ADJUSTING**

- A. Adjust doors to operate correctly, without binding to frame, sill, or adjacent doors.
- B. Adjust door hardware for smooth operation.

#### **3.05 CLEANING**

- A. Clean installed work to like-new condition.

#### **3.06 PROTECTION**

- A. Protect installed products until Date of Substantial Completion.
- B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

**END OF SECTION**

**SECTION 084313  
ALUMINUM-FRAMED STOREFRONTS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Aluminum doors and frames.
- B. Door hardware.
- C. Perimeter sealant.

**1.02 RELATED REQUIREMENTS**

- A. Section 019119-Commissioning of Building Enclosure (BECx): Commissioning requirements and procedures.
- B. Section 087100 - Door Hardware: Hardware items other than specified in this section.
- C. Section 088000 - Glazing: Glass and glazing accessories.

**1.03 REFERENCE STANDARDS**

- A. AAMA CW-10 - Care and Handling of Architectural Aluminum from Shop to Site; 2015.
- B. AAMA 501.2 - Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtain Walls, and Sloped Glazing Systems; 2015.
- C. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2020.
- D. AAMA 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections; 2009.
- E. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.
- F. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.
- G. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.
- H. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014 (Reapproved 2021).
- I. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2023).

**1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Coordinate with installation of other components that comprise the exterior enclosure.

**1.05 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, glass and infill, door hardware, and internal drainage details.
- C. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related work, expansion and contraction joint location and details, and field welding required.
  - 1. Include design engineer's stamp or seal on shop drawings for attachments and anchors.
- D. Manufacturer's Certificate: Certify that the products supplied meet or exceed the specified requirements.
- E. Design Data: Provide framing member structural and physical characteristics, engineering calculations, and dimensional limitations.
- F. Hardware Schedule: Complete itemization of each item of hardware to be provided for each door, cross-referenced to door identification numbers in Contract Documents.
- G. Field Quality Control Submittals: Report of field testing for water penetration and air leakage.
- H. Designer's Qualification Statement.
- I. Manufacturer's Qualification Statement.
- J. Installer's Qualification Statement.
- K. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

## **1.06 QUALITY ASSURANCE**

- A. Designer Qualifications: Design structural support framing components under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed in the State in which the Project is located.
- B. Manufacturer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.
- C. Installer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.

## **1.07 DELIVERY, STORAGE, AND HANDLING**

- A. Handle products of this section in accordance with AAMA CW-10.
- B. Protect finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond to aluminum when exposed to sunlight or weather.

## **1.08 FIELD CONDITIONS**

- A. Do not install sealants when ambient temperature is less than 40 degrees F. Maintain this minimum temperature during and 48 hours after installation.

## **1.09 WARRANTY**

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within a five year period after Date of Substantial Completion.
- C. Provide twenty year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking.

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

### **2.02 MANUFACTURERS**

- A. Aluminum-Framed Storefront and Doors:
  - 1. Kawneer North America: [www.kawneer.com](http://www.kawneer.com).
  - 2. Manko Window Systems, Inc: [www.mankowindows.com](http://www.mankowindows.com).
  - 3. Tubelite, Inc: [www.tubeliteinc.com](http://www.tubeliteinc.com).
  - 4. Substitutions: See Section 016000 - Product Requirements.

### **2.03 STOREFRONT**

- A. Aluminum-Framed Storefront: Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.
  - 1. Glazing Position: Front-set.
  - 2. Vertical Mullion Dimensions: 2 inches wide by 6 inches deep. \*Deep mullions at two locations- See Drawings\*
  - 3. Finish: Class I color anodized.
  - 4. Finish Color: Black.
  - 5. Fabrication: Joints and corners flush, hairline, and weatherproof, accurately fitted and secured; prepared to receive anchors and hardware; fasteners and attachments concealed from view; reinforced as required for imposed loads.
  - 6. Construction: Eliminate noises caused by wind and thermal movement, prevent vibration harmonics, and prevent "stack effect" in internal spaces.
  - 7. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.
  - 8. Expansion/Contraction: Provide for expansion and contraction within system components caused by cycling temperature range of 170 degrees F over a 12 hour period without causing detrimental effect to system components, anchorages, and other building elements.
  - 9. Movement: Allow for movement between storefront and adjacent construction, without damage to components or deterioration of seals.
  - 10. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.

- B. Performance Requirements:
1. Wind Loads: Design and size components to withstand the specified load requirements without damage or permanent set, when tested in accordance with ASTM E330/E330M, using loads 1.5 times the design wind loads and 10 second duration of maximum load.
    - a. Member Deflection: Limit member deflection to flexure limit of glass in any direction, with full recovery of glazing materials.
  2. Water Penetration Resistance on Manufactured Assembly: No uncontrolled water on interior face, when tested in accordance with ASTM E331 at pressure differential of 6.66 psf
  3. Air Leakage Laboratory Test: Maximum of 0.09 cu ft/min sq ft of wall area, when tested in accordance with ASTM E283 at 6.24 psf pressure differential across assembly.
  4. Condensation Resistance Factor of Framing: 63, minimum, measured in accordance with AAMA 1503.
  5. Overall U-value Including Glazing: 0.36 Btu/(hr sq ft deg F), maximum.

#### **2.04 COMPONENTS**

- A. Aluminum Framing Members: Tubular aluminum sections, thermally broken with interior section insulated from exterior, drainage holes and internal weep drainage system.
1. Framing members for interior applications need not be thermally broken.
  2. Glazing Stops: Flush.
  3. Structurally Reinforced Members: Extruded aluminum with internal reinforcement of structural steel member.
- B. Glazing: As specified in Section 088000.
- C. Swing Doors: Glazed thermally broken aluminum.
1. Thickness: 1-3/4 inches.
  2. Top Rail: 6 inches wide.
  3. Vertical Stiles: 6 inches wide.
  4. Bottom Rail: 12 inches wide.
  5. Glazing Stops: Square.
  6. Finish: Same as storefront.

#### **2.05 MATERIALS**

- A. Extruded Aluminum: ASTM B221 (ASTM B221M).
- B. Sheet Aluminum: ASTM B209 (ASTM B209M).
- C. Fasteners: Stainless steel.
- D. Exposed Flashings: Aluminum sheet, 20 gage, 0.032 inch minimum thickness; finish to match framing members.
- E. Concealed Flashings: Sheet aluminum, 26 gage, 0.017 inch minimum thickness.
- F. Sill Flashing Sealant: Elastomeric, silicone or polyurethane, compatible with flashing material.
- G. Sealant for Setting Thresholds: Non-curing butyl type.
- H. Glazing Gaskets: Type to suit application to achieve weather, moisture, and air infiltration requirements.
- I. Glazing Accessories: As specified in Section 088000.

#### **2.06 FINISHES**

- A. Class I Color Anodized Finish: AAMA 611 AA-M12C22A42 Integrally colored anodic coating not less than 0.7 mils thick.

#### **2.07 HARDWARE**

- A. For each door, include weatherstripping, sill sweep strip, and threshold.
- B. Other Door Hardware: Storefront manufacturer's standard type to suit application.
1. Finish on Hand-Contacted Items: Polished chrome.
  2. For each door, include pivots, push handle, pull handle, exit device, narrow stile handle latch, and closer.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify dimensions, tolerances, and method of attachment with other work.
- B. Verify that wall openings and adjoining air and vapor seal materials are ready to receive work of this section.

### **3.02 INSTALLATION**

- A. Install wall system in accordance with manufacturer's instructions.
- B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.
- C. Provide alignment attachments and shims to permanently fasten system to building structure.
- D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.
- E. Provide thermal isolation where components penetrate or disrupt building insulation.
- F. Install sill flashings. Turn up ends and edges; seal to adjacent work to form water tight dam.
- G. Where fasteners penetrate sill flashings, make watertight by seating and sealing fastener heads to sill flashing.
- H. Coordinate attachment and seal of perimeter air and vapor barrier materials.
- I. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.
- J. Set thresholds in bed of sealant and secure.
- K. Install hardware using templates provided.
- L. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

### **3.03 TOLERANCES**

- A. Maximum Variation from Plumb: 0.06 inch per 3 feet non-cumulative or 0.06 inch per 10 feet, whichever is less.
- B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch.

### **3.04 FIELD QUALITY CONTROL**

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections.
  - 1. ASTM E1105, ASTM E238/E238M and AAMA 501.2 Water/Air testing. Contractor to assist with testing by providing safe access, water, power, chamber materials and personnel to perform the tests. If failure occurs provide additional test assistance as needed to pass test at no additional cost.
- B. Water Penetration Testing: Perform four tests ASTM E1105. Test specimen sizes will be no larger than 10' x 10'.
  - 1. The static air pressure differential for testing shall be 6.66 psf.
  - 2. Test failure is defined as any water penetration.
- C. Air Leakage Test: Perform 4 tests in accordance with ASTM E 783. Test specimen sizes will be no larger than 10' x 10'. Test specimens will be same specimens tested during water penetration testing.
  - 1. The uniform static air pressure differential for testing shall be 6.24 psf and the allowable leakage shall be 0.09 cfm/ft<sup>2</sup>.
- D. Repair or replacework if test results and inspections indicate that it does not comply with specified requirements.
- E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements. If any test results in failure, re-test the failed specimen and test one additional specimen for each failed test. Re-testing and additional tests shall be at Contractor's expense. No limit shall be set of the total number of tests required to verify compliance with specified performance requirements.
- F. Aluminum-framed assemblies will be considered defective if they do not pass tests and inspections.

### **3.05 ADJUSTING**

- A. Adjust operating hardware and sash for smooth operation.

### **3.06 CLEANING**

- A. Remove protective material from pre-finished aluminum surfaces.
- B. Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths, and take care to remove dirt from corners and to wipe surfaces clean.
- C. Remove excess sealant by method acceptable to sealant manufacturer.

### **3.07 PROTECTION**

- A. Protect installed products from damage until Date of Substantial Completion.

**END OF SECTION**



**SECTION 084413  
GLAZED ALUMINUM CURTAIN WALLS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Aluminum-framed curtain wall, with vision glazing and glass infill panels.
- B. Firestopping between curtain wall and edge of floor slab.

**1.02 RELATED REQUIREMENTS**

- A. Section 019119-Commissioning of Building Enclosure (BECx): Commissioning requirements and procedures.
- B. Section 033000 - Cast-in-Place Concrete: Weld plates embedded in concrete for attachment of anchors.
- C. Section 051200 - Structural Steel Framing: Steel attachment members.
- D. Section 079200 - Joint Sealants: Sealing joints between frames and adjacent construction.

**1.03 REFERENCE STANDARDS**

- A. AAMA CW-10 - Care and Handling of Architectural Aluminum from Shop to Site; 2015.
- B. AAMA 501.1 - Standard Test Method for Water Penetration of Windows, Curtain Walls and Doors Using Dynamic Pressure; 2017.
- C. AAMA 609 & 610 - Cleaning and Maintenance Guide for Architecturally Finished Aluminum (Combined Document); 2015.
- D. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2020.
- E. AAMA 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections; 2009.
- F. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.
- G. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric); 2014.
- H. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.
- I. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.
- J. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2004 (Reapproved 2012).

**1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Coordinate with installation of other components that comprise the exterior enclosure.
- B. Preinstallation Meeting: Conduct a preinstallation meeting one week before starting work of this section; require attendance by all affected installers.

**1.05 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, internal drainage details, glazing, and infill.
- C. Shop Drawings: Drawings showing layout, dimensions, identification of components, and interface with adjacent construction.
  - 1. Include field measurements of openings and verify prior to fabrication.
  - 2. Include 1/2" = 1'-0" elevations showing:
    - a. Each window type.
    - b. Glass and glazing types.
  - 3. Include full size details of:
    - a. Requirements for support and bracing at openings.
    - b. Each composite member.
    - c. All anchorage types and locations.
    - d. Installation details.
    - e. Sealants used.

- D. Samples: Submit two samples 12 by 12 inches in size illustrating finished aluminum surface, glazing, and glazing materials.
- E. Manufacturer's Certificate: Certify that the products supplied meet or exceed the specified requirements.
- F. Design Data: Provide framing member structural and physical characteristics and engineering calculations, and identify dimensional limitations; include load calculations at points of attachment to building structure.
- G. Designer's Qualification Statement.
- H. Manufacturer's Qualification Statement.
- I. Installer's Qualification Statement.
- J. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

#### **1.06 QUALITY ASSURANCE**

- A. Designer Qualifications: Design curtain wall and its structural support framing components under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed at the State in which the Project is located.
- B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with not less than five years of documented experience.
- C. Installer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.

#### **1.07 DELIVERY, STORAGE, AND HANDLING**

- A. Handle products of this section in accordance with AAMA CW-10.
- B. Protect finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond to aluminum when exposed to sunlight or weather.

#### **1.08 FIELD CONDITIONS**

- A. Do not install sealants when ambient temperature is less than 40 degrees F. Maintain this minimum temperature during and 48 hours after installation.

#### **1.09 WARRANTY**

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within a five year period after Date of Substantial Completion.
- C. Provide twenty year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking.

### **PART 2 PRODUCTS**

#### **2.01 MANUFACTURERS**

- A. Glazed Aluminum Curtain Walls:
  1. C.R. Laurence Company, Inc; U.S. Aluminum: [www.crl-arch.com/#sle](http://www.crl-arch.com/#sle).
  2. Kawneer North America: [www.kawneer.com/#sle](http://www.kawneer.com/#sle).
  3. Oldcastle Building Envelope: [www.oldcastlebe.com/#sle](http://www.oldcastlebe.com/#sle).
  4. Tubelite, Inc: [www.tubeliteinc.com/#sle](http://www.tubeliteinc.com/#sle).
  5. Substitutions: See Section 016000 - Product Requirements.

#### **2.02 CURTAIN WALL**

- A. Aluminum-Framed Curtain Wall: Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.
  1. Fabrication Method: Either shop/factory or field fabricated system.
  2. Glazing Method: Either shop/factory or field glazed system.
  3. Vertical Mullion Dimensions: 2-1/2 inches wide by 7-1/2 inches deep.
  4. Finish: Class I color anodized.
    - a. Factory finish surfaces that will be exposed in completed assemblies.
    - b. Coat concealed metal surfaces that will be in contact with cementitious materials or dissimilar metals with bituminous paint.
  5. Provide flush joints and corners, weathersealed, accurately fitted and secured; prepared to receive anchors; fasteners and attachments concealed from view; reinforced as

- required for imposed loads.
  - 6. Construction: Eliminate noises caused by wind and thermal movement, prevent vibration harmonics, and prevent "stack effect" in internal spaces.
  - 7. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.
  - 8. Air and Vapor Seal: Maintain continuous air barrier and vapor retarder throughout assembly, primarily in line with inside pane of glazing and inner sheet of infill panel and heel bead of glazing compound.
  - 9. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.
  - 10. Preparation for Window Treatments: Provide reinforced interior horizontal head rail.
- B. Structural Performance Requirements: Design and size components to withstand the following load requirements without damage or permanent set.
- 1. Design Wind Loads: Comply with the applicable code.
  - 2. Movement: Accommodate the following movement without damage to components or deterioration of seals:
    - a. Expansion and contraction caused by 180 degrees F surface temperature.
    - b. Expansion and contraction caused by cycling temperature range of 170 degrees F over a 12 hour period.
    - c. Movement of curtain wall relative to perimeter framing.
    - d. Deflection of structural support framing, under permanent and dynamic loads.
- C. Water Penetration Resistance on Manufactured Assembly: No uncontrolled water on indoor face when tested as follows:
- D. Water Penetration Resistance on Manufactured Assembly: No uncontrolled water on indoor face when tested as follows:
- 1. Test Pressure Differential: 6.66 psf.
- E. Air Leakage Laboratory Test: Maximum of 0.09 cu ft/min sq ft of wall area, when tested in accordance with ASTM E283 at 6.24 psf pressure differential across assembly.
- F. Thermal Performance Requirements:
- 1. Condensation Resistance Factor of Framing: 63, minimum, measured in accordance with AAMA 1503.
  - 2. Overall U-value Including Glazing: 0.36 Btu/(hr sq ft deg F), maximum.

### 2.03 COMPONENTS

- A. Aluminum Framing Members: Tubular aluminum sections, thermally broken with interior section insulated from exterior, drainage holes and internal weep drainage system.
  - 1. Framing members for interior applications need not be thermally broken.
  - 2. Structurally Reinforced Members: Extruded aluminum with internal reinforcement of structural steel member.
- B. Glazing: As specified in Section 088000.

### 2.04 MATERIALS

- A. Extruded Aluminum: ASTM B221 (ASTM B221M).
- B. Sheet Aluminum: ASTM B209 (ASTM B209M).
- C. Fasteners: Stainless steel; type as required or recommended by curtain wall manufacturer.
- D. Concealed Flashings: Sheet aluminum, 26 gage, 0.017 inch minimum thickness.
- E. Firestopping: As specified in Section 078400.
- F. Sill Flashing Sealant: Elastomeric, silicone or polyurethane, and compatible with flashing material.
- G. Glazing Accessories: As specified in Section 088000.
- H. Shop and Touch-Up Primer for Steel Components: Zinc oxide, alkyd, linseed oil primer appropriate for use over hand cleaned steel.

## **2.05 FINISHES**

- A. Class I Color Anodized Finish: AAMA 611 AA-M12C22A42 Integrally colored anodic coating not less than 0.7 mils thick.
- B. Color: To be selected by Architect from manufacturer's full range.
- C. Touch-Up Materials: As recommended by coating manufacturer for field application.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify dimensions, tolerances, and method of attachment with other related work.
- B. Verify that curtain wall openings and adjoining air and vapor seal materials are ready to receive work of this section.
- C. Verify that anchorage devices have been properly installed and located.

### **3.02 INSTALLATION**

- A. Install curtain wall system in accordance with manufacturer's instructions.
- B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.
- C. Provide alignment attachments and shims to permanently fasten system to building structure.
- D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.
- E. Provide thermal isolation where components penetrate or disrupt building insulation.
- F. Install sill flashings. Turn up ends and edges; seal to adjacent work to form water tight dam.
- G. Install firestopping at each floor slab edge.
- H. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

### **3.03 TOLERANCES**

- A. Maximum Variation from Plumb: 0.06 inches every 3 ft non-cumulative or 0.5 inches per 100 ft, whichever is less.
- B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch.
- C. Sealant Space Between Curtain Wall Mullions and Adjacent Construction: Maximum of 3/4 inch and minimum of 1/4 inch.

### **3.04 FIELD QUALITY CONTROL**

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections.
  - 1. ASTM E1105, ASTM E238/E238M and AAMA 501.2 Water/Air testing. Contractor to assist with testing by providing safe access, water, power, chamber materials and personnel to perform the tests. If failure occurs provide additional test assistance as needed to pass test at no additional cost.
- B. Water Penetration Testing: Perform four tests ASTM E1105. Test specimen sizes will be no larger than 10' x 10'.
  - 1. The static air pressure differential for testing shall be 6.66 psf.
  - 2. Test failure is defined as any water penetration.
- C. Air Leakage Test: Perform 4 tests in accordance with ASTM E 783. Test specimen sizes will be no larger than 10' x 10'. Test specimens will be same specimens tested during water penetration testing.
  - 1. The uniform static air pressure differential for testing shall be 6.24 psf and the allowable leakage shall be 0.09 cfm/ft<sup>2</sup>.
- D. Repair or replacework if test results and inspections indicate that it does not comply with specified requirements.
- E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements. If any test results in failure, re-test the failed specimen and test one additional specimen for each failed test. Re-testing and additional tests shall be at Contractor's expense. No limit shall be set of the total number of tests required to verify compliance with specified performance requirements.

- F. Aluminum-framed assemblies will be considered defective if they do not pass tests and inspections.
- G. Repair or replace curtain wall components that have failed designated field testing, and retest to verify performance complies with specified requirements. Any retesting costs are the responsibility of the contractor.

### **3.05 ADJUSTING**

- A. Adjust operating sash for smooth operation.

### **3.06 CLEANING**

- A. Remove protective material from pre-finished aluminum surfaces.
- B. Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths, take care to remove dirt from corners, and wipe surfaces clean.
- C. Upon completion of installation, thoroughly clean aluminum surfaces in accordance with AAMA 609 & 610.

### **3.07 PROTECTION**

- A. Protect installed products from damage until Date of Substantial Completion.

**SECTION 087100  
DOOR HARDWARE**

**PART 1 - GENERAL**

**1.1 CONDITIONS**

- A. Conditions of the contract (General and Supplementary Conditions) and Division 01 - General Requirements, govern the work of this section.
- B. This section includes all material, and related service necessary to furnish all finish hardware indicated on the drawings or specified herein.
- C. Furnish UL listed hardware for all labeled and 20 min. openings in conformance with the requirements for the class of opening scheduled. Underwriters' requirements shall have precedence over specification where conflicts exist.
- D. All work shall be in accordance with all applicable state and local building codes. Code requirements shall have precedence over this specification where conflicts exist.

**1.2 WORK INCLUDED**

- A. This section includes the following:
  - 1. Furnish door hardware (for hollow metal, wood and aluminum doors) specified herein, listed in the hardware schedule, and/or required by the drawings.
  - 2. Cylinders for Aluminum Doors
  - 3. Thresholds and Weather-stripping (Aluminum frame seals to be provided by aluminum door supplier)
  - 4. Electro-Mechanical Devices
  - 5. Access Control components and or systems specified within this section.
- B. Where items of hardware are not definitely or correctly specified and is required for the intended service, such omission, error or other discrepancy should be directed to the Architect prior to the bid date for clarification by addendum. Otherwise furnish such items in the type and quantity established by this specification for the appropriate service intended.

**1.3 RELATED WORK IN OTHER SECTIONS**

- A. This section includes coordination with related work in the following sections:
  - 1. Division 06 Section "Finish Carpentry".
  - 2. Division 06 Section "Cabinet Hardware"
  - 3. Division 08 Section "Hollow Metal Doors and Frames".
  - 4. Division 08 Section "Wood Doors"
  - 5. Division 08 Section "Storm Doors"
  - 6. Division 08 Section "Aluminum Entrances and Storefronts"
  - 7. Division 26 Sections "Electrical"
  - 8. Division 28 Sections "Electronic Safety and Security".

**1.4 REFERENCES**

- A. Publications of agencies and organizations listed below form a part of this specification section to the extent referenced.
  - 1. DHI – Installation Guide for Doors and Hardware (2020).
  - 2. NFPA 80 - Standards for Fire Doors and Windows.
  - 3. NFPA 101 - Code for Safety to Life from Fire in Buildings and Structures.
  - 4. UL - Building Material Directory.
  - 5. DHI - Door and Hardware Institute
  - 6. WHI - Warnock Hersey
  - 7. BHMA - Builders Hardware Manufacturers Association
  - 8. ANSI – American National Standards Institute

9. IBC - International Building Code 2018 Edition (as adopted and amended by local building code)

## **1.5 SUBMITTALS**

- A. Within ten days after award of contract, submit detailed hardware schedule in quantities as required by Division 01 - General Requirements.
- B. Schedule format shall be consistent with recommendations for a vertical format as set forth in the Door & Hardware Institute's (DHI) publication "Sequence and Format for the Hardware Schedule". Hardware sets shall be consolidated to group multiple door openings which share similar hardware requirements. Schedule shall include the following information:
  1. Door number, location, size, handing, and rating.
  2. Door and frame material, handing.
  3. Degree of swing.
  4. Manufacturer
  5. Product name and catalog number
  6. Function, type and style
  7. Size and finish of each item
  8. Mounting heights
  9. Explanation of abbreviations, symbols, etc.
  10. Numerical door index, indicating the hardware set/ group number for each door.
- C. When universal type door closers are to be provided, the schedule shall indicate the application method to be used for installation at each door: (regular arm, parallel arm, or top jamb).
- D. The schedule will be prepared under the direct supervision of a certified Architectural Hardware Consultant (AHC), or certified Door Hardware Consultant (DHC) employed by the hardware distributor. The hardware schedule shall be signed and embossed or stamped with the DHI certification seal of the supervising AHC or DHC. The supervising AHC or DHC shall attend any meetings related to the project when requested by the architect.
- E. Check the specified hardware for suitability and adaptability to the details and surrounding conditions.
- F. Review drawings from related trades as required to verify compatibility with specified hardware. Indicate unsuitable or incompatible items, and proposed substitutions in the hardware schedule.
- G. Provide documentation for all hardware to be furnished on labeled fire doors indicating compliance with positive pressure fire testing UL 10C.
- H. Furnish manufacturers' catalog data for each item of hardware in quantities as required by Division 01 - General Requirements.
- I. Submit a sample of each type of hardware requested by the architect. Samples shall be of the same finish, style, and function as specified herein. Tag each sample with its permanent location so that it may be used in the final work.
- J. Furnish with first submittal, a list of required lead times for all hardware items.
- K. After final approved schedule is returned, transmit corrected copies for distribution and field use in quantities as required by Division 01 - General Requirements.
- L. Furnish approved hardware schedules, template lists, and pertinent templates as requested by related trades.
- M. Furnish necessary diagrams, schematics, voltage and amperage requirements for all electro-mechanical devices or systems as required by related trades. Wiring diagrams shall be opening specific and include both a riser diagram and point to point diagram showing all wiring terminations.
- N. After receipt of approved hardware schedule, Hardware supplier shall initiate a meeting including the owner's representative to determine keying requirements. Upon completion of initial key

meeting, hardware supplier shall prepare a proposed key schedule with symbols and abbreviations as set forth in the door and hardware institute's publication "Keying Procedures, Systems, and Nomenclature". Submit copies of owner approved key schedule for review and field use in quantities as required by Division 01 - General Requirements. Wiring diagrams shall be included in final submittals transmitted for distribution of field use.

## **1.6 QUALITY ASSURANCE**

- A. Manufacturers and model numbers listed are to establish a standard of function and quality. Similar items by approved manufacturers that are equal in design, function, and quality, may be considered for prior approval of the architect, provided the required data and physical samples are submitted for approval as set forth in Division 01 - General Requirements.
- B. Where indicated in this specification, products shall be independently certified by ANSI for compliance with relevant ANSI/BHMA standards A156.1 - A156.36 – Standards for Hardware and Specialties. All products shall meet or exceed certification requirements for the respective grade indicated within this specification. Supplier shall provide evidence of certification when requested by the architect.
- C. Obtain each type of hardware (hinges, latch & locksets, exit devices, closers, etc.) from a single manufacturer, although several may be indicated as offering products complying with requirements.
- D. Electrical drawings and electrical specifications are based on the specific electrified hardware components specified in hardware sets. When electronic hardware components other than those indicated in hardware sets are provided, the supplier shall be responsible for all costs incurred by the design team and their consultants to review and revise electrical drawings and electrical specifications. Supplier shall also be responsible for any additional costs associated with required changes in related equipment, materials, installation, or final hook up to ensure the system will operate and function as indicated in the construction documents, including hardware set operational / functional descriptions.
- E. All hardware items shall be manufactured no earlier than 6 months prior to delivery to site.
- F. Hardware supplier shall be factory trained and certified by the manufacture to provide and support all computer managed locks and system components.
- G. Installation of hardware shall be installed or directly supervised and inspected by a skilled installer certified by the manufacturer of locksets, door closers, and exit devices used on the project, or with not less than 3 years' experience in successful completion of projects similar in size and scope.
- H. Provide hardware for all labeled fire doors, which complies with positive pressure fire testing UL 10C.
- I. Comply with all applicable provisions of the standards referenced within section 1.4 of this specification.
- J. Hardware supplier shall participate when reasonably requested to meet with the contractor and or architect to inspect any claim for incorrect or non-functioning materials; following such inspection, the hardware supplier shall provide a written statement documenting the cause and proposed remedy of any unresolved items.

## **1.7 DELIVERY, STORAGE AND HANDLING**

- A. Hardware supplier shall deliver hardware to the job site unless otherwise specified.
- B. All hardware shall be delivered in manufacturers' original cartons and shall be clearly marked with set and door number.
- C. Coordinate with contractor prior to hardware delivery and recommend secure storage and protection against loss and damage at job site.



- D. Contractor shall receive all hardware and provide secure and proper protection of all hardware items to avoid delays caused by lost or damaged hardware. Contractor shall report shortages to the Architect and hardware supplier immediately after receipt of material at the job site.
- E. Coordinate with related trades under the direction of the contractor for delivery of hardware items necessary for factory installation.

**1.8 PRE-INSTALLATION MEETING**

- A. Schedule a hardware pre-installation meeting on site to review and discuss required door operating clearances and the installation of continuous hinges, locksets, door closers, exit devices, overhead stops, and electromechanical door hardware.
- B. Meeting attendees shall be notified 7 days in advance and shall include: Architect, Contractor, Door Hardware Installers (including low voltage hardware), Manufacturers representatives for above hardware items, and any other effected subcontractors or suppliers.
- C. All attendees shall be prepared to distribute installation manuals, hardware schedules, templates, and physical hardware samples.

**1.9 WARRANTY**

- A. All hardware items shall be warranted against defects in material and workmanship as set forth in Division 01 - General Requirements.
- B. Repair, replace, or otherwise correct deficient materials and workmanship without additional cost to owner.

**PART 2 - PRODUCTS**

**2.1 FASTENERS**

- A. All exposed fasteners shall be Phillips head or as otherwise specified and shall match the finish of the adjacent hardware. All fasteners ex-posed to the weather shall be non-ferrous or stainless steel. Furnish correct fasteners to accommodate surrounding conditions.
- B. Coordinate required reinforcements for doors and frames. Seek approval of the architect prior to furnishing through-bolts. Furnish through-bolts as required for materials not readily reinforced.

**2.2 BUTT HINGES**

- A. Acceptable manufacturers and respective catalog numbers:

	<u>Ives</u>	<u>Stanley</u>	<u>Hager</u>	<u>McKinney</u>
1. Standard Weight, Plain Bearing	5PB1	F179	****	T2714
2. Standard Weight, Ball Bearing	5BB1	BB179	BB1279	TB2714
3. Standard Weight, Ball Bearing, Non-Ferrous	5BB1	FBB191	BB1191	TB2314
4. Heavy Weight, Ball Bearing	5BB1HW	FBB168	BB1168	T4B3786
5. Heavy Weight, Ball Bearing, Non-Ferrous	5BB1HW	FBB199	BB1199	T4B3386

- B. Hinges shall be independently certified by ANSI for compliance with ANSI A156.1 (2006). Hinges shall meet or exceed the following ANSI grade requirements as indicated below:
  - 1. Standard Weight, Plain Bearing Hinges: Grade 3
  - 2. Standard Weight, 2 Ball Bearing Hinges: Grade 2
  - 3. Heavy Weight, 4 Ball Bearing Hinges: Grade 1
- C. Unless otherwise specified, furnish the following hinge quantities for each door leaf.
  - 1. 3 hinges for doors up to 90 inches.
  - 2. 1 additional hinge for every 30 inches on doors over 90 inches.
  - 3. 4 hinges for Dutch door applications.
- D. Unless otherwise specified, top and bottom hinges shall be located as specified in Division 08 Section "Hollow Metal Doors and Frames". Intermediate hinges shall be located equidistant from others.

- E. Unless otherwise specified, furnish hinge weight and type as follows:
  1. Standard weight: plain bearing hinge 5PB1 or ball bearing hinge 5BB1 for interior openings through 36 inches wide without a door closer.
  2. Standard weight: ball bearing hinge 5BB1 for interior opening over 36 through 40 inches wide without a door closer, and for interior openings through 40 inches wide with a door closer.
  3. Heavyweight: 4 ball bearing hinge 5BB1HW for interior openings over 40 inches wide, and for all vestibule doors.
  4. Heavyweight: 4 ball bearing hinge 5BB1HWss for exterior openings unless otherwise listed in groups.
  5. Heavyweight: 4 ball bearing hinge 5BB1HWss 5" for all exterior doors or 4 ball bearing hinge 5BB1HW 5" for interior doors, that have an automatic operator.
- F. At existing frames receiving new hinges, match existing hinge size and weight.
- G. Unless otherwise specified, furnish hinges for exterior doors, fabricated from brass, bronze, or stainless steel. Unless otherwise specified, hinges for interior doors may be fabricated from steel.
- H. Unless otherwise specified, furnish hinges in the following sizes:
  1. 5" x 5"                      2-1/4" thick doors
  2. 4-1/2" x 4-1/2"        1-3/4" thick doors
  3. 3-1/2" x 3-1/2"        1-3/8" thick doors
- I. Furnish hinges with width to accommodate trim and allow for 180-degree swing.
- J. Unless otherwise specified, furnish hinges with flat button tips with non-rising pins at interior doors, non-removable loose pins (NRP) at exterior, and out-swinging lockable interior doors.
- K. Unless otherwise specified, furnish all hinges to template standards.

**2.3 CONTINUOUS PIN AND BARREL HINGES**

- A. Acceptable manufacturers and respective catalog numbers:
 

	<u>Ives</u>	<u>Markar</u>	<u>Stanley</u>
1. Edge Mount Pin & Barrel Stainless Steel Continuous Hinge	700 Series	300 Series	650 Series
- B. Hinges shall be independently certified by ANSI for compliance with ANSI A156.26, Grade 1 (2012).
- C. Continuous hinges shall be full height pin and barrel type hinge providing full height door support up to 600 lbs. Edge mount (unless noted otherwise).
- D. Construct hinges of heavy-duty 14-gauge material. The stainless internal pin shall have a diameter of 0.25 and the exterior barrel diameter of 0.438.
- E. Hinge shall be non-handed with symmetrical template hole pattern and factory drilled. Hinge must accept a minimum of 21 fasteners on the door and 21 fasteners on the frame.
- F. Each knuckle to be 2 inches, including split nylon bearing at each separation for quiet, smooth, self-lubricating operation.
- G. Hinge to be able to carry Warnock Hersey Int. or UL for fire rated doors and frames up to 3 hours.
- H. Provide machine screws for doors which have been reinforced to accept machine screws.
- I. Note: Fire label for doors and frames should be placed on the header and top rail of fire rated doors and frames.
- J. Provide adjusting screws equal to Ives "Adjust-a-Stud" for continuous hinges specified as 705. Adjustment to be able to correct frame fit problems up to 3/8 inch.

## 2.4 POWER TRANSFERS

- A. Acceptable manufacturers and respective catalog numbers:
- |                       | <u>Von Duprin</u> | <u>ASSA</u> |
|-----------------------|-------------------|-------------|
| 1. Concealed Two Wire | EPT-2             | CEPT-10     |
| 2. Concealed Ten Wire | EPT-10            | CEPT-10     |
- B. Door cords shall be armored cable with screw on caps.
- C. Concealed power transfers shall be concealed in the door and frame when the door is closed.
- D. Concealed power transfers shall have a steel tube to protect wires from being cut.
- E. Concealed power transfers with spring tubes shall be rejected.
- F. Concealed power transfers shall be supplied with a mud box to house all terminations.

## 2.5 FLUSH BOLTS AND DUST PROOF STRIKES

- A. Acceptable manufacturers and respective catalog numbers:
- |  | <u>Ives</u> | <u>Door Controls</u> | <u>Hager</u> |
|--|-------------|----------------------|--------------|
| 1. Dust Proof Strike                   | DP2         | 80                   | 280X         |
| 2. Auto Flush Bolt (Metal Door)        | FB31P       | 842                  | 292D         |
| 3. Auto Flush Bolt (Wood Door)         | FB41P       | 942                  | 291D         |
| 4. Constant Latching Bolt (Metal Door) | FB51P       | 845                  | 293D         |
| 5. Constant Latching Bolt (Wood Door)  | FB61P       | 945                  | 294D         |
| 6. Manual Flush Bolt                   | FB458       | 780                  | 282D         |
- B. Unless otherwise specified, provide 12" rods for manual flush bolts for door 7'6" or less, 24" top rods for doors over 7'6" to 8'6".
- C. Unless otherwise specified, provide doors over 8'6" with automatic top bolts.
- D. Provide automatic flush bolts where required to maintain fire door listing and or egress requirements on pairs of doors.
- E. All flush-bolt applications shall be UL listed to be installed with top flush-bolt only. Provide auxiliary fire bolt as required for fire rated openings where less bottom bolt has been specified.
- F. Provide all bottom flush bolts with non-locking dust proof strikes.

## 2.6 EXIT DEVICES

- A. Acceptable manufacturers and respective catalog numbers:
- |  | <u>Von Duprin</u> | <u>No Substitution</u> |
|--|-------------------|------------------------|
| 1. Wide Stile, Push Pad                  | 98 Series         |                        |
| 2. Wide Stile, Electric Latch Retraction | QEL 98 Series     |                        |
| 3. Lever Trim                            | 996 Series        |                        |
| 4. Pull Trim                             | 990 Series        |                        |
- A. Exit devices shall be independently certified by ANSI for compliance with ANSI A156.3, Grade 1 (2008).
- B. Obtain exit devices from a single manufacturer, although several may be indicated as offering products complying with requirements.
- C. All exit devices shall be equipped with a sound-dampening feature to reduce touch pad return noise.
- D. Quiet Electric Latch Retraction shall be accomplished using a motor driven assembly, and shall incorporate the following features:
1. Motor shall retract both the push pad assembly and latchbolt.
  2. Automatic calibration of latch throw and pull.
  3. Built-in time delay.
  4. On-board installation and troubleshooting diagnostics built into power supply and device.

5. Retry mode if device does not pull on the first try.
- E. On full glass doors there shall be no exposed fasteners on the back of the mechanism visible through the glass.
- F. All exit devices shall be provided with flush end caps to reduce potential damage from impact.
- G. All exit devices shall be provided with dead-locking latch bolts to ensure security.
- H. All exit devices shall be U.L. listed for accident hazard. Exit device for use on fire doors shall also be U.L. listed for fire exit hardware.
- I. Provide optional strikes, special length rods, and adapter plates to accommodate door and frame conditions. Provide narrow style series devices in lieu of wide stile series devices where optional strikes will not accommodate door and frame conditions.
- J. Coordinate with related trades to ensure adequate clearance and reinforcement is provided in doors and frames. Provide thru bolts as required.
- K. Refer to hardware groups for exit device applications utilizing the option of: "less bottom rod and floor strike" (LBR)
- L. All exit devices shall be provided with optional trim designs to match other lever and pull designs used on the project.
- M. Unless specific exit device dogging options are noted within hardware sets, provide dogging options as follows:
  1. Fire Rated devices: Dogging not permitted.
  2. Non-Rated Exit Only functions not equipped with outside trim or pull: Less Dogging.
  3. Non-Rated Classroom functions: Less Dogging.
  4. Non-Rated devices utilizing electric latch retraction or electrified outside trim: Less Dogging.
  5. All Other Non-Rated devices: Cylinder Dogging utilizing interchangeable core cylinders. Cylinder keyway shall match locksets furnished on this project.
- N. Provide glass bead kits as required to accommodate door conditions. Screws shall not be visible through full glass doors.
- O. Where specified, provide compatible keyed mullions with cylinder for pairs of doors.
- P. Provide Von Duprin #154 or equivalent mullion/frame stabilizers at the following application(s):
  1. Lockable exterior or vestibule paired openings with a fixed or removable hollow metal or aluminum mullion.
  2. Lockable exterior or vestibule single doors in aluminum frames.
- Q. Provide reinforced crossbars for all traditional style exit devices applied to doors over 36" wide.

## 2.7 LOCKS AND LATCHES

- A. Acceptable manufacturers and respective catalog numbers:
 

	<u>Schlage</u>
1. Grade 1 Mortise	L Series (Match existing lever trim)
2. Grade 1 Cylindrical	ND Series
- B. Bored locks shall be independently certified by ANSI for compliance with ANSI A156.2 (2011). Interconnected locks shall be independently certified by ANSI for compliance with ANSI A156.12 (2013). Mortise locks shall be independently certified by ANSI for compliance with ANSI A156.13 (2012).
- C. Minimize transmission of heat to lock trim. Provide temperature control modules (TCM) on all electrified locks when cataloged by the lock manufacturer.
- D. Unless otherwise specified, all locks and latches to have:
  1. 2-3/4" Backset
  2. 1/2" minimum throw latchbolt

3. 1" throw deadbolt
  4. ANSI A115.2 strikes
- E. Provide guarded latch bolts for all locksets, and latch bolts with throw to maintain fire rating of both single and paired door assemblies.
  - F. Provide strike with lip length adequate to clear surrounding trim.
  - G. Provide wrought boxes for strikes at inactive doors, wood frames, and metal frames without integral mortar covers.
  - H. Provide Von Duprin #154 or equivalent mullion/frame stabilizers at the following application(s) unless provided with deadbolt:
    1. Lockable exterior or vestibule paired openings with a fixed or removable hollow metal or aluminum mullion.
    2. Lockable exterior or vestibule single doors in aluminum frames.

## 2.8 PULLS, PUSH BARS, PUSH/PULL PLATES

- A. Acceptable manufacturers and respective catalog numbers:

	<u>Burns</u>	<u>Hager</u>	<u>Ives</u>
1. Offset Door Pull (1" dia., 10" CTC)	39C	12J	8190-0
2. Offset Pull / Push-Bar (1" dia., 10" CTC Pull)	422 x 39C	159	9190-0
3. Push Plate (.050 6"X 16")	56	30S 6 x 16	8200 6" X 16"
4. Pull Plate (1" dia., 10" CTC - .050" X 4" X 16")	5426C	34J 4 x 16	8303-0 4" X 16"

- A. Adjust dimensions of push plates to accommodate stile and rail dimensions, lite and louver cutouts, and adjacent hardware. Where required by adjacent hardware, push plates shall be factory drilled for cylinders or other mortised hardware. All push plates shall be beveled 4 sides and counter sunk.
- B. Where possible, provide back-to-back, and concealed mounting for pulls and push bars. Push bar length shall be 3" less door width, or center of stile to center of stile for stile & rail or full glass doors.

## 2.9 CLOSERS

- A. Acceptable manufacturers and respective catalog numbers:

<u>LCN</u>	<u>No Substitution</u>
1. 4040XP / 4040XP EDA	

- B. Door closers shall be independently certified by ANSI for compliance with ANSI A156.4, Grade 1 (2013).
- C. Obtain door closers from a single manufacturer, although several may be indicated as offering products complying with requirements.
- D. Provide extra heavy-duty arm (EDA / HD) when closer is to be installed using parallel arm mounting.
- E. Hardware supplier shall coordinate with related trades to ensure aluminum frame profiles will accommodate specified door closers.
- F. Closers shall use high strength cast iron cylinders, forged main arms, and one-piece forged steel pistons.
- G. Closers shall utilize a stable fluid withstanding temperature range of +120deg F to -30deg F without seasonal adjustment of closer speed to properly close the door. Closers for fire-rated doors shall be provided with temperature stabilizing fluid that complies with standards UL10C.
- H. Unless otherwise specified, all door closers shall have full covers and separate adjusting valves for sweeps, latch, and backcheck.
- I. Provide closers for all labeled doors. Provide closer series and type consistent with other closers for similar doors specified elsewhere on the project.

- J. Provide closers with adjustable spring power. Size closers to ensure exterior and fire rated doors will consistently close and latch doors under existing conditions. Size all other door closers to allow for reduced opening force not to exceed 5 lbs.
- K. Install closers on the room side of corridor doors, stair side of stairways and interior side of exterior doors.
- L. Closers shall be furnished complete with all mounting brackets and cover plates as required by door and frame conditions, and by adjacent hardware.
- M. Door closers shall be provided with a powder coat finish to provide superior protection against the effects of weathering. Powder coat finish shall successfully pass a 100 hour salt spray test.
- N. Pressure Relief Valve, PRV, shall not be acceptable.

## **2.10 LOW ENERGY ELECTRO-HYDRAULIC AUTOMATIC OPERATORS**

- A. Acceptable manufacturers and respective catalog numbers:
 

	<u>LCN</u>
1. Electro-Hydraulic Operator	4640
- B. Low energy operators shall be independently certified by ANSI for compliance with ANSI A156.19 (2002).
- C. Where low kinetic energy, as defined by ANSI/BHMA Standard A156.19, power operators are indicated for doors required to be accessible to the disabled, provide electrically powered operators complying with the ADA for opening force and time to close standards.
- D. The closing action shall be controlled by modern type cast iron door closer cylinder filled with a flat viscosity fluid, stable from +120F to -30F that would require no seasonal adjustments. The closer shall have field adjustable spring power; have two independent closing speed adjustment valves, and hydraulic back-check.
- E. Full closing force shall be provided when the power or assist cycle ends.
- F. All power operator systems shall include the following features and functions:
  - 1. Provisions for separate conduits to carry high and low voltage wiring in compliance with the National Electrical Code, section 725-31.
  - 2. The operator will be designed with an electronically controlled mechanical clutching mechanism to prevent damage to the operator if the system is actuated while the door is latched or if the door is forced closed during the opening cycle.
  - 3. All covers, mounting plates and arm systems shall be powder coated and successfully pass a minimum of 100 hours testing as outlined in ANSI/BHMA Standard A156.18.
  - 4. UL listed for use on labeled doors.
  - 5. All operators shall be non-handed with spring power over a range of at least four sizes; either 1 through 4 or 2 through 5.
  - 6. The power operator shall incorporate microprocessor controlled digital controls including factory default memory settings, on-board diagnostics, non-volatile memory, and integrated delay and relay for controlling door release devices.
  - 7. Provisions in the control box or module shall provide control {inputs and outputs} for; electric strike delay, auxiliary contacts, sequential operation, fire alarms systems, actuators, swing side sensors, and stop side sensors.
  - 8. Exterior switches shall be weather resistant and mount on a single gang electrical box furnished by Division 26.
- G. All electrically powered operators shall include the following features or functions:
  - 1. When an obstruction or resistance to the opening swing is encountered, the operator will pause at that point, then attempt to continue opening the door. If the obstruction or resistance remains, the operator will again pause the door.
  - 2. Easily accessible main power and maintain hold open switches will be provided on the operator.

3. An electronically controlled clutch to provide adjustable opening force.
  4. A microprocessor to control all motor and clutch functions.
  5. An on-board power supply capable of delivering both 12V and 24V outputs up to a maximum of 1.0 ampere combined load.
  6. All input and output power wiring shall be protected by slow blow fuses. These fuses shall be easily replaceable without special tools or component replacement.
  7. If electrical failure occurs, the unit shall operate as a standard door closer.
- H. Power Operators shall be warranted by the manufacture to be free from defects in material and workmanship for a period of two years.

**2.11 KICK PLATES AND MOP PLATES**

- A. Furnish protective plates as specified in hardware groups.
- B. Where specified, provide 10" kick plates, 34" armor plates, and 4" mop plates. Unless otherwise specified, metal protective plates shall be .050" thick; plastic plates shall be 1/8" thick.
- C. Protective plates shall be 2" less door width, or 1" less door width at pairs. All protective plates shall be beveled 4 sides and counter sunk.
- D. Protection plates over 16" shall not be provided for labeled doors unless specifically approved by door manufacturers listing. When protection plates over 16" are provided for labeled doors, the plate shall be labeled.
- E. Where specified, provide surface mounted door edges. Edges shall butt to protective plates. Provide edges with cutouts as required adjacent hardware.
- F. Adjust dimensions of protection plates to accommodate stile and rail dimensions, lite and louver cutouts, and adjacent hardware. Where required by adjacent hardware, protection plates shall be factory drilled for cylinders or other mortised hardware.

**2.12 OVERHEAD STOPS**

- A. Acceptable manufacturers and respective catalog numbers:
 

	<u>Glynn-Johnson</u>	<u>Rixson</u>	<u>Sargent</u>
1. Heavy Duty Surface Mount	GJ900 Series	9 Series	590
2. Heavy Duty Concealed Mount	GJ100 Series	1 Series	690
- B. Unless otherwise specified, furnish GJ900 series overhead stop for hollow metal or 1-3/4" solid core doors equipped with regular arm surface type closers that swing more than 140 degrees before striking a wall, for hollow metal or 1-3/4" solid core doors that open against equipment, casework, sidelights, or other objects that would make wall bumpers inappropriate, and as specified in hardware groups.
- C. Furnish sex bolt attachments for wood and mineral core doors unless doors are supplied with proper reinforcing blocks.
- D. Provide special stop only ("SE" suffix) overhead stops when used in conjunction with electronic hold open closers.
- E. Do not provide holder function for labeled doors.

**2.13 WALL STOPS AND HOLDERS**

- A. Acceptable manufacturers and respective catalog numbers:
 

	<u>Ives</u>	<u>Hager</u>	<u>Burns</u>
1. Wrought Convex Wall Stop	WS406CVX	232W	570
2. Wrought Concave Wall Stop	WS406CCV	236W	575
3. Automatic Wall Holder	WS40	326W	533
- B. Furnish a stop or holder for all doors.
- C. Provide concave style wall stop at all adjacent integral push button locks; provide convex style wall stop at all other locations.

- D. Where wall stops are not applicable, furnish overhead stops.
- E. Furnish floor stops or hinge pin stops only where specified in hardware sets.
- F. Do not provide holder function for labeled doors.

**2.14 WEATHERSTRIP, GASKETING**

A. Acceptable manufacturers and respective catalog numbers:

	<u>Zero</u>	<u>Pemko</u>	<u>NGP</u>	<u>Reese</u>
1. Weatherstrip	429	2891_PK	700NA	755
2. Adhesive Gasket	188	S88	5050	797
3. Sweep w/ drip	8198	345_N	C627	354
4. Drip Cap	142	346	16	R201

- B. Weatherstrip and gasketing shall be independently certified by ANSI for compliance with ANSI A156.22 (2005).
- C. Where specified in the hardware groups, furnish the above products unless otherwise detailed in groups.
- D. Provide weatherstripping all exterior doors and where specified.
- E. Provide intumescent and other required edge sealing systems as required by individual fire door listings to comply with positive pressure standards UL 10C.
- F. Provide Zero 188 smoke gaskets at all fire rated doors and smoke and draft control assemblies.
- G. Provide gasketing for all meeting edges on pairs of fire doors. Gasketing shall be compatible with astragal design provided by door supplier as required for specific fire door listings.

**2.15 THRESHOLDS**

A. Acceptable manufacturers and respective catalog numbers:

	<u>Zero</u>	<u>Pemko</u>	<u>NGP</u>	<u>Reese</u>
1. Saddle Thresholds	8655	171	425	S205
2. Half Saddle Thresholds	1674	227	324	S239
3. Interlocking Threshold	74A	114	442-5	T550

- A. Thresholds shall be independently certified by ANSI for compliance with ANSI A156.21 (2001).
- B. Hardware supplier shall verify all finish floor conditions and coordinate proper threshold as required to ensure a smooth transition between threshold and interior floor finish.
- C. Threshold Types:
  - 1. Unless otherwise specified, provide saddle threshold similar to Zero 8655 for all exterior openings with an interior floor finish less than or equal to 1/4" in height.
  - 2. Unless otherwise specified, provide half saddle threshold similar to Zero 1674 for all exterior openings with an interior floor finish greater than 1/4" in height. Threshold height shall match thickness of interior floor finish.

**2.16 DOOR POSITION SWITCHES**

A. Acceptable manufacturers and respective catalog numbers:

	<u>Schlage Electronics</u>	<u>GRI</u>	<u>Sargent</u>
1. Concealed	679 Series	190-12	3287

**2.17 FINISHES AND BASE MATERIALS**

A. Unless otherwise indicated in the hardware groups or herein, hardware finishes shall be applied over base metals as specified in the following finish schedule:

<u>HARDWARE ITEM</u>	<u>BHMA FINISH AND BASE MATERIAL</u>
1. Butt Hinges: Exterior, or Non-Ferrous	630 (US32D - Satin Stainless Steel)
2. Butt Hinges: Interior	652 (US26D - Satin Chromium)
3. Continuous Hinges	630 (US32D - Satin Stainless Steel)



4. Flush Bolts	626 (US26D - Satin Chromium)
5. Exit Devices	626 (US26D - Satin Chromium)
6. Locks and Latches	626 (US26D - Satin Chromium)
7. Pulls and Push Plates/Bars	630 (US32D - Satin Stainless Steel)
8. Coordinators	600 (Prime painted or mill alum.)
9. Closers	689 (Powder Coat Aluminum)
10. Protective Plates	630 (US32D - Satin Stainless Steel)
11. Overhead Stops	630 (US32D - Satin Stainless Steel)
12. Wall Stops and Holders	630 (US32D - Satin Stainless Steel)
13. Thresholds	719 (Mill Aluminum)
14. Weather-strip, Sweeps Drip Caps	Aluminum Anodized
15. Miscellaneous	626 (US26D - Satin Chromium)

## 2.18 KEYING

- A. Provide all cylinders in keyways as required to accommodate owners existing key system.
- B. All locks under this section shall be keyed as directed by the owner to an existing Master Key System.
- C. Furnish a total of 2 keys per cylinder. Actual cut keys to be determined by owner.
- D. Master keys, control keys, and change keys shall be delivered by registered mail to the owner. Construction keys shall be delivered to the contractor.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Prior to installation of hardware, installer shall examine door frame installation to ensure frames have been set square and plumb. Installer shall examine doors, door frames, and adjacent wall, floor, and ceiling for conditions, which would adversely affect proper operation and function of door assemblies. Do not proceed with hardware installation until such deficiencies have been corrected.

### 3.2 INSTALLATION

- A. Before hardware installation, general contractor/construction manager shall coordinate a hardware installation seminar with a 1 week notice to all parties involved. The seminar is to be conducted on the installation of hardware, specifically of locksets, closers, exit devices, continuous hinges and overhead stops. Manufacturer's representative of the above products to present seminar. Seminar to be held at the job site and attended by installers of hardware (including low voltage hardware) for aluminum, hollow metal and wood doors. Training to include use of installation manuals, hardware schedule, templates and physical products samples.
- B. Shim doors as required to maintain proper operating clearance between door and frame.
- C. Install all hardware in accordance with the approved hardware schedule and manufacturer's instructions for installation and adjustment.
- D. Set units level, plumb and true to the line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.
- E. Provide blocking or reinforcement for all hardware mounted to drywall construction, including wall mounted door stops and holders.
- F. Drill and countersink units which are not factory-prepared for anchorage fasteners. Space fasteners and anchors in accord with industry standards.
- G. Drill appropriate size pilot holes for all hardware attached to wood doors and frames.

- H. Unless otherwise specified, locate all hardware in accordance with the recommended locations for builders hardware for standard doors and frames as published by the Door and Hardware Institute (TDH-007-20).
- I. Use only fasteners supplied by or approved by the manufacturer for each respective item of hardware.
- J. Mortise and cut to close tolerance and conceal evidence of cutting in the finished work.
- K. Conceal push and pull bar fasteners where possible. Do not install through bolts through push plates.
- L. Install hardware on UL labeled openings in accordance with manufacturer's requirements to maintain the label.
- M. Apply self-adhesive gasketing on frame stop at head & latch side and on rabbet of frame at hinge side.
- N. Install hardware in accordance with supplemental "S" label instructions on all fire rated openings.
- O. Install wall stops to contact lever handles or pulls. Do not mount wall stops on casework, or equipment.
- P. Where necessary, adjust doors and hardware as required to eliminate binding between strike and latchbolt. Doors should not rattle.
- Q. Overhead stops used in conjunction with electrified hold open closers shall be templated and installed to coincide with engagement of closer hold open position.
- R. Install door closers on corridor side of lobby doors, room side of corridor doors, and stair side of stairways.
- S. Adjust spring power of door closers to the minimum force required to ensure exterior and fire rated doors will consistently close and latch doors under existing conditions. Adjust all other door closers to ensure opening force does not to exceed 5 lbs.
- T. Adjust "sweep", "latch", & "back check" valves on all door closers to properly control door throughout the opening and closing cycle. Adjust total closing speed as required to comply with all applicable state and local building codes.
- U. Install "hardware compatible" (bar stock) type weatherstripping continuously for an uninterrupted seal. Adjust templating for parallel arm door closers, exit devices, etc., as required to accommodate weatherstripping.
- V. Unless otherwise specified or detailed, install thresholds with the bevel in vertical alignment with the outside door face. Notch and closely fit thresholds to frame profile. Set thresholds in full bed of sealant.
- W. Compress sweep during installation as recommended by sweep manufacturer to facilitate a water-resistant seal.
- X. Deliver to the owner 1 complete set of installation and adjustment instructions, and tools as furnished with the hardware.

### **3.3 FIELD QUALITY CONTROL**

- A. After installation has been completed, the hardware supplier and manufacturers representative for locksets, door closers, exit devices, and overhead stops shall check the project and verify compliance with installation instructions, adjustment of all hardware items, and proper application according to the approved hardware schedule. Hardware supplier shall submit a list of all hardware that has not been installed correctly.
- B. After installation has been completed, the hardware supplier and manufacturers representative shall meet with the owner to explain the functions, uses, adjustment, and maintenance of each item of hardware. Hardware supplier shall provide the owner with a copy of all wiring diagrams.

Wiring diagrams shall be opening specific and include both a riser diagram and point to point diagram showing all wiring terminations.

**3.4 ADJUSTMENT AND CLEANING**

- A. At final completion, and when H.V.A.C. equipment is in operation, installer shall make final adjustments to and verify proper operation of all door closers and other items of hardware. Lubricate moving parts with type lubrication recommended by the manufacturer.
- B. All hardware shall be left clean and in good operation. Hardware found to be disfigured, defective, or inoperative shall be repaired or replaced.

**3.5 HARDWARE SCHEDULE**

- A. The following schedule of hardware groups are intended to describe opening function. The hardware supplier is cautioned to refer to the preamble of this specification for a complete description of all materials and services to be furnished under this section.

**HW SET 01**

	EA	HINGES	(AS SPECIFIED)	IVE
1	EA	PASSAGE SET	ND10S	SCH
1	EA	WALL STOP	WS406/407CVX	IVE

FUNCTION: ND10 (F75) PASSAGE LATCH  
BOTH LEVERS ALWAYS UNLOCKED.

**HW SET 02**

	EA	HINGES	(AS SPECIFIED)	IVE
1	EA	PUSH/PULL LATCH	HL6	SCH
1	EA	WALL STOP	WS406/407CVX	IVE

NOTE: PUSH/PULL

**HW SET 04**

	EA	HINGES	(AS SPECIFIED)	IVE
1	EA	ENTRANCE/OFFICE LOCK	ND50	SCH
1	EA	WALL STOP	WS406/407CVX	IVE

FUNCTION: ND50 (F82) ENTRANCE/OFFICE LOCK  
PUSH-BUTTON LOCKING. PUSH-BUTTON LOCKS OUTSIDE LEVER UNTIL UNLOCKED WITH KEY OR BY TURNING INSIDE LEVER.

**HW SET 05**

	EA	HINGES	(AS SPECIFIED)	IVE
1	EA	OFFICE W/SIM RETRACT	L9056N L283-722 (FULL ESUTCHEON)	SCH
1	EA	WALL STOP	WS406/407CVX	IVE

FUNCTION: L9056 OFFICE AND INNER ENTRY LOCK WITH AUTOMATIC UNLOCKING LATCHBOLT RETRACTED BY KNOB/LEVER FROM EITHER SIDE UNLESS OUTSIDE IS MADE INOPERATIVE BY KEY OUTSIDE OR BY ROTATING INSIDE THUMBTURN. OUTSIDE KNOB/LEVER UNLOCKED BY KEY OUTSIDE OR THUMBTURN. ROTATING INSIDE KNOB/LEVER SIMULTANEOUSLY RETRACTS LATCHBOLT AND UNLOCKS OUTSIDE KNOB/LEVER. AUXILIARY LATCH DEADLOCKS LATCHBOLT WHEN DOOR IS CLOSED. INSIDE LEVER IS ALWAYS FREE FOR IMMEDIATE EGRESS.

**HW SET 06**

	EA	HINGES	(AS SPECIFIED)	IVE
1	EA	CLASSROOM LOCK	ND70	SCH
1	EA	WALL STOP	WS406/407CVX	IVE

FUNCTION: ND70 (F84) CLASSROOM LOCK  
OUTSIDE LEVER LOCKED AND UNLOCKED BY KEY. INSIDE LEVER ALWAYS UNLOCKED.

**HW SET 07**

	EA	HINGES	(AS SPECIFIED)	IVE
1	EA	CLASSROOM LOCK	ND70	SCH
1	EA	OH STOP	90S	GLY

FUNCTION: ND70 (F84) CLASSROOM LOCK  
OUTSIDE LEVER LOCKED AND UNLOCKED BY KEY. INSIDE LEVER ALWAYS UNLOCKED.

**HW SET 08A**

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGES	(AS SPECIFIED)	IVE
1	EA	CLASSROOM LOCK	ND70	SCH
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	IVE
1	EA	WALL STOP	WS406/407CVX	IVE

FUNCTION: ND70 (F84) CLASSROOM LOCK OUTSIDE LEVER LOCKED AND UNLOCKED BY KEY. INSIDE LEVER ALWAYS UNLOCKED.

**HW SET 09**

	EA	HINGES	(AS SPECIFIED)	IVE
1	EA	CLASSROOM SECURITY	ND75	SCH
1	EA	WALL STOP	WS406/407CVX	IVE

FUNCTION: ND75 CLASSROOM SECURITY LOCK  
KEY IN EITHER LEVER LOCKS OR UNLOCKS OUTSIDE LEVER. INSIDE LEVER IS ALWAYS UNLOCKED.

**HW SET 10A**

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGES	(AS SPECIFIED)	IVE
1	EA	CONST LATCHING BOLT	FB51T / FB61T	IVE
1	EA	CLASSROOM LOCK	ND70	SCH
2	EA	OH STOP	450S	GLY
1	EA	OVERLAP ASTRAGAL	(BY DOOR SUPPLIER)	

FUNCTION: ND70 (F84) CLASSROOM LOCK OUTSIDE LEVER LOCKED AND UNLOCKED BY KEY. INSIDE LEVER ALWAYS UNLOCKED.

**HW SET 11A**

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGES	(AS SPECIFIED)	IVE
1	EA	CLASSROOM LOCK	ND70	SCH
1	EA	SURFACE CLOSER	4040XP / 4040XP EDA	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	IVE
1	EA	WALL STOP	WS406/407CVX	IVE
1	EA	SMOKE SEALS	188S (AT RATED OR SMOKE & DRAFT CONTROL DRS ONLY)	ZER

FUNCTION: ND70 (F84) CLASSROOM LOCK OUTSIDE LEVER LOCKED AND UNLOCKED BY KEY. INSIDE LEVER ALWAYS UNLOCKED.

**HW SET 12**

	EA	HINGES	(AS SPECIFIED)	IVE
1	EA	STOREROOM LOCK	ND80	SCH
1	EA	SURFACE CLOSER	4040XP SCUSH	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	IVE
1	EA	SMOKE SEALS	188S (AT RATED OR SMOKE & DRAFT CONTROL DRS ONLY)	ZER

FUNCTION: ND80 (F86) STOREROOM LOCK OUTSIDE LEVER FIXED. ENTRANCE BY KEY ONLY. INSIDE LEVER ALWAYS UNLOCKED.

**HW SET 13**

	EA	HINGES	(AS SPECIFIED)	IVE
1	EA	CLASSROOM SECURITY	ND75	SCH
1	EA	OH STOP	100S	GLY
1	EA	SURFACE CLOSER	4040XP EDA	LCN

FUNCTION: ND75 CLASSROOM SECURITY LOCK KEY IN EITHER LEVER LOCKS OR UNLOCKS OUTSIDE LEVER. INSIDE LEVER IS ALWAYS UNLOCKED.

**HW SET 14**

	EA	HINGES	(AS SPECIFIED)	IVE
1	EA	MANUAL FLUSH BOLT	FB458	IVE
			(BOTTOM BOLT)	
1	EA	CONST LATCHING BOLT	FB51T / FB61T	IVE
			(TOP BOLT)	
1	EA	DUST PROOF STRIKE	DP2	IVE
1	EA	CLASSROOM SECURITY	ND75	SCH
1	EA	SURFACE CLOSER	4040XP SHCUSH	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS	IVE
1	EA	WALL STOP & HOLDER	WS40	IVE
			(INACTIVE LEAF)	
1	EA	OVERLAP ASTRAGAL	(BY DOOR SUPPLIER)	

FUNCTION: ND75 CLASSROOM SECURITY LOCK  
KEY IN EITHER LEVER LOCKS OR UNLOCKS OUTSIDE LEVER. INSIDE LEVER IS ALWAYS UNLOCKED.

**HW SET:14A**

	EA	HINGES	(AS SPECIFIED)	IVE
1	EA	POWER TRANSFER	EPT10	VON
1	EA	MANUAL FLUSH BOLT	FB458	IVE
			(BOTTOM BOLT)	
1	EA	CONST LATCHING BOLT	FB51T / FB61T	IVE
			(TOP BOLT)	
1	EA	DUST PROOF STRIKE	DP2	IVE
1	EA	EU STOREROOM LOCK	ND80EU	SCH
1	EA	SURFACE CLOSER	4040XP SHCUSH	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS	IVE
1	EA	WALL STOP & HOLDER	WS40	IVE
			(INACTIVE LEAF)	
1	EA	OVERLAP ASTRAGAL	(BY DOOR SUPPLIER)	
1	EA	CREDENTIAL READER	(BY DIV 28)	
2	EA	DOOR CONTACT	679 SERIES	SCE
1	EA	POWER SUPPLY	(BY DIV 28)	BYO
1	EA	WIRING DIAGRAMS	RISER & POINT-TO-POINT (BY HARDWARE SUPPLIER)	

FUNCTION: ND80EU ELECTRICALLY UNLOCKED (FAIL SECURE )  
OUTSIDE LEVER CONTINUOUSLY LOCKED UNTIL UNLOCKED BY KEY OR ELECTRIC CURRENT.  
AUXILIARY LATCH DEADLOCKS LATCHBOLT WHEN DOOR IS CLOSED. INSIDE LEVER ALWAYS FREE FOR IMMEDIATE EXIT. VALID CREDENTIAL UNLOCKS DOOR.

**HW SET 15**

	EA	HINGES	(AS SPECIFIED)	IVE
1	EA	MANUAL FLUSH BOLT	FB458	IVE
			(BOTTOM BOLT)	
1	EA	CONST LATCHING BOLT	FB51T / FB61T	IVE
			(TOP BOLT)	
1	EA	DUST PROOF STRIKE	DP2	IVE
1	EA	CLASSROOM SECURITY	ND75	SCH
1	EA	SURFACE CLOSER	4040XP EDA	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS	IVE
2	EA	WALL STOP & HOLDER	WS40	IVE
1	EA	OVERLAP ASTRAGAL	(BY DOOR SUPPLIER)	

FUNCTION: ND75 CLASSROOM SECURITY LOCK  
KEY IN EITHER LEVER LOCKS OR UNLOCKS OUTSIDE LEVER. INSIDE LEVER IS ALWAYS UNLOCKED.

**HW SET:15A**

	EA	HINGES	(AS SPECIFIED)	IVE
1	EA	POWER TRANSFER	EPT10	VON
1	EA	MANUAL FLUSH BOLT	FB458	IVE
			(BOTTOM BOLT)	
1	EA	CONST LATCHING BOLT	FB51T / FB61T	IVE
			(TOP BOLT)	
1	EA	DUST PROOF STRIKE	DP2	IVE
1	EA	EU STOREROOM LOCK	ND80EU	SCH
1	EA	SURFACE CLOSER	4040XP EDA	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS	IVE
2	EA	WALL STOP & HOLDER	WS40	IVE
			(INACTIVE LEAF)	
1	EA	OVERLAP ASTRAGAL	(BY DOOR SUPPLIER)	
1	EA	CREDENTIAL READER	(BY DIV 28)	
2	EA	DOOR CONTACT	679 SERIES	SCE
1	EA	POWER SUPPLY	(BY DIV 28)	BYO
1	EA	WIRING DIAGRAMS	RISER & POINT-TO-POINT (BY HARDWARE SUPPLIER)	

FUNCTION: ND80EU ELECTRICALLY UNLOCKED (FAIL SECURE )  
OUTSIDE LEVER CONTINUOUSLY LOCKED UNTIL UNLOCKED BY KEY OR ELECTRIC CURRENT.  
AUXILIARY LATCH DEADLOCKS LATCHBOLT WHEN DOOR IS CLOSED. INSIDE LEVER ALWAYS FREE FOR IMMEDIATE EXIT. VALID CREDENTIAL UNLOCKS DOOR.

**HW SET 16**

	EA	HINGES	(AS SPECIFIED)	IVE
1	EA	POWER TRANSFER	EPT10	VON
1	EA	EU STOREROOM LOCK	ND80EU	SCH
1	EA	SURFACE CLOSER	4040XP / 4040XP EDA	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	IVE
1	EA	WALL STOP	WS406/407CVX	IVE
1	EA	SMOKE SEALS	188S (AT RATED OR SMOKE & DRAFT CONTROL DRS ONLY)	ZER
1	EA	CREDENTIAL READER	(BY DIV 28)	
1	EA	DOOR CONTACT	679 SERIES	SCE
1	EA	POWER SUPPLY	(BY DIV 28)	BYO
1	EA	WIRING DIAGRAMS	RISER & POINT-TO-POINT (BY HARDWARE SUPPLIER)	

FUNCTION: ND80EU ELECTRICALLY UNLOCKED (FAIL SECURE)  
 OUTSIDE LEVER CONTINUOUSLY LOCKED UNTIL UNLOCKED BY KEY OR ELECTRIC CURRENT.  
 AUXILIARY LATCH DEADLOCKS LATCHBOLT WHEN DOOR IS CLOSED. INSIDE LEVER ALWAYS  
 FREE FOR IMMEDIATE EXIT. VALID CREDENTIAL UNLOCKS DOOR.

**HW SET 17**

	EA	HINGES	(AS SPECIFIED)	IVE
1	EA	POWER TRANSFER	EPT10	VON
1	EA	EU STOREROOM LOCK	ND80EU	SCH
1	EA	SURFACE CLOSER	4040XP SCUSH	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	IVE
1	EA	RAIN DRIP	142	ZER
1	EA	GASKETING	429	ZER
1	EA	DOOR SWEEP W/DRIP	8198	ZER
1	EA	THRESHOLD	(PROFILE AS REQUIRED)	ZER
1	EA	CREDENTIAL READER	(BY DIV 28)	
1	EA	DOOR CONTACT	679 SERIES	SCE
1	EA	POWER SUPPLY	(BY DIV 28)	BYO
1	EA	WIRING DIAGRAMS	RISER & POINT-TO-POINT (BY HARDWARE SUPPLIER)	

FUNCTION: ND80EU ELECTRICALLY UNLOCKED (FAIL SECURE)  
 OUTSIDE LEVER CONTINUOUSLY LOCKED UNTIL UNLOCKED BY KEY OR ELECTRIC CURRENT.  
 AUXILIARY LATCH DEADLOCKS LATCHBOLT WHEN DOOR IS CLOSED. INSIDE LEVER ALWAYS  
 FREE FOR IMMEDIATE EXIT. VALID CREDENTIAL UNLOCKS DOOR.



**HW SET:17A**

	EA	HINGES	(AS SPECIFIED)	IVE
1	EA	POWER TRANSFER	EPT10	VON
1	EA	ELEC PANIC HARDWARE	QEL-98-NL	VON
1	EA	INTERCHANGEABLE CORE	(CYLINDER AS REQUIRED)	SCH
1	EA	SURFACE CLOSER	4040XP SCUSH	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	IVE
1	EA	RAIN DRIP	142	ZER
1	EA	GASKETING	429	ZER
1	EA	DOOR SWEEP W/DRIP	8198	ZER
1	EA	THRESHOLD	(PROFILE AS REQUIRED)	ZER
1	EA	CREDENTIAL READER	(BY DIV 28)	
1	EA	DOOR CONTACT	679 SERIES	SCE
1	EA	POWER SUPPLY	(BY DIV 28)	BYO
1	EA	WIRING DIAGRAMS	RISER & POINT-TO-POINT (BY HARDWARE SUPPLIER)	

FUNCTION: (NL) LATCHBOLT RETRACTED INSIDE BY EXIT DEVICE PUSH PAD AND OUTSIDE BY KEY IN CYLINDER. DOOR LOCKS WHEN KEY IS REMOVED AND DOOR IS CLOSED. ACCESS FROM EXTERIOR WHEN EXIT DEVICE PUSH PAD IS DOGGED DOWN. VALID CREDENTIAL UNLOCKS DOOR.

**HW SET 18**

	EA	HINGES	(AS SPECIFIED)	IVE
1	EA	EU STOREROOM LOCK	ND80EU	SCH
1	EA	OH STOP	100S	GLY
1	EA	SURFACE CLOSER	4040XP EDA	LCN
1	EA	CREDENTIAL READER	(BY DIV 28)	
1	EA	DOOR CONTACT	679 SERIES	SCE
1	EA	POWER SUPPLY	(BY DIV 28)	BYO
1	EA	WIRING DIAGRAMS	RISER & POINT-TO-POINT (BY HARDWARE SUPPLIER)	

FUNCTION: ND80EU ELECTRICALLY UNLOCKED (FAIL SECURE)  
OUTSIDE LEVER CONTINUOUSLY LOCKED UNTIL UNLOCKED BY KEY OR ELECTRIC CURRENT. AUXILIARY LATCH DEADLOCKS LATCHBOLT WHEN DOOR IS CLOSED. INSIDE LEVER ALWAYS FREE FOR IMMEDIATE EXIT. VALID CREDENTIAL UNLOCKS DOOR.

**HW SET 19**

	EA	HINGES	(AS SPECIFIED)	IVE
1	EA	PANIC HARDWARE	LD-98-EO	VON
1	EA	SURFACE CLOSER	4040XP SCUSH	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	IVE
1	EA	RAIN DRIP	142	ZER
1	EA	GASKETING	429	ZER
1	EA	DOOR SWEEP W/DRIP	8198	ZER
1	EA	THRESHOLD	(PROFILE AS REQUIRED)	ZER

FUNCTION: (EO) LATCHBOLT RETRACTED INSIDE BY EXIT DEVICE PUSH PAD. NO EXTERIOR TRIM.

**HW SET 20**

	EA	HINGES	(AS SPECIFIED)	IVE
1	EA	PANIC HARDWARE	CDSI-98-L-NL	VON
2	EA	INTERCHANGEABLE CORE	(CYLINDER AS REQUIRED)	SCH
1	EA	OH STOP	100S	GLY
1	EA	SURFACE CLOSER	4040XP EDA	LCN

FUNCTION: (NL) LATCHBOLT RETRACTED INSIDE BY EXIT DEVICE PUSH PAD AND OUTSIDE BY KEY IN CYLINDER. DOOR LOCKS WHEN KEY IS REMOVED AND DOOR IS CLOSED. ACCESS FROM EXTERIOR WHEN EXIT DEVICE PUSH PAD IS DOGGED DOWN.

**HW SET 21**

	EA	HINGES	(AS SPECIFIED)	IVE
1	EA	PANIC HARDWARE	CDSI-98-L-NL	VON
2	EA	INTERCHANGEABLE CORE	(CYLINDER AS REQUIRED)	SCH
1	EA	SURFACE CLOSER	4040XP SCUSH	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	IVE

FUNCTION: (NL) LATCHBOLT RETRACTED INSIDE BY EXIT DEVICE PUSH PAD AND OUTSIDE BY KEY IN CYLINDER. DOOR LOCKS WHEN KEY IS REMOVED AND DOOR IS CLOSED. ACCESS FROM EXTERIOR WHEN EXIT DEVICE PUSH PAD IS DOGGED DOWN.

**HW SET:21A**

	EA	HINGES	(AS SPECIFIED)	IVE
1	EA	PANIC HARDWARE	LD-98-L-NL	VON
1	EA	INTERCHANGEABLE CORE	(CYLINDER AS REQUIRED)	SCH
1	EA	SURFACE CLOSER	4040XP SCUSH	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	IVE

FUNCTION: (NL) LATCHBOLT RETRACTED INSIDE BY EXIT DEVICE PUSH PAD AND OUTSIDE BY KEY IN CYLINDER. DOOR LOCKS WHEN KEY IS REMOVED AND DOOR IS CLOSED.

**HW SET 22**

	EA	HINGES	(AS SPECIFIED)	IVE
1	EA	PANIC HARDWARE	98-L-BE	VON
1	EA	SURFACE CLOSER	4040XP / 4040XP EDA	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	IVE
1	EA	WALL STOP	WS406/407CVX	IVE

FUNCTION: (L-BE) LATCHBOLT RETRACTED INSIDE BY EXIT DEVICE PUSH PAD, EXTERIOR BY LEVER. LEVER DOES NOT LOCK.

**HW SET 23**

	EA	HINGES	(AS SPECIFIED)	IVE
1	EA	FIRE EXIT HARDWARE	9827-EO-F-LBR	VON
1	EA	PANIC HARDWARE	9827-L-BE-LBR	VON
2	EA	SURFACE CLOSER	4040XP / 4040XP EDA	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS	IVE
2	EA	WALL STOP	WS406/407CVX	IVE

FUNCTION: (L-BE) LATCHBOLT RETRACTED INSIDE BY EXIT DEVICE PUSH PAD, EXTERIOR BY LEVER. LEVER DOES NOT LOCK.

**HW SET:23A**

	EA	HINGES	(AS SPECIFIED)	IVE
1	EA	POWER TRANSFER	EPT10	VON
1	EA	FIRE EXIT HARDWARE	9827-EO-F-LBR	VON
1	EA	ELEC FIRE EXIT HARDWARE	QEL-9827-L-NL-F-LBR	VON
1	EA	INTERCHANGEABLE CORE	(CYLINDER AS REQUIRED)	SCH
2	EA	SURFACE CLOSER	4040XP / 4040XP EDA	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS	IVE
2	EA	WALL STOP	WS406/407CVX	IVE
1	EA	MEETING STILE SEAL	S771	PEM
1	EA	SMOKE SEALS	188S (AT RATED OR SMOKE & DRAFT CONTROL DRS ONLY)	ZER
1	EA	CREDENTIAL READER	(BY DIV 28)	
2	EA	DOOR CONTACT	679 SERIES	SCE
1	EA	POWER SUPPLY	(BY DIV 28)	BYO
1	EA	WIRING DIAGRAMS	RISER & POINT-TO-POINT (BY HARDWARE SUPPLIER)	

FUNCTION: (NL) LATCHBOLT RETRACTED INSIDE BY EXIT DEVICE PUSH PAD AND OUTSIDE BY KEY IN CYLINDER. DOOR LOCKS WHEN KEY IS REMOVED AND DOOR IS CLOSED. ACCESS FROM EXTERIOR WHEN EXIT DEVICE PUSH PAD IS DOGGED DOWN. VALID CREDENTIAL UNLOCKS DOOR.

**HW SET 24**

2	EA	CONTINUOUS HINGE	700	IVE
2	EA	PUSH/PULL BAR	9190-10"	IVE
2	EA	OH STOP	100S	GLY
1	EA	SURFACE CLOSER	4040XP EDA	LCN
1	EA	SURF. AUTO OPERATOR	4642	LCN
2	EA	ACTUATOR, TOUCH	8310-853 / 8310-818	LCN

FUNCTION: PUSH/PULL.

THIS DOOR HAS A POWER OPERATOR. BOTH ACTUATORS ALWAYS ACTIVE TO OPEN THE DOOR.

**HW SET 25**

2	EA	CONTINUOUS HINGE	700 EPT	IVE
2	EA	POWER TRANSFER	EPT10	VON
1	EA	KEYED REMOVABLE MULLION	KR-4954 STAB	VON
1	EA	ELEC PANIC HARDWARE	QEL-98-EO	VON
1	EA	ELEC PANIC HARDWARE	QEL-98-NL-OP	VON
2	EA	INTERCHANGEABLE CORE	(CYLINDER AS REQUIRED)	SCH
2	EA	90 DEG OFFSET PULL	8190 10"	IVE
2	EA	OH STOP	100S	GLY
1	EA	SURFACE CLOSER	4040XP EDA	LCN
1	EA	SURF. AUTO OPERATOR	4642	LCN
2	EA	ACTUATOR, TOUCH	8310-853 / 8310-818	LCN
1	EA	RAIN DRIP	142	ZER
	EA	WEATHERSTRIP	(BY DR/FR SUPPLIER)	
2	EA	DOOR SWEEP W/DRIP	8198	ZER
1	EA	THRESHOLD	(PROFILE AS REQUIRED)	ZER
1	EA	MULLION SEAL	8780	ZER
1	EA	CREDENTIAL READER	(BY DIV 28)	
2	EA	DOOR CONTACT	679 SERIES	SCE
1	EA	POWER SUPPLY	(BY DIV 28)	BYO
1	EA	WIRING DIAGRAMS	RISER & POINT-TO-POINT (BY HARDWARE SUPPLIER)	

FUNCTION: (NL) LATCHBOLT RETRACTED INSIDE BY EXIT DEVICE PUSH PAD AND OUTSIDE BY KEY IN CYLINDER. DOOR LOCKS WHEN KEY IS REMOVED AND DOOR IS CLOSED. THIS DOOR HAS A POWER OPERATOR. INTERIOR ACTUATOR ALWAYS ACTIVE TO UNLOCK AND OPEN THE DOOR. A VALID CREDENTIAL WILL UNLOCK BOTH DOORS AND MAKE THE EXTERIOR ACTUATOR ACTIVE.

**HW SET 26**

2	EA	CONTINUOUS HINGE	700 EPT	IVE
2	EA	POWER TRANSFER	EPT10	VON
1	EA	KEYED REMOVABLE MULLION	KR-4954 STAB	VON
1	EA	ELEC FIRE EXIT HARDWARE	QEL-98-EO-F	VON
1	EA	ELEC FIRE EXIT HARDWARE	QEL-98-NL-OP-F	VON
2	EA	INTERCHANGEABLE CORE	(CYLINDER AS REQUIRED)	SCH
2	EA	90 DEG OFFSET PULL	8190 10"	IVE
2	EA	OH STOP	100S	GLY
1	EA	SURFACE CLOSER	4040XP EDA	LCN
1	EA	SURF. AUTO OPERATOR	4642	LCN
2	EA	ACTUATOR, TOUCH	8310-853 / 8310-818	LCN
1	EA	RAIN DRIP	142	ZER
	EA	WEATHERSTRIP	(BY DR/FR SUPPLIER)	
2	EA	DOOR SWEEP W/DRIP	8198	ZER
1	EA	THRESHOLD	(PROFILE AS REQUIRED)	ZER
1	EA	MULLION SEAL	8780	ZER
1	EA	CREDENTIAL READER	(BY DIV 28)	
2	EA	DOOR CONTACT	679 SERIES	SCE
1	EA	POWER SUPPLY	(BY DIV 28)	BYO
1	EA	WIRING DIAGRAMS	RISER & POINT-TO-POINT (BY HARDWARE SUPPLIER)	

FUNCTION: (NL) LATCHBOLT RETRACTED INSIDE BY EXIT DEVICE PUSH PAD AND OUTSIDE BY KEY IN CYLINDER. DOOR LOCKS WHEN KEY IS REMOVED AND DOOR IS CLOSED. THIS DOOR HAS A POWER OPERATOR. INTERIOR ACTUATOR ALWAYS ACTIVE TO UNLOCK AND OPEN THE DOOR. A VALID CREDENTIAL WILL UNLOCK BOTH DOORS AND MAKE THE EXTERIOR ACTUATOR ACTIVE.

**HW SET 27**

ALL HARDWARE BY DOOR SUPPLIER.

**HW SET 28**

	EA	HINGES	(AS SPECIFIED)	IVE
1	EA	PUSH PLATE	8200 6" X 16"	IVE
1	EA	PULL PLATE	8303 10" 4" X 16"	IVE
1	EA	SURFACE CLOSER	4040XP / 4040XP EDA	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	IVE
1	EA	WALL STOP	WS406/407CVX	IVE

FUNCTION: PUSH/PULL

**HW SET:28A**

	EA	HINGES	(AS SPECIFIED)	IVE
1	EA	PUSH PLATE	8200 6" X 16"	IVE
1	EA	PULL PLATE	8303 10" 4" X 16"	IVE
1	EA	SURF. AUTO OPERATOR	4642	LCN
2	EA	ACTUATOR, TOUCH	8310-853 / 8310-818	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	IVE
1	EA	WALL STOP	WS406/407CVX	IVE

FUNCTION: PUSH/PULL

**HW SET#:30**

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGES	(AS SPECIFIED)	IVE
1	EA	DBL CYL STORE LOCK	ND66	SCH
1	EA	SURFACE CLOSER	4040XP / 4040XP EDA	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	IVE
1	EA	WALL STOP	WS406/407CVX	IVE
1	EA	SMOKE SEALS	188S (AT RATED OR SMOKE & DRAFT CONTROL DRS ONLY)	ZER

FUNCTION: ND66 (F91) STORE LOCK KEY IN EITHER LEVER LOCKS OR UNLOCKS BOTH LEVERS.

**SECTION 088000  
GLAZING**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Insulating glass units.
- B. Glazing units.
- C. Plastic films.
- D. Glazing compounds and accessories.

**1.02 RELATED REQUIREMENTS**

- A. Section 019119-Commissioning of Building Enclosure (BECx): Commissioning requirements and procedures.
- B. Section 081213 - Hollow Metal Frames: Glazed borrowed lites.
- C. Section 081416 - Flush Wood Doors: Glazed lites in doors.
- D. Section 084313 - Aluminum-Framed Storefronts: Glazing furnished as part of storefront assembly.

**1.03 REFERENCE STANDARDS**

- A. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers; 2005 (Reapproved 2019).
- B. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2016 (Reapproved 2023).
- C. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2022.
- D. ASTM E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation; 2019.
- E. ITS (DIR) - Directory of Listed Products; Current Edition.
- F. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; 2022.
- G. NFPA 257 - Standard on Fire Test for Window and Glass Block Assemblies; 2022.
- H. UL (DIR) - Online Certifications Directory; Current Edition.
- I. UL 9 - Standard for Fire Tests of Window Assemblies; Current Edition, Including All Revisions.
- J. UL 10B - Standard for Fire Tests of Door Assemblies; Current Edition, Including All Revisions.
- K. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.
- L. UL 263 - Standard for Fire Tests of Building Construction and Materials; Current Edition, Including All Revisions.

**1.04 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data on Insulating Glass Unit and Glazing Unit Glazing Types: Provide structural, physical and environmental characteristics, size limitations, special handling and installation requirements.
- C. Product Data on Glazing Compounds and Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements. Identify available colors.
- D. Samples: Submit one samples 12 by 12 inch in size of glass units.

**1.05 QUALITY ASSURANCE**

- A. Installer Qualifications: Company specializing in performing the work of this section with minimum three years documented experience.

**1.06 FIELD CONDITIONS**

- A. Do not install glazing when ambient temperature is less than 40 degrees F.
- B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

**1.07 WARRANTY**

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

- B. Insulating Glass Units: Provide a ten (10) year manufacturer warranty to include coverage for seal failure, interpane dusting or misting, including replacement of failed units.

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Float Glass Manufacturers:
  - 1. Cardinal Glass Industries: [www.cardinalcorp.com/#sle](http://www.cardinalcorp.com/#sle).
  - 2. Guardian Industries Corp.: [www.sunguardglass.com/#sle](http://www.sunguardglass.com/#sle).
  - 3. Pilkington North America Inc.: [www.pilkington.com/na](http://www.pilkington.com/na).
  - 4. PPG Industries, Inc.: [www.ppgideasapes.com/#sle](http://www.ppgideasapes.com/#sle).
  - 5. Oldcastle, Inc..
  - 6. Substitutions: Refer to Section 016000 - Product Requirements.

### **2.02 PERFORMANCE REQUIREMENTS - EXTERIOR GLAZING ASSEMBLIES**

- A. Select type and thickness of exterior glazing assemblies to withstand dead and live loads caused by positive and negative wind pressure acting normal to plane of glass.
- B. Vapor Retarder and Air Barrier Seals: Provide completed assemblies that maintain continuity of building enclosure vapor retarder and air barrier.
  - 1. In conjunction with vapor retarder and joint sealer materials described in other sections.
- C. Thermal and Optical Performance: Provide glass products with performance properties as indicated. Performance properties are in accordance with manufacturer's published data as determined with the following procedures and/or test methods:
  - 1. Center of Glass U-Value: Comply with NFRC 100 using Lawrence Berkeley National Laboratory (LBNL) WINDOW computer program.
  - 2. Center of Glass Solar Heat Gain Coefficient (SHGC): Comply with NFRC 200 using Lawrence Berkeley National Laboratory (LBNL) WINDOW computer program.

### **2.03 GLASS MATERIALS**

#### **2.04 INSULATING GLASS UNITS**

- A. Insulating Glass Units Manufacturers:
  - 1. Any of the manufacturers specified for float glass.
- B. Insulating Glass Units: Types as indicated.
  - 1. Durability: Certified by an independent testing agency to comply with ASTM E2190.
  - 2. Warm-Edge Spacers: \_\_\_\_\_.
    - a. Spacer Width: As required for specified insulating glass unit.
    - b. Manufacturers:
      - 1) Basis of Design: Viracon VTS spacer.
      - 2) Substitutions: Refer to Section 016000 - Product Requirements.
  - 3. Spacer Color: Black.
  - 4. Edge Seal:
  - 5. Color: Black.
  - 6. Purge interpane space with dry air, hermetically sealed.
- C. Type IGU-1 - Insulating Glass Units: Vision glass, double glazed.
  - 1. Applications: Exterior glazing unless otherwise indicated.
  - 2. Space between lites filled with argon.
  - 3. Outboard Lite: Annealed float glass, 1/4 inch thick, minimum.
    - a. Tint: Clear.
    - b. Coating: Low-E (passive type), on #2 surface.
  - 4. Inboard Lite: Annealed float glass, 1/4 inch thick, minimum.
    - a. Tint: Clear.
  - 5. Total Thickness: 1 inch.
  - 6. Overall U-value within system: [.95] Btu/(hr sq ft deg F), maximum.
  - 7. Visible Light Transmittance (VLT): 57 percent, nominal.
  - 8. Solar Heat Gain Coefficient (SHGC): 25 percent, nominal.
  - 9. Glazing Method: Dry glazing method, gasket glazing.



- D. Type IGU-2 - Insulating Glass Units: Spandrel glazing.
  - 1. Applications: Exterior spandrel glazing unless otherwise indicated.
  - 2. Space between lites filled with air.
  - 3. Outboard Lite: Annealed float glass, 1/4 inch thick, minimum.
    - a. Tint: Clear.
    - b. Coating: Same as on vision units, on #2 surface.
  - 4. Inboard Lite: Heat-strengthened float glass, 1/4 inch thick.
    - a. Tint: Clear.
    - b. Opacifier: Elastomeric coating, on #4 surface.
    - c. Opacifier Color: To be selected from Manufacturer's full line.
  - 5. Total Thickness: 1 inch.
  - 6. Glazing Method: Dry glazing method, gasket glazing.
- E. Type IGU-1A & IGU-2A - Insulating Glass Units: Safety glazing.
  - 1. Applications:
    - a. Glazed lites in exterior doors.
    - b. Glazed sidelights and panels next to doors.
    - c. Other locations required by applicable federal, state, and local codes and regulations.
  - 2. Space between lites filled with argon.
  - 3. Glass Type: Same as Type IGU-1 except use heat soaked fully tempered float glass for both outboard and inboard lites.
  - 4. Total Thickness: 1 inch.

## 2.05 PLASTIC FILMS

- A. Type WF-1 - Decorative Plastic Film: Polyester type.
  - 1. Application: Locations as indicated on drawings.
  - 2. Series Type: See Finish Legend.
  - 3. Color: See Finish Legend.
  - 4. Manufacturers: Basis of Design: 3M
    - a. Substitutions: Refer to Section 016000 - Product Requirements.

## 2.06 GLAZING COMPOUNDS

- A. Manufacturers:
  - 1. Bostik Inc: [www.bostik-us.com](http://www.bostik-us.com).
  - 2. Momentive Performance Materials, Inc (formerly GE Silicones): [www.momentive.com](http://www.momentive.com).
  - 3. Pecora Corporation: [www.pecora.com](http://www.pecora.com).
  - 4. BASF Corporation: [www.basf.com/us/en.html](http://www.basf.com/us/en.html).
  - 5. Substitutions: Refer to Section 016000 - Product Requirements.

## 2.07 ACCESSORIES

- A. Setting Blocks: Silicone, with 80 to 90 Shore A durometer hardness; ASTM C864 Option II. Length of 0.1 inch for each square foot of glazing or minimum 4 inch x width of glazing rabbet space minus 1/16 inch x height to suit glazing method and pane weight and area.
- B. Spacer Shims: Neoprene, 50 to 60 Shore A durometer hardness; ASTM C864 Option II. Minimum 3 inch long x one half the height of the glazing stop x thickness to suit application, self adhesive on one face.
- C. Glazing Splines: Resilient silicone extruded shape to suit glazing channel retaining slot; ASTM C864 Option II; color black.
- D. Glazing Clips: Manufacturer's standard type.
- E. Drips at head.
- F. Flashing at sill.

## PART 3 EXECUTION

### 3.01 VERIFICATION OF CONDITIONS

- A. Verify that openings for glazing are correctly sized and within tolerances, including those for size, squareness, and offsets at corners.
- B. Verify that the minimum required face and edge clearances are being provided.

- C. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and support framing is ready to receive glazing system.
- D. Verify that sealing between joints of glass framing members has been completed effectively.

### **3.02 PREPARATION**

- A. Clean contact surfaces with appropriate solvent and wipe dry within maximum of 24 hours before glazing. Remove coatings that are not tightly bonded to substrates.
- B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.
- C. Prime surfaces scheduled to receive sealant where required for proper sealant adhesion.

### **3.03 INSTALLATION, GENERAL**

- A. Install glazing sealants in accordance with ASTM C1193, GANA Sealant Manual, and manufacturer's instructions.
- B. Do not exceed edge pressures around perimeter of glass lites as stipulated by glass manufacturer.
- C. Set glass lites of system with uniform pattern, draw, bow, and similar characteristics.
- D. Set glass lites in proper orientation so that coatings face exterior or interior as indicated.
- E. Prevent glass from contact with any contaminating substances that may be the result of construction operations such as, and not limited to the following; weld splatter, fire-safing, plastering, mortar droppings, etc.

### **3.04 INSTALLATION - DRY GLAZING METHOD (GASKET GLAZING)**

- A. Application - Exterior and/or Interior Glazed: Set glazing infills from either the exterior or the interior of the building.
- B. Place setting blocks at 1/4 points with edge block no more than 6 inch from corners.
- C. Rest glazing on setting blocks and push against fixed stop with sufficient pressure on gasket to attain full contact.
- D. Install removable stops without displacing glazing gasket; exert pressure for full continuous contact.

### **3.05 CLEANING**

- A. Remove excess glazing materials from finish surfaces immediately after application using solvents or cleaners recommended by manufacturers.
- B. Remove non-permanent labels immediately after glazing installation is complete.
- C. Clean glass and adjacent surfaces after sealants are fully cured.
- D. Clean glass on both exposed surfaces not more than 4 days prior to Date of Substantial Completion in accordance with glass manufacturer's written recommendations.

### **3.06 PROTECTION**

- A. After installation, mark pane with an 'X' by using removable plastic tape or paste; do not mark heat absorbing or reflective glass units.
- B. Remove and replace glass that is damaged during construction period prior to Date of Substantial Completion.

**END OF SECTION**

**SECTION 092116  
GYPSUM BOARD ASSEMBLIES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Performance criteria for gypsum board assemblies.
- B. Metal stud wall framing.
- C. Metal channel ceiling framing.
- D. Acoustic insulation.
- E. Gypsum sheathing.
- F. Cementitious backing board.
- G. Gypsum wallboard.
- H. Joint treatment and accessories.

**1.02 RELATED REQUIREMENTS**

- A. Section 061000 - Rough Carpentry: Wood blocking product and execution requirements.

**1.03 REFERENCE STANDARDS**

- A. ANSI A108.11 - American National Standard Specifications for Interior Installation of Cementitious Backer Units; 2018.
- B. AISI SG02-1 - North American Specification for the Design of Cold-Formed Steel Structural Members; American Iron and Steel Institute; 2001 with 2004 supplement. (replaced SG-971)
- C. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2017 (Reapproved 2022).
- D. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members; 2018.
- E. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2023.
- F. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2020.
- G. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board; 2020.
- H. ASTM C1047 - Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base; 2019.
- I. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2017.
- J. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2017.
- K. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2021.
- L. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009 (Reapproved 2016).
- M. ASTM E413 - Classification for Rating Sound Insulation; 2022.
- N. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015, with Editorial Revision (2021).
- O. GA-216 - Application and Finishing of Gypsum Panel Products; 2021.
- P. GA-226 - Application of Gypsum Board to Form Curved Surfaces; 2019.
- Q. GA-600 - Fire Resistance and Sound Control Design Manual; 2021.
- R. UL (FRD) - Fire Resistance Directory; Current Edition.

**1.04 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate special details associated with fireproofing and acoustic seals.
- C. Product Data: Provide data on metal framing, gypsum board, accessories, and joint finishing system.

**PART 2 PRODUCTS**

- A. Provide completed assemblies complying with ASTM C840 and GA-216.
- B. Interior Partitions, Indicated as Acoustic: Provide completed assemblies with the following characteristics:

1. Acoustic Attenuation: STC of 45-49 calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.
- C. Shaft Walls at HVAC Shafts: Provide completed assemblies with the following characteristics:
1. Air Pressure Within Shaft: Sustained loads of 5 lbf/sq ft with maximum mid-span deflection of L/240.
  2. Acoustic Attenuation: STC of 35-39 calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.
- D. Fire-Resistance-Rated Assemblies: Provide completed assemblies with the following characteristics:
1. Fire Rated Partitions, Ceilings, and Soffits : See Drawings.
  2. UL Assembly Numbers: Provide construction equivalent to that listed for the particular assembly in the current UL (FRD).

## 2.02 METAL FRAMING MATERIALS

- A. Manufacturers - Metal Framing, Connectors, and Accessories:
1. ClarkDietrich Building Systems: [www.clarkdietrich.com/#sle](http://www.clarkdietrich.com/#sle).
  2. Jaimes Industries: [www.jaimesind.com/#sle](http://www.jaimesind.com/#sle).
  3. Marino: [www.marinoware.com/#sle](http://www.marinoware.com/#sle).
  4. Steel Construction Systems: [www.steelconsystems.com/#sle](http://www.steelconsystems.com/#sle).
  5. Phillips Manufacturing Company: [www.phillipsmfg.com](http://www.phillipsmfg.com).
  6. Substitutions: See Section 016000 - Product Requirements.
- B. Non-Loadbearing Framing System Components: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated, with maximum deflection of wall framing of L/120 at 5 psf.
1. Studs: "C" shaped with flat or formed webs with knurled faces.
  2. Runners: U shaped, sized to match studs.
  3. Ceiling Channels: C-shaped.
  4. Furring: Hat-shaped sections, minimum depth of 7/8 inch.
  5. Resilient Furring Channels: Single or double leg configuration; 1/2 inch channel depth.
    - a. Products:
      - 1) ClarkDietrich; RC Deluxe Resilient Channel: [www.clarkdietrich.com/#sle](http://www.clarkdietrich.com/#sle).
      - 2) Phillips Manufacturing Co; RC-2 Resilient Sound Channel: [www.phillipsmfg.com/#sle](http://www.phillipsmfg.com/#sle).
      - 3) Substitutions: See Section 016000 - Product Requirements.
- C. Shaft Wall Studs and Accessories: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 and specified performance requirements.
1. Products:
    - a. Same manufacturer as other framing materials.
    - b. Substitutions: See Section 016000 - Product Requirements.
- D. Area Separation Wall Studs and Accessories: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with specified performance requirements.
1. Products:
    - a. Phillips Manufacturing Co; Hemmed H-Stud: [www.phillipsmfg.com/#sle](http://www.phillipsmfg.com/#sle).
    - b. Substitutions: See Section 016000 - Product Requirements.
- E. Ceiling Hangers: Type and size as specified in ASTM C754 for spacing required.
- F. Partition Head to Structure Connections: Provide mechanical anchorage devices that accommodate deflection using slotted holes, screws and anti-friction bushings, preventing rotation of studs while maintaining structural performance of partition.
1. Structural Performance: Maintain lateral load resistance and vertical movement capacity required by applicable code, when evaluated in accordance with AISI S100-12.
  2. Material: ASTM A653/A653M steel sheet, SS Grade 50/340, with G60/Z180 hot dipped galvanized coating.
  3. Deflection and Firestop Track:
    - a. Provide mechanical anchorage devices as described above that accommodate deflection while maintaining the fire-rating of the wall assembly.

## 2.03 BOARD MATERIALS

- A. Manufacturers - Gypsum-Based Board:
  - 1. American Gypsum Company: [www.americangypsum.com/#sle](http://www.americangypsum.com/#sle).
  - 2. CertainTeed Corporation: [www.certainteed.com/#sle](http://www.certainteed.com/#sle).
  - 3. Georgia-Pacific Gypsum: [www.gpgypsum.com/#sle](http://www.gpgypsum.com/#sle).
  - 4. National Gypsum Company: [www.nationalgypsum.com/#sle](http://www.nationalgypsum.com/#sle).
  - 5. USG Corporation: [www.usg.com/#sle](http://www.usg.com/#sle).
  - 6. Substitutions: See Section 016000 - Product Requirements.
- B. Ceiling Board: Special sag resistant gypsum ceiling board as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
  - 1. Application: Ceilings, unless otherwise indicated.
  - 2. Thickness: 5/8 inch.
  - 3. Edges: Tapered.
  - 4. Products:
    - a. American Gypsum; Interior Ceiling Board.
    - b. CertainTeed Corporation; ProRoc Interior Ceiling.
    - c. Georgia-Pacific Gypsum; ToughRock Span 24 Ceiling Board.
    - d. Lafarge North America Inc; Sagcheck.
    - e. National Gypsum Company; High Strength Brand Ceiling Board.
    - f. Pacific Coast Building Products, Inc; PABCO Ceiling Board.
    - g. USG Corporation; Sheetrock Brand Sag-Resistant Interior Gypsum Ceiling Board.
    - h. Substitutions: See Section 016000 - Product Requirements.
- C. Ceiling Board For Wet Areas: Mold and moisture resistant gypsum ceiling board with fiberglass mats as defined in ; sizes to minimize joints in place; ends square cut.
  - 1. Application: Ceilings in wet areas, unless otherwise indicated.
  - 2. Thickness: 5/8 inch.
  - 3. Edges: Tapered.
  - 4. Products:
    - a. Basis of Design: Georgia-Pacific Gypsum; DensArmor Plus.
    - b. Substitutions: See Section 016000 - Product Requirements.
- D. Exterior Sheathing Board: Sizes to minimize joints in place; ends square cut.
  - 1. Application: Exterior sheathing, unless otherwise indicated.
  - 2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
  - 3. Fungal Resistance: No fungal growth when tested in accordance with ASTM G21.
  - 4. Glass Mat Faced Sheathing: Glass mat faced gypsum substrate as defined in ASTM C1177/C1177M.
  - 5. At Assemblies Indicated with Fire-Resistance Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X board, UL or WH listed.
  - 6. Core Type: Regular.
  - 7. Regular Board Thickness: 1/2 inch.
  - 8. Edges: Square.
  - 9. Glass Mat Faced Products:
    - a. CertainTeed Corporation; GlasRoc Brand.
    - b. Georgia-Pacific Gypsum; DensGlass Sheathing.
    - c. National Gypsum Company; Gold Bond eXP Sheathing.
    - d. Substitutions: See Section 016000 - Product Requirements.

## 2.04 GYPSUM WALLBOARD ACCESSORIES

- A. Acoustic Insulation: ASTM C665; preformed glass fiber, friction fit type, unfaced. Thickness: 6 inch.
- B. Acoustic Sealant: Acrylic emulsion latex or water-based elastomeric sealant; do not use solvent-based non-curing butyl sealant.
  - 1. Products:
    - a. Franklin International, Inc; Titebond GREENchoice Professional Acoustical Smoke and Sound Sealant: [www.titebond.com/#sle](http://www.titebond.com/#sle).

- b. Liquid Nails, a brand of PPG Architectural Coatings; AS-825 Acoustical Sound Sealant: [www.liquidnails.com/#sle](http://www.liquidnails.com/#sle).
  - c. Specified Technologies Inc; Smoke N Sound Acoustical Sealant: [www.stifirestop.com/#sle](http://www.stifirestop.com/#sle).
  - d. Substitutions: See Section 016000 - Product Requirements.
- C. Beads, Joint Accessories, and Other Trim: ASTM C1047, rigid plastic, galvanized steel, or rolled zinc, unless noted otherwise.
  - D. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.
    - 1. Paper Tape: 2 inch wide, creased paper tape for joints and corners, except as otherwise indicated.
    - 2. Ready-mixed vinyl-based joint compound.
    - 3. Chemical hardening type compound.
  - E. Screws for Fastening of Gypsum Panel Products to Cold-Formed Steel Studs Less than 0.033 inch in Thickness and Wood Members: ASTM C1002; self-piercing tapping screws, corrosion resistant.
  - F. Screws for Fastening of Gypsum Panel Products to Steel Members from 0.033 to 0.112 inch in Thickness: ASTM C954; steel drill screws, corrosion resistant.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Verify that project conditions are appropriate for work of this section to commence.

#### **3.02 SHAFT WALL INSTALLATION**

- A. Shaft Wall Framing: Install in accordance with manufacturer's installation instructions.
  - 1. Fasten runners to structure with short leg to finished side, using appropriate power-driven fasteners at not more than 24 inches on center.
  - 2. Install studs at spacing required to meet performance requirements.
- B. Shaft Wall Liner: Cut panels to accurate dimensions and install sequentially between special friction studs.
  - 1. On walls over sixteen feet high, screw-attach studs to runners top and bottom.
  - 2. Seal perimeter of shaft wall and penetrations with acoustical sealant.

#### **3.03 FRAMING INSTALLATION**

- A. Metal Framing: Install in accordance with ASTM C754 and manufacturer's instructions.
- B. Suspended Ceilings and Soffits: Space framing and furring members at 16 inches on center.
  - 1. Laterally brace entire suspension system.
  - 2. Install bracing as required at exterior locations to resist wind uplift.
- C. Studs: Space studs at 16 inches on center.
  - 1. Partitions Terminating at Ceiling: Attach ceiling runner securely to ceiling track in accordance with manufacturer's instructions.
  - 2. Partitions Terminating at Structure: Attach extended leg top runner to structure, maintain clearance between top of studs and structure, and brace both flanges of studs with continuous bridging.
  - 3. Partitions Terminating at Structure: Attach top runner to structure, maintain clearance between top of studs and structure, and connect studs to track using specified mechanical devices in accordance with manufacturer's instructions; verify free movement of top of stud connections; do not leave studs unattached to track.
- D. Openings: Reinforce openings as required for weight of doors or operable panels, using not less than double studs at jambs.
- E. Standard Wall Furring: Install at concrete walls scheduled to receive gypsum board, not more than 4 inches from floor and ceiling lines and abutting walls. Secure in place on alternate channel flanges at maximum 24 inches on center.
- F. Furring for Fire-Resistance Ratings: Install as required for fire-resistance ratings indicated and to GA-600 requirements.
- G. Blocking: Install wood blocking for support of:

1. Framed openings.
2. Wall mounted cabinets.
3. Plumbing fixtures.
4. Toilet partitions.
5. Toilet accessories.
6. Wall mounted door hardware.

### **3.04 ACOUSTIC ACCESSORIES INSTALLATION**

- A. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.
- B. Acoustic Sealant: Install in accordance with manufacturer's instructions.
  1. Place one bead continuously on substrate before installation of perimeter framing members.
  2. Place continuous bead at perimeter of each layer of gypsum board.
  3. Seal around all penetrations by conduit, pipe, ducts, and rough-in boxes, except where firestopping is provided.

### **3.05 BOARD INSTALLATION**

- A. Comply with ASTM C840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.
- B. Single-Layer Nonrated: Install gypsum board in most economical direction, with ends and edges occurring over firm bearing.
- C. Double-Layer, Nonrated: Use gypsum board for first layer, placed parallel to framing or furring members, with ends and edges occurring over firm bearing. Use glass mat faced gypsum board at exterior walls and at other locations as indicated. Place second layer perpendicular to framing or furring members. Offset joints of second layer from joints of first layer.
- D. Fire-Resistance-Rated Construction: Install gypsum board in strict compliance with requirements of assembly listing.
- E. Exterior Sheathing: Comply with ASTM C1280. Install sheathing vertically, with edges butted tight and ends occurring over firm bearing.
  1. Seal joints, cut edges, and holes with water-resistant sealant.
- F. Exterior Soffits: Install exterior soffit board perpendicular to framing, with staggered end joints over framing members or other solid backing.
  1. Seal joints, cut edges, and holes with water-resistant sealant.
- G. Cementitious Backing Board: Install over steel framing members and plywood substrate where indicated, in accordance with ANSI A108.11 and manufacturer's instructions.
- H. Installation on Metal Framing: Use screws for attachment of gypsum board except face layer of nonrated double-layer assemblies, which may be installed by means of adhesive lamination.
- I. Curved Surfaces: Apply gypsum board to curved substrates in accordance with GA-226.

### **3.06 INSTALLATION OF TRIM AND ACCESSORIES**

- A. Control Joints: Place control joints consistent with lines of building spaces and as follows:
  1. Not more than 30 feet apart on walls and ceilings over 50 feet long.
  2. At exterior soffits, not more than 30 feet apart in both directions.
- B. Corner Beads: Install at external corners, using longest practical lengths.
- C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials.

### **3.07 JOINT TREATMENT**

- A. Glass Mat Faced Gypsum Board and Exterior Glass Mat Faced Sheathing: Use fiberglass joint tape, embed and finish with setting type joint compound.
- B. Paper Faced Gypsum Board: Use paper joint tape, bedded with ready-mixed vinyl-based joint compound and finished with ready-mixed vinyl-based joint compound.
  1. Level 4: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated.
  2. Level 1: Fire rated wall areas above finished ceilings, whether or not accessible in the completed construction.

- C. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
  - 1. Feather coats of joint compound so that camber is maximum 1/32 inch.
- D. Fill and finish joints and corners of cementitious backing board as recommended by manufacturer.

**3.08 TOLERANCES**

- A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet in any direction.

**END OF SECTION**



**SECTION 092216  
NON-STRUCTURAL METAL FRAMING**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Metal partition, ceiling, and soffit framing.
- B. Framing accessories.

**1.02 RELATED REQUIREMENTS**

- A. Section 061000 - Rough Carpentry: Wood blocking within stud framing.
- B. Section 09 2116 - Gypsum Board Assemblies: Metal studs for gypsum board partition framing.

**1.03 REFERENCE STANDARDS**

- A. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members; 2018.
- B. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2020.
- C. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs; 2022.

**1.04 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data describing framing member materials and finish, product criteria, load charts, and limitations.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

- A. Metal Framing, Connectors, and Accessories:
  - 1. Clarkwestern Dietrich Building Systems LLC: [www.clarkdeitrich.com](http://www.clarkdeitrich.com).
  - 2. Marino: [www.marinoware.com/#sle](http://www.marinoware.com/#sle).
  - 3. Simpson Strong Tie: [www.strongtie.com/#sle](http://www.strongtie.com/#sle).
  - 4. Substitutions: See Section 016000 - Product Requirements.

**2.02 FRAMING MATERIALS**

- A. Non-Loadbearing Framing System Components: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated, with maximum deflection of wall framing of L/240 at 5 psf.
  - 1. Studs: C shaped with flat or formed webs with knurled faces.
  - 2. Runners: U shaped, sized to match studs.
  - 3. Ceiling Channels: C shaped.
  - 4. Furring: Hat-shaped and Z shaped sections, minimum depth of 7/8 inch.
  - 5. Steel Stud Framing Connectors:
    - a. Products:
      - 1) Simpson Strong Tie, Bridging Connectors; DBC Bridging Connector: [www.strongtie.com](http://www.strongtie.com).
      - 2) Substitutions: See Section 016000 - Product Requirements.
- B. Loadbearing Studs: As specified in Section 054000.
- C. Ceiling Hangers: Type and size as specified in ASTM C754 for spacing required.
- D. Partition Head to Structure Connections: Provide track fastened to structure with legs of sufficient length to accommodate deflection, for friction fit of studs cut short .
- E. Tracks and Runners: Same material and thickness as studs, bent leg retainer notched to receive studs with provision for crimp locking to stud.
- F. Fasteners: ASTM C1002 self-piercing tapping screws.
- G. Anchorage Devices: Powder actuated.

**2.03 FABRICATION**

- A. Fabricate assemblies of framed sections to sizes and profiles required.
- B. Fit, reinforce, and brace framing members to suit design requirements.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify existing conditions before starting work.
- B. Verify that rough-in utilities are in proper location.

### **3.02 INSTALLATION OF STUD FRAMING**

- A. Extend partition framing to structure where indicated and to ceiling in other locations.
- B. Partitions Terminating at Ceiling: Attach ceiling runner securely to ceiling track in accordance with manufacturer's instructions.
- C. Align and secure top and bottom runners at 24 inches on center.
- D. Fit runners under and above openings; secure intermediate studs to same spacing as wall studs.
- E. Align stud web openings horizontally.
- F. Secure studs to tracks using crimping method. Do not weld.
- G. Fabricate corners using a minimum of three studs.
- H. Double stud at wall openings, door and window jambs, not more than 2 inches from each side of openings.
- I. Coordinate installation of bucks, anchors, and blocking with electrical, mechanical, and other work to be placed within or behind stud framing.

### **3.03 CEILING AND SOFFIT FRAMING**

- A. Install furring after work above ceiling or soffit is complete. Coordinate the location of hangers with other work.
- B. Install furring independent of walls, columns, and above-ceiling work.
- C. Securely anchor hangers to structural members or embed in structural slab. Space hangers as required to limit deflection to criteria indicated. Use rigid hangers at exterior soffits.
- D. Space main carrying channels at maximum 72 inch on center, and not more than 6 inches from wall surfaces. Lap splice securely.
- E. Securely fix carrying channels to hangers to prevent turning or twisting and to transmit full load to hangers.
- F. Place furring channels perpendicular to carrying channels, not more than 2 inches from perimeter walls, and rigidly secure. Lap splices securely.

### **3.04 TOLERANCES**

- A. Maximum Variation From True Position: 1/8 inch in 10 feet.
- B. Maximum Variation From Plumb: 1/8 inch in 10 feet.

**END OF SECTION**

## **SECTION 093000 TILING**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Tile for floor applications.
- B. Tile for wall applications.
- C. Coated glass mat backer board as tile substrate.
- D. Ceramic accessories.
- E. Non-ceramic trim.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 079200 - Joint Sealants: Sealing joints between tile work and adjacent construction and fixtures.
- B. Section 092116 - Gypsum Board Assemblies: Tile backer board.

#### **1.03 REFERENCE STANDARDS**

- A. ANSI A108/A118/A136.1 - Specifications for the Installation of Ceramic Tile; 2020.
- B. ANSI A108.11 - American National Standard Specifications for Interior Installation of Cementitious Backer Units; 2018.
- C. ANSI A118.3 - American National Standard Specifications for Chemical Resistant, Water Cleanable Tile-Setting and -Grouting Epoxy and Water Cleanable Tile-Setting Epoxy Adhesive; 2021.
- D. ANSI A118.4 - American National Standard Specifications for Modified Dry-Set Cement Mortar; 2019.
- E. ANSI A118.6 - American National Standard Specifications for Standard Cement Grouts for Tile Installation; 2019.
- F. ANSI A118.12 - American National Standard Specifications for Crack Isolation Membranes for Thin-Set Ceramic Tile and Dimension Stone Installation; 2014 (Reaffirmed 2019).
- G. ANSI A137.1 - American National Standard Specifications for Ceramic Tile; 2022.
- H. ASTM C373 - Standard Test Methods for Determination of Water Absorption and Associated Properties by Vacuum Method for Pressed Ceramic Tiles and Glass Tiles and Boil Method for Extruded Ceramic Tiles and Non-tile Fired Ceramic Whiteware Products; 2018 (Reapproved 2023).
- I. ASTM C1178/C1178M - Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel; 2018.
- J. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation; 2023.

#### **1.04 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturers' data sheets on tile, mortar, grout, and accessories. Include instructions for using grouts and adhesives.
- C. Shop Drawings: Indicate tile layout, patterns, color arrangement, perimeter conditions, junctions with dissimilar materials, control and expansion joints, thresholds, ceramic accessories, and setting details.
- D. Samples: Mount tile and apply grout on two plywood panels, minimum 18 by 18 inches in size illustrating pattern, color variations, and grout joint size variations.
- E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- F. Maintenance Data: Include recommended cleaning methods, cleaning materials, and stain removal methods.
- G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 016000 - Product Requirements, for additional provisions.
  - 2. Extra Tile: 5 percent of each size, color, and surface finish combination.

#### **1.05 QUALITY ASSURANCE**

- A. Maintain one copy of and ANSI A108/A118/A136.1 and TCNA (HB) on site.
- B. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, with minimum five years of documented experience.

- C. Installer Qualifications:
  1. Company specializing in performing tile installation, with minimum of five years of documented experience.
- D. Installer Qualifications: Company specializing in performing tile installation, with minimum of five years of documented experience.

#### **1.06 MOCK-UP**

- A. See Section 014000 - Quality Requirements, for general requirements for mock-up.
- B. Construct tile mock-up where indicated on drawings, incorporating all components specified for the location.
  1. Approved mock-up may remain as part of the Work.

#### **1.07 DELIVERY, STORAGE, AND HANDLING**

- A. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.

#### **1.08 FIELD CONDITIONS**

- A. Do not install solvent-based products in an unventilated environment.
- B. Maintain ambient and substrate temperature of 50 degrees F during installation of mortar materials.

### **PART 2 PRODUCTS**

#### **2.01 TILE**

- A. Manufacturers:
  1. Basis of Design: Ergon.
  2. Substitutions: See Section 016000 - Product Requirements.
- B. Porcelain Floor Tile, Type CT-1 & CT-2: ANSI A137.1, standard grade.
  1. Moisture Absorption: 0.5 to 3.0 percent as tested in accordance with ASTM C373.
  2. Size: 12" x 24", nominal.
  3. Shape: Rectangle.
  4. Edges: Square.
  5. Color(s): See Schedule.
  6. Products:
    - a. Stone Project by Ergon.
    - b. Substitutions: See Section 016000 - Product Requirements.
- C. Non-Ceramic Trim: See Finish Schedule for finish, style and dimensions to suit application, for setting using tile mortar or adhesive.
  1. Applications:
    - a. Open edges of wall tile.
    - b. Wall corners, outside and inside.
    - c. Transition between floor finishes of different heights.
    - d. Thresholds at door openings.
    - e. Expansion and control joints, floor and wall as indicated on Drawings.
    - f. Borders and other trim as indicated on drawings.
  2. Manufacturers:
    - a. Schluter-Systems: [www.schluter.com/#sle](http://www.schluter.com/#sle).
    - b. Genesis APS International: [www.genesis-aps.com/#sle](http://www.genesis-aps.com/#sle).
    - c. Substitutions: See Section 016000 - Product Requirements.

#### **2.02 SETTING MATERIALS**

- A. Manufacturers:
  1. ARDEX Engineered Cements: [www.ardexamericas.com/#sle](http://www.ardexamericas.com/#sle).
  2. Bostik Inc: [www.bostik-us.com/#sle](http://www.bostik-us.com/#sle).
  3. Custom Building Products: [www.custombuildingproducts.com/#sle](http://www.custombuildingproducts.com/#sle).
  4. LATICRETE International, Inc: [www.laticrete.com/#sle](http://www.laticrete.com/#sle).
  5. Merkrete, by Parex USA, Inc: [www.merkrete.com/sle](http://www.merkrete.com/sle).
  6. ProSpec, an Oldcastle brand: [www.prospec.com](http://www.prospec.com).

- B. Provide setting materials made by the same manufacturer as grout.
- C. Latex-Portland Cement Mortar Bond Coat: {rs#1}, {rs#1}.
  - 1. Products:
    - a. ARDEX Engineered Cements; ARDEX X 77 MICROTEC: [www.ardexamericas.com](http://www.ardexamericas.com).
    - b. AVM Industries, Inc; Thin-Set 780: [www.avmindustries.com](http://www.avmindustries.com).
    - c. LATICRETE International, Inc; LATICRETE 254 Platinum: [www.laticrete.com](http://www.laticrete.com).
    - d. Substitutions: See Section 016000 - Product Requirements.

### 2.03 GROUTS

- A. Manufacturers:
  - 1. ARDEX Engineered Cements: [www.ardexamericas.com/#sle](http://www.ardexamericas.com/#sle).
  - 2. LATICRETE International, Inc; LATICRETE PERMACOLOR Grout: [www.laticrete.com/#sle](http://www.laticrete.com/#sle).
  - 3. Basis of Design: Mapei.
  - 4. Substitutions: See Section 016000 - Product Requirements.
- B. Standard Grout: ANSI A118.6 standard cement grout.
  - 1. Applications: Use this type of grout where indicated and where no other type of grout is indicated.
  - 2. Use sanded grout for joints 1/8 inch wide and larger; use unsanded grout for joints less than 1/8 inch wide.
  - 3. Color(s): As indicated on drawings.
  - 4. Products:
    - a. LATICRETE International, Inc; LATICRETE 1500 Sanded Grout: [www.laticrete.com/#sle](http://www.laticrete.com/#sle).
- C. Epoxy Grout: ANSI A118.3 chemical resistant and water-cleanable epoxy grout.
  - 1. Color(s): As indicated on drawings.
  - 2. Products:
    - a. LATICRETE International, Inc; LATICRETE SPECTRALOCK PRO Premium Grout: [www.laticrete.com/#sle](http://www.laticrete.com/#sle).
    - b. Substitutions: See Section 016000 - Product Requirements.
- D. Grout Sealer: Liquid-applied, moisture and stain protection for existing or new Portland cement grout.
  - 1. Composition: Water-based colorless silicone.

### 2.04 ACCESSORY MATERIALS

- A. Concrete Floor Slab Crack Isolation Membrane: Material complying with ANSI A118.12; not intended as waterproofing.
  - 1. Thickness: 20 mils, maximum.
  - 2. Crack Resistance: No failure at 1/16 inch gap, minimum.
  - 3. Products:
    - a. LATICRETE International, Inc; LATICRETE Blue 92 Anti-Fracture Membrane: [www.laticrete.com/#sle](http://www.laticrete.com/#sle).
    - b. Substitutions: See Section 016000 - Product Requirements.
- B. Backer Board: Coated glass mat type complying with ASTM C1178/C1178M; inorganic fiberglass mat on both surfaces and integral acrylic coating vapor retarder.
- C. Mesh Tape: 2 inch wide self-adhesive fiberglass mesh tape.

## PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Verify that sub-floor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive tile.
- B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive tile.
- C. Verify that sub-floor surfaces are dust-free and free of substances that could impair bonding of setting materials to sub-floor surfaces.

- D. Verify that concrete sub-floor surfaces are ready for tile installation by testing for moisture emission rate and alkalinity; obtain instructions if test results are not within limits recommended by tile manufacturer and setting materials manufacturer.
- E. Verify that required floor-mounted utilities are in correct location.

### **3.02 PREPARATION**

- A. Protect surrounding work from damage.
- B. Vacuum clean surfaces and damp clean.
- C. Seal substrate surface cracks with filler. Level existing substrate surfaces to acceptable flatness tolerances.
- D. Install backer board in accordance with ANSI A108.11 and board manufacturer's instructions. Tape joints and corners, cover with skim coat of setting material to a feather edge.

### **3.03 INSTALLATION - GENERAL**

- A. Install tile, thresholds, and stair treads and grout in accordance with applicable requirements of ANSI A108.1a through ANSI A108.13, manufacturer's instructions, and TCNA (HB) recommendations.
- B. Lay tile to pattern indicated. Do not interrupt tile pattern through openings.
- C. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly. Align floor joints.
- D. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make grout joints without voids, cracks, excess mortar or excess grout, or too little grout.
- E. Form internal angles square and external angles bullnosed.
- F. Install non-ceramic trim in accordance with manufacturer's instructions.
- G. Sound tile after setting. Replace hollow sounding units.
- H. Keep control and expansion joints free of mortar, grout, and adhesive.
- I. Keep expansion joints free of adhesive or grout. Apply sealant to joints.
- J. Prior to grouting, allow installation to completely cure; minimum of 48 hours.
- K. Grout tile joints unless otherwise indicated. Use standard grout unless otherwise indicated.
- L. At changes in plane and tile-to-tile control joints, use tile sealant instead of grout, with either bond breaker tape or backer rod as appropriate to prevent three-sided bonding.
- M. Apply sealant to junction of tile and dissimilar materials and junction of dissimilar planes.

### **3.04 INSTALLATION - FLOORS - THIN-SET METHODS**

- A. Over interior concrete substrates, install in accordance with TCNA (HB) Method F113, dry-set or latex-Portland cement bond coat, with standard grout, unless otherwise indicated.
  - 1. Use uncoupling membrane under all tile unless other underlayment is indicated.
  - 2. Where waterproofing membrane is indicated, install in accordance with TCNA (HB) Method F122, with latex-Portland cement grout.

### **3.05 INSTALLATION - WALL TILE**

- A. Over coated glass mat backer board on studs, install in accordance with TCNA (HB) Method W245.

### **3.06 CLEANING**

- A. Clean tile and grout surfaces.

### **3.07 PROTECTION**

- A. Do not permit traffic over finished floor surface for 4 days after installation.

**END OF SECTION**

**SECTION 095100  
ACOUSTICAL CEILINGS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Suspended metal grid ceiling system.
- B. Acoustical units.

**1.02 REFERENCE STANDARDS**

- A. ASTM C635/C635M - Standard Specification for Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; 2022.
- B. ASTM E1264 - Standard Classification for Acoustical Ceiling Products; 2023.

**1.03 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on suspension system components.
- C. Samples: Submit two samples 6 by 6 inch in size illustrating material and finish of acoustical units.
- D. Samples: Submit one samples each, 6 inches long, of suspension system main runner.
- E. Manufacturer's Installation Instructions: Indicate special procedures.
- F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 016000 - Product Requirements, for additional provisions.
  - 2. Extra Acoustical Units: Quantity equal to 5 percent of total installed.

**1.04 QUALITY ASSURANCE**

- A. Suspension System Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- B. Acoustical Unit Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

**1.05 FIELD CONDITIONS**

- A. Maintain uniform temperature of minimum 60 degrees F, and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.

**PART 2 PRODUCTS**

**2.01 ACOUSTICAL UNITS**

- A. Manufacturers: Basis of Design: Rockfon
  - 1. Acoustic Ceiling Products, Inc.: [www.acpideas.com](http://www.acpideas.com).
  - 2. CertainTeed Corporation: [www.certainteed.com](http://www.certainteed.com).
  - 3. Hunter Douglas Contract: [www.hunterdouglascontract.com](http://www.hunterdouglascontract.com).
  - 4. USG: [www.usg.com](http://www.usg.com).
  - 5. Substitutions: See Section 01 6000 - Product Requirements.
- B. Acoustical Panels, Type APC-1: Mineral wool, with the following characteristics:
  - 1. Classification: ASTM E1264 Type XX.
    - a. Pattern: "E" - lightly textured.
  - 2. Size: 24 by 48 inch.
  - 3. Thickness: 3/4 inch
  - 4. Panel Edge: Square Tegular.
  - 5. Color: White.
  - 6. Suspension System Type \_\_\_\_: Exposed grid.
  - 7. Products:
    - a. Rockfon Sonar Square Tegular.
    - b. Substitutions: See Section 016000 - Product Requirements.
- C. Metal-Faced Acoustical Panels Type MPC-2: Aluminum flat formed sheet, with translucent media backing; with the following characteristics:
  - 1. Size: 24 by 48 inches.

2. Surface Pattern: Perforated.
3. Openness: 19%.
4. Suspension System: Torsion Grid.
5. Products:
  - a. Basis of Design: Arktura Vapor Sky.
  - b. Substitutions: See Section 016000 - Product Requirements.

## **2.02 SUSPENSION SYSTEM(S)**

- A. Manufacturers:
  1. Armstrong World Industries, Inc: [www.armstrong.com](http://www.armstrong.com).
  2. Acoustic Ceiling Products, Inc.: [www.acpideas.com](http://www.acpideas.com).
  3. CertainTeed Corporation: [www.certainteed.com](http://www.certainteed.com).
  4. Chicago Metallic Corporation: [www.chicagometallic.com](http://www.chicagometallic.com).
  5. Hunter Douglas Contract: [www.hunterdouglascontract.com](http://www.hunterdouglascontract.com).
  6. USG: [www.usg.com](http://www.usg.com).
  7. Substitutions: See Section 01 6000 - Product Requirements.
- B. Metal Suspension Systems - General: Complying with ASTM C635/C635M; die cut and interlocking components, with stabilizer bars, clips, splices, perimeter moldings, and hold down clips as required.
- C. Exposed Steel Suspension System: Formed steel, commercial quality cold rolled; heavy-duty.
  1. Profile: Tee; 15/16 inch wide face.
  2. Construction: Double web.
  3. Finish: White painted.
  4. Products:
    - a. Basis of Design: Donn DX by USG.
    - b. Substitutions: See Section 016000 - Product Requirements.

## **2.03 ACCESSORIES**

- A. Perimeter Moldings: Same material and finish as grid.
  1. At Exposed Grid: Provide L-shaped molding for mounting at same elevation as face of grid. Basis of Design: USG Compasso Elite 2" x 13/16" profile
- B. Touch-up Paint: Type and color to match acoustical and grid units.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify existing conditions before starting work.
- B. Verify that layout of hangers will not interfere with other work.

### **3.02 INSTALLATION - SUSPENSION SYSTEM**

- A. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.
- B. Install after major above-ceiling work is complete. Coordinate the location of hangers with other work.
- C. Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.
- D. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.
- E. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.
- F. Support fixture loads using supplementary hangers located within 6 inches of each corner, or support components independently.
- G. Do not eccentrically load system or induce rotation of runners.
- H. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
  1. Use longest practical lengths.
  2. Overlap and rivet corners.



### **3.03 INSTALLATION - ACOUSTICAL UNITS**

- A. Install acoustical units in accordance with manufacturer's instructions.
- B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.
- C. Fit border trim neatly against abutting surfaces.
- D. Install units after above-ceiling work is complete.
- E. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.
- F. Cutting Acoustical Units:
  - 1. Make field cut edges of same profile as factory edges.

### **3.04 TOLERANCES**

- A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.
- B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

**END OF SECTION**

**SECTION 095426  
SUSPENDED WOOD CEILINGS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Wood grilles.

**1.02 RELATED REQUIREMENTS**

- A. Section 095100 - Acoustical Ceilings: Metal suspension systems.

**1.03 REFERENCE STANDARDS**

- A. ASTM C635/C635M - Standard Specification for Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; 2022.
- B. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels; 2019.
- C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023b.
- D. ASTM E580/E580M - Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions; 2022.
- E. ASTM E1264 - Standard Classification for Acoustical Ceiling Products; 2023.
- F. CISCA (WC) - Wood Ceilings Technical Guidelines; 2009.

**1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Sequence work to ensure ceilings are not installed until building is enclosed, dust generating activities have terminated, and overhead work is completed.

**1.05 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Shop Drawings: Indicate grid layout and related dimensioning, attachment of wood ceiling components to grid, accessory attachments, junctions with other ceiling finishes, and mechanical and electrical items installed in the ceiling.
- C. Product Data: Provide data on wood ceiling components and suspension system components.
- D. Samples: Submit two full size samples illustrating material and finish of wood ceiling components.
- E. Test Reports: Certified test data from an independent test agency verifying that panels meet specified requirements for fire, acoustical, and seismic performance.
- F. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.
- G. Manufacturer's qualification statement.
- H. Installer's qualification statement.
- I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 016000 - Product Requirements for additional provisions.
  - 2. Wood Ceiling Components: Provide a quantity equal to 2 percent of total product installed.

**1.06 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section, with at least three years documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years documented experience.

**1.07 MOCK-UPS**

- A. See Section 014000 - Quality Requirements for additional requirements.
- B. Locate where directed.
- C. Mock-up may remain as part of the work.

**1.08 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver wood ceiling components to project site in original, unopened packages.

- B. Store in fully enclosed space, flat, level and off the floor.

## **1.09 FIELD CONDITIONS**

- A. Do not install suspended wood ceiling system until wet construction work is complete and permanent heat and air conditioning is installed and operating.
- B. Maintain room temperature between 60 degrees F and 75 degrees F and relative humidity between 35 to 55 percent before, during, and after installation.

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Suspended Wood Ceilings: Basis of Design:9Wood.
  - 1. Substitutions: See Section 016000 - Product Requirements.

### **2.02 SUSPENDED WOOD CEILING SYSTEM**

- A. Performance Requirements:
  - 1. Design for maximum deflection of 1/360 of span.
- B. Wood Ceiling Products: See Finish Legend for style, color, size, and install pattern.
- C. Wood Grilles: Pre-assembled module of solid wood grilles with battens and dowels.
  - 1. Module Size: 1' wide up to 10'; See Drawings., nominal.
  - 2. Veneer Species: White Oak.
    - a. Factory Finish: Clear sealer.
  - 3. Solid Wood Species: See Finish Schedule..
    - a. Factory Finish: As scheduled.
  - 4. Attachment: Cross piece backer attached to gypsum wallboard ceiling.
- D. Accessories: Manufacturer's standard accessories for installation method indicated, seismic requirements and above-ceiling accessibility.

### **2.03 FABRICATION**

- A. Shop fabricate wood ceiling components to the greatest extent possible.
- B. Fabricate components to allow access to ceiling plenum as required.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify existing conditions before starting work.
- B. Do not install ceiling until after interior wet work is dry.

### **3.02 PREPARATION**

- A. Coordinate the location of hangers with other work.
- B. Provide hanger clips during steel deck erection. Provide additional hangers and inserts as required.
- C. Layout wood ceiling components in pattern according to reflected ceiling plan and as shown on shop drawings.
- D. Acclimate wood ceiling materials by removing from packaging in installation area a minimum of 48 hours prior to installation.

### **3.03 INSTALLATION**

- A. General: Install suspended wood ceiling system in accordance with CISCA (WC).
- B. Suspension System:
  - 1. Install suspension system in accordance with ASTM C636/C636M, ASTM E580/E580M, and manufacturer's instructions and as supplemented in this section.
  - 2. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.
  - 3. Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.
  - 4. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.

5. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.
  6. Do not eccentrically load system or induce rotation of runners.
- C. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
- D. Wood Ceiling:
1. Install wood ceilings in accordance with manufacturer's instructions.
  2. Fit wood components in place, free from damaged edges or other defects detrimental to appearance and function.
  3. Install components in uniform plane, and free from twist, warp, and dents.
  4. Cut to fit irregular grid and perimeter edge trim.
  5. Make field cut edges of same profile as factory edges, seal and finish according to manufacturer.
  6. Install clips, stabilizer bars, and other attachments as indicated to secure wood ceiling components tight to the grid system.
  7. Install acoustical backer above wood ceiling components; fit tight between grid members.

### **3.04 TOLERANCES**

- A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.

### **3.05 CLEANING**

- A. Clean and touch up minor finish damage. Remove and replace components that cannot be successfully cleaned and repaired.

**END OF SECTION**

**SECTION 096500  
RESILIENT FLOORING**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Resilient tile flooring.
- B. Static control resilient tile flooring.
- C. Resilient base.
- D. Installation accessories.

**1.02 RELATED REQUIREMENTS**

- A. Section 033000 - Cast-in-Place Concrete: Restrictions on curing compounds for concrete slabs and floors.
- B. Section 260526 - Grounding and Bonding for Electrical Systems: Grounding and bonding of static control flooring to building grounding system.

**1.03 REFERENCE STANDARDS**

- A. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source; 2019a, with Editorial Revision (2020).
- B. ASTM F150 - Standard Test Method for Electrical Resistance of Conductive and Static Dissipative Resilient Flooring; 2006 (Reapproved 2018).
- C. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2022.
- D. ASTM F1066 - Standard Specification for Vinyl Composition Floor Tile; 2004 (Reapproved 2018).
- E. ASTM F1861 - Standard Specification for Resilient Wall Base; 2021.
- F. ASTM F2169 - Standard Specification for Resilient Stair Treads; 2015 (Reapproved 2020).
- G. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source; 2023.

**1.04 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.
- C. Verification Samples: Submit two samples, 12 by 12 inch in size illustrating color and pattern for each resilient flooring product specified.
- D. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.
- E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 016000 - Product Requirements, for additional provisions.
  - 2. Extra Flooring Material: 5% of square feet of each type and color.
  - 3. Extra Wall Base: 5% of linear feet of each type and color.

**1.05 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing specified flooring with minimum five years documented experience.
- B. Installer Qualifications: Company specializing in installing specified flooring with minimum five years experience and approved by flooring manufacturer.
- C. The resilient stage floor installation shall be the responsibility of a single Contractor, including moisture barrier, anchorage system, sleepers, resilient mounts, adhesives, acoustical batting, sub-flooring, flooring, trim, expansion provisions, and finish. This Contractor shall assume complete responsibility for the installation of the work in this Section, and shall hold the Owner, Architect, Theater Consultant, and all their Employees and Consultants harmless for any costs for errors or omissions associated with the work of this Section and any action arising therefrom.
- D. The Contractor shall obtain all flooring from single manufacturer or source to ensure match of quality, color, pattern, and texture.

## 1.06 WARRANTY

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. Provide five year warranty for resilient stage floor to include warranty against discoloration due to cleaning, crazing or cracking, and staining.

## 1.07 DELIVERY, STORAGE, AND HANDLING

- A. Upon receipt, immediately remove any shrink-wrap and check materials for damage and the correct style, color, quantity and run numbers.
- B. Store all materials off of the floor in an acclimatized, weather-tight space.
- C. Maintain temperature in storage area between 55 degrees F and 90 degrees F.
- D. Protect roll materials from damage by storing on end.
- E. Do not double stack pallets.
- F. Place wood flooring materials in stage area at least 7 days in advance of start of installation. Open sealed packages of wood flooring to permit natural adjustment of moisture content.

## 1.08 FIELD CONDITIONS

- A. Maintain temperature in storage area between 55 degrees F and 90 degrees F.
- B. Store materials for not less than 48 hours prior to installation in area of installation at a temperature of 70 degrees F to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F.

## PART 2 PRODUCTS

### 2.01 TILE FLOORING

- A. Vinyl Plank: LVT-1: Printed film type, with transparent or translucent wear layer, and:
  - 1. Minimum Requirements: Comply with ASTM F1700, of Class corresponding to type specified.
  - 2. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E 648 or NFPA 253.
  - 3. Size: 12" x 18"
  - 4. Wear Layer Thickness: .020 inch.
  - 5. Total Thickness: .098 inch.
  - 6. Pattern: SSS5A3805.
  - 7. Color: Satin Weave.
  - 8. Manufacturers:
    - a. Basis of Design: Mannington; Product Spacia Abstract
    - b. Substitutions: See Section 01 6000 - Product Requirements.
- B. Static Control Tile - Type VCT-1: Homogeneous; color and pattern throughout thickness.
  - 1. Manufacturers:
    - a. Excelon SDT by Armstrong.
    - b. Substitutions: See Section 016000 - Product Requirements.
  - 2. Minimum Requirements: Vinyl composition tile complying with ASTM F1066, Class 2.
  - 3. Electrical Resistance:
    - a. Conductive Tile: Resistance between 25 kilohms and 1.0 megohms as tested in accordance with ASTM F150.
  - 4. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E 648, NFPA 253, ASTM E 648, or NFPA 253.
  - 5. Tile Size: 12 by 12 inch.
  - 6. Total Thickness: 0.125 inch.
  - 7. Color: 51951 Armor Gray.

### 2.02 STAIR COVERING

- A. Stair Treads with Integral Risers: Rubber; full height of riser, full width and depth of tread in one piece; tapered thickness.
  - 1. Manufacturers:
    - a. Roppe Corp; Rubber Tread Rib Design: [www.roppe.com](http://www.roppe.com).
    - b. Substitutions: See Section 016000 - Product Requirements.

2. Minimum Requirements: Comply with ASTM F2169, Type TS, rubber, vulcanized thermoset.
  3. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E648 or NFPA 253.
  4. Nominal Thickness: 0.1875 inch.
  5. Striping: 2 inch wide contrasting color abrasive strips; pebble white grit strip.
  6. Tread Texture: Ribbed.
  7. Color: Dark Gray- Solid.
- B. Stair Nosings: 1-1/2 inch horizontal return, 1-1/8 inch vertical return, full width of stair tread in one piece.
1. Manufacturers:
    - a. Johnsonite, a Tarkett Company: [www.johnsonite.com/#sle](http://www.johnsonite.com/#sle).
    - b. Substitutions: See Section 016000 - Product Requirements.
  2. Material: Rubber.
  3. Nominal Thickness: 0.125 inch.
  4. Profile: DTN-48
  5. Size: 1-3/4" x 1-3/4".
  6. Texture: Ribbed.
  7. Color: 48 Grey.
  8. Associated Base: Duracove by Tarkett.
    - a. Height: 6 inch; toeless.
    - b. Thickness: 0.125 inch.
    - c. Color: 48 Grey.

### 2.03 RESILIENT BASE

- A. Resilient Base - Type RB-1: ASTM F1861, Type TS rubber, vulcanized thermoset; top set Style B, Cove.
1. Manufacturers:
    - a. Roppe Corp; Pinnacle/Straight: [www.roppe.com/#sle](http://www.roppe.com/#sle).
    - b. Substitutions: See Section 016000 - Product Requirements.
  2. Height: 4 inch.
  3. Thickness: 0.125 inch.
  4. Finish: Matte.
  5. Color: See Finish Schedule.

### 2.04 ACCESSORIES

- A. Subfloor Filler: White premix latex; type recommended by adhesive material manufacturer.
- B. Primers, Adhesives, and Seam Sealer: Waterproof; types recommended by flooring manufacturer.
- C. Copper Grounding Strips: Type and size as recommended by static control flooring manufacturer.

## PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Verify that surfaces are flat to tolerances acceptable to flooring manufacturer, free of cracks that might telegraph through flooring, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of flooring to substrate.
- B. Cementitious Sub-floor Surfaces: Verify that substrates are dry enough and ready for resilient flooring installation by testing for moisture and pH.

### 3.02 PREPARATION

- A. Prepare floor substrates as recommended by flooring and adhesive manufacturers.
- B. Remove sub-floor ridges and bumps. Fill minor low spots, cracks, joints, holes, and other defects with sub-floor filler to achieve smooth, flat, hard surface.
- C. Prohibit traffic until filler is fully cured.
- D. Clean substrate.

### **3.03 INSTALLATION - GENERAL**

- A. Starting installation constitutes acceptance of sub-floor conditions.
- B. Install in accordance with manufacturer's written instructions.
- C. Adhesive-Applied Installation:
  - 1. Place copper grounding strip in conductive adhesive and apply additional adhesive to top side of strip before installing static control flooring. Allow strip to extend beyond flooring in accordance with static control flooring manufacturer's instructions. Refer to Section 260526 for grounding and bonding to building grounding system.
  - 2. Fit joints and butt seams tightly.
  - 3. Set flooring in place, press with heavy roller to attain full adhesion.
- D. Loose-Laid Installation: Set flooring in place in accordance with manufacturer's instructions.
- E. Where type of floor finish, pattern, or color are different on opposite sides of door, terminate flooring under centerline of door.
- F. Install edge strips at unprotected or exposed edges, where flooring terminates, and where indicated.
- G. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.
- H. Install flooring in recessed floor access covers, maintaining floor pattern.
- I. At movable partitions, install flooring under partitions without interrupting floor pattern.
- J. Spread only enough adhesive to permit installation of materials before initial set.
- K. Fit joints and butt seams tightly.
- L. Set flooring in place, press with heavy roller to attain full adhesion.
- M. Where type of floor finish, pattern, or color are different on opposite sides of door, terminate flooring under centerline of door.
- N. Install edge strips at unprotected or exposed edges, where flooring terminates, and where indicated.
- O. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.

### **3.04 INSTALLATION - TILE FLOORING**

- A. Mix tile from container to ensure shade variations are consistent when tile is placed, unless otherwise indicated in manufacturer's installation instructions.

### **3.05 INSTALLATION OF RESILIENT STAGE FLOORING**

- A. Contractor shall employ only experienced floor installers for the installation of work of this Section. A competent supervisor shall be maintained on this Project during the entire installation. A change of supervisor shall not be acceptable unless by written authorization of the Architect.

### **3.06 COORDINATE INSTALLATION WITH ALL OTHER TRADES DOING ADJOINING WORK.**

- A. Examine all existing conditions at the job site prior to beginning installation.
- B. Install all items in conformity with standard trade practices and manufacturers' recommendations. Position all items accurately and true to plumb line and level.
- C. Comply with flooring manufacturer's instructions and recommendations for this application, but not less than MFMA standards and WSFI standards.
- D. Provide expansion space at walls and other obstructions and terminations of flooring, not less than 1 inch.
- E. Glue resilient pads to sleepers 16" on center. Glue and staple intermediate plywood blocks to sleepers 16" on center, evenly spaced between resilient pads.
- F. Place the sleepers around the perimeter of the stage. Place the balance of the sleepers in parallel rows on 16" centers across the center of the stage. Solid blocking anchored to the stage floor should be used in lieu of sleepers at the perimeter of the floor, particularly at the edge of the orchestra pit and at all threshold locations.
- G. Attach the plywood sub-floor to the sleepers, providing 3/32" space between panels and staggering seams between layers. Provide layer of felt between layers of sub-floor.
- H. Apply Stagelam panels with flat head wood screws on 12" centers around perimeter and through center of each sheet. Leave 3/32" expansion space at all joints. Use no adhesives.



Stagger Stagelam seams with subfloor seams.

### **3.07 INSTALLATION - RESILIENT BASE**

- A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches between joints.
- B. Miter internal corners. At external corners, 'V' cut back of base strip to 2/3 of its thickness and fold. At exposed ends, use premolded units.
- C. Install base on solid backing. Bond tightly to wall and floor surfaces.

### **3.08 INSTALLATION - STAIR COVERINGS**

- A. Adhere over entire surface. Fit accurately and securely.

### **3.09 CLEANING**

- A. Remove excess adhesive from floor, base, and wall surfaces without damage.
- B. Clean in accordance with manufacturer's written instructions.

### **3.10 PROTECTION**

- A. Prohibit traffic on resilient flooring for 48 hours after installation.

**END OF SECTION**

**SECTION 096813  
TILE CARPETING**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Carpet tile, loose laid with edges and control grid adhered.

**1.02 REFERENCE STANDARDS**

- A. ASTM D2859 - Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials; 2016 (Reapproved 2021).
- B. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2022.
- C. CRI (CIS) - Carpet Installation Standard; Carpet and Rug Institute; 2011.
- D. CRI (GLA) - Green Label Testing Program - Approved Adhesive Products; Carpet and Rug Institute; Current Edition.

**1.03 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns, colors available, and method of installation.
- C. Shop Drawings: Indicate pattern and layout direction.
- D. Samples: Submit two carpet tiles illustrating color and pattern design for each carpet color selected.
- E. Manufacturer's Installation Instructions: Indicate special procedures.
- F. Manufacturer's Qualification Statement.
- G. Installer's Qualification Statement.
- H. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.
- I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 016000 - Product Requirements, for additional provisions.
  - 2. Extra Carpet Tiles: Quantity equal to 5 percent of total installed of each color and pattern installed.

**1.04 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing specified carpet tile with minimum three years documented experience.
- B. Installer Qualifications: Company specializing in installing carpet tile with minimum three years documented experience and approved by carpet tile manufacturer.

**1.05 FIELD CONDITIONS**

- A. Store materials in area of installation for minimum period of 24 hours prior to installation.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

- A. Tile Carpeting: Basis of Design: Bentley
  - 1. Substitutions: See Section 016000 - Product Requirements.

**2.02 MATERIALS**

- A. Tile Carpeting, Type CPT-1 thru CPT-5: Multi-Level Pattern Loop, manufactured in one color dye lot.
  - 1. Product: See Finish Schedule manufactured by Shaw Contract.
  - 2. Tile Size: See Finish Schedule inch, nominal.
  - 3. Color: See Finish Schedule.
  - 4. Installation Method: See Finish Schedule
- B. Carpet Tile Type EFC-1: Tufted tip-Sheared, manufactured in one color dye lot.
  - 1. Product: Rough Idea Shear manufactured by Bentley.
  - 2. Tile Size: 24 x 24, nominal.

3. Color: Outline 800115.
4. Gage: 5/64 inch.
5. Stitches: 6.3 per inch.
6. Weight: 82 oz/sq yd
7. Installation Method: Monolithic

### **2.03 ACCESSORIES**

- A. Sub-Floor Filler: White premix latex; type recommended by flooring material manufacturer.
- B. Edge Strips: Embossed aluminum, color as selected by Architect.
- C. Stair Nosing: Anodized aluminum angle.
  1. Basis of Design: Kuberit KS-A.
  2. Style & Finish: See Finish Schedule
- D. Adhesives: Acceptable to carpet tile manufacturer, compatible with materials being adhered; maximum VOC of 50 g/L; CRI Green Label certified; in lieu of labeled product, independent test report showing compliance is acceptable.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that sub-floor surfaces are smooth and flat within tolerances specified for that type of work and are ready to receive carpet tile.
- B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive carpet tile.
- C. Verify that sub-floor surfaces are dust-free and free of substances that could impair bonding of adhesive materials to sub-floor surfaces.
- D. Cementitious Sub-floor Surfaces: Verify that substrates are dry enough and ready for flooring installation by testing for moisture and pH.

### **3.02 PREPARATION**

- A. Prepare floor substrates as recommended by flooring and adhesive manufacturers.
- B. Remove sub-floor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with sub-floor filler.
- C. Vacuum clean substrate.

### **3.03 INSTALLATION**

- A. Starting installation constitutes acceptance of sub-floor conditions.
- B. Install carpet tile in accordance with manufacturer's instructions.
- C. Blend carpet from different cartons to ensure minimal variation in color match.
- D. Cut carpet tile clean. Fit carpet tight to intersection with vertical surfaces without gaps.
- E. Lay carpet tile in square pattern, with pile direction parallel to next unit, set parallel to building lines.
- F. Trim carpet tile neatly at walls and around interruptions.
- G. Complete installation of edge strips, concealing exposed edges.

### **3.04 CLEANING**

- A. Remove excess adhesive without damage, from floor, base, and wall surfaces.
- B. Clean and vacuum carpet surfaces.

**END OF SECTION**

**SECTION 097800  
INTERIOR WALL PANELING**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Metal interior wall paneling.
- B. Accessories.

**1.02 REFERENCE STANDARDS**

- A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023b.

**1.03 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Submit manufacturer's descriptive literature for each specified product. Include anchorage devices specific to project substrate types.
- C. Shop Drawings: Submit elevations for each application and location. Indicate details of joints and attachments.
  - 1. Scale of Drawing Elevations: 1/4 inch to 1 foot, minimum.
  - 2. Scale of Drawing Details: 1-1/2 inches to 1 foot, minimum.
- D. Samples: Submit two samples 12 by 12 inches in size, indicating finish, surface design, and color for each type of panels.
- E. Manufacturer's Instructions: Provide manufacturer's installation instructions.
- F. Installer's qualification statement.
- G. Maintenance Data: Include recommended instructions, methods, and materials for cleaning panels.
- H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. Extra Panels: Quantity equal to 5 percent of total installed.

**1.04 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with at least five years of documented experience.
- B. Installer Qualifications: Company specializing in installing work of the type specified in this section, and with at least five years of documented experience.

**1.05 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver products to project site in manufacturer's original packaging, marked with manufacturer's product identification.
- B. Store panels flat, indoors, on a clean, dry surface. Remove packaging and allow panels to acclimate to room temperature for 48 hours prior to installation.
- C. Packaging Waste Management: See Section 017419.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

- A. Metal Interior Wall Paneling:
  - 1. Moz Design; Powder Coat Collection.
  - 2. Forms + Surfaces; Fused Metal.
  - 3. Substitutions: See Section 01 6000 - Product Requirements.

**2.02 REGULATORY REQUIREMENTS**

- A. Surface Burning Classification: Provide wall paneling assemblies meeting Class A when tested in accordance with ASTM E84.

**2.03 METAL INTERIOR WALL PANELING**

- A. Metal Wall Panel System: DM-1; Moz Designs Powder Coat.
  - 1. Applications: Wall cladding.
  - 2. Material: Aluminum sheet.
  - 3. Panel Size: 4 by 8 feet.

4. Thickness: 0.040 inch.
  5. Finish: Powder coat.
  6. Color: Cognac Sand.
  7. Substrate: As indicated on drawings.
- B. Metal Wall Panel System: DM-2; Forms + Surfaces Fused Metal.
1. Applications: Elevator cabs.
  2. Material: Stainless steel sheet.
  3. Panel Size: 4 by 8 feet.
  4. Thickness: 0.035 inch.
  5. Finish: Seastone.
  6. Color: Graphite
  7. Substrate: As indicated on drawings.
- C. Fabrication: Shop fabricate to greatest extent possible.
- D. Adhesive: Type recommended by panel manufacturer.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Verify existing conditions and substrate flatness before starting work.
- B. Verify that substrate surfaces for adhered items are clean and smooth.
  1. Test painted or wall covering surfaces for adhesion in inconspicuous area, as recommended by manufacturer.
- C. Start of installation constitutes acceptance of project conditions.

#### **3.02 INSTALLATION**

- A. Install panels in accordance with manufacturer's instructions.
- B. Apply adhesive to back side of panel using trowel recommended by adhesive manufacturer.
- C. Apply panels to wall with vertical joints plumb and horizontal joints level and pattern aligned with adjoining panels.
- D. Using a roller, apply pressure to panel face to ensure proper adhesion between surfaces.
- E. Install panels with manufacturer's recommended gaps for panel field and corner joints.
- F. Install trim with adhesive.

#### **3.03 ADJUSTING**

- A. Replace paneling installed out of plumb and/or not aligned with adjacent panels or construction.

#### **3.04 CLEANING**

- A. See Section 017000 - Execution and Closeout Requirements for additional requirements.
- B. Clean panel faces using cleaning agents and methods recommended by manufacturer to remove soiling.

#### **3.05 PROTECTION**

- A. Protect installed interior wall paneling from subsequent construction operations.

**END OF SECTION**

**SECTION 098430  
SOUND-ABSORBING WALL AND CEILING UNITS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Sound-absorbing panels.
- B. Sound-absorbing ceiling clouds.
- C. Mounting accessories.

**1.02 RELATED REQUIREMENTS**

- A. Section 099123 - Interior Painting.

**1.03 REFERENCE STANDARDS**

- A. ASTM C423 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method; 2023.
- B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023b.
- C. ASTM E795 - Standard Practices for Mounting Test Specimens During Sound Absorption Tests; 2023.

**1.04 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's printed data sheets for products specified.
- C. Shop Drawings: Fabrication and installation details, panel layout, and fabric orientation.
- D. Verification Samples: Fabricated samples of each type of panel specified; 12 by 12 inch, showing construction, edge details, and fabric covering.
- E. Test Reports: Certified test data from an independent test agency verifying that panels meet specified requirements for acoustical and fire performance.
- F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 016000 - Product Requirements, for additional provisions.
  - 2. Extra Panels: Quantity equal to 5 percent of total installed, but not less than one of each type.

**1.05 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company with not less than five years of experience in manufacturing acoustical products similar to those specified.

**1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Protect acoustical units from moisture during shipment, storage, and handling. Deliver in factory-wrapped bundles; do not open bundles until units are needed for installation.
- B. Store units flat, in dry, well-ventilated space; do not stand on end.
- C. Protect edges from damage.

**PART 2 PRODUCTS**

**2.01 FABRIC-COVERED SOUND-ABSORBING UNITS**

- A. Manufacturers:
  - 1. Basis of Design: Filzfelt Index Linear.
  - 2. Basis of Design: Turf Design Swell.
  - 3. Basis of Design: Turf Design Switchblade Classic
  - 4. Substitutions: See Section 016000 - Product Requirements.
- B. Sound Absorbing Units: Prefinished, factory assembled fabric panels.
  - 1. Surface Burning Characteristics: Flame spread index of 25 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.
- C. Fabric Acoustical Panels for Walls (SAP-1 thru SAP-3): Filzfelt Index Linear
  - 1. Noise Reduction Coefficient (NRC): .50 when tested in accordance with ASTM C423 for Type I mounting, per ASTM E795.
  - 2. Panel Thickness: 1/4 - 5/16 inches.

3. Fabric: 100% Wool Design Felt.
  4. Color: See Finish Schedule.
  5. Patterns: Where fabric with directional or repeating patterns or fabric with directional weave is used, mark for installation in same direction.
- D. Acoustical Ceiling Diffusers:
1. Noise Reduction Coefficient (NRC): .1 when tested in accordance with ASTM C423 for Type I mounting, per ASTM E795.
  2. Thickness: As required to meet required acoustical performance.
  3. Size: 4' X 4'
  4. Finish: Painted - See Finish Schedule.
  5. Color: See Finish Schedule.
- E. Acoustical Wall Diffusers (SAP-4): Unika Vaev Scalla Wall Panel.
1. Construction: 100% Polyester.
  2. Size: See Drawings.
  3. Profile: Concave.
  4. NRC: .80.
  5. Color: As indicated on Finish Schedule.
  6. Mounting: Concealed brackets, wall mounted.

## **2.02 FABRICATION**

- A. Fabric Wrapped, General: Fabricate panels to sizes and configurations as indicated, with fabric facing installed without sagging, wrinkles, blisters, or visible seams.
1. Where radiused or mitered corners are indicated, install fabric to avoid seams or gathering of material.
- B. Tolerances: Fabricate to finished tolerance of plus or minus 1/16 inch for thickness, overall length and width, and squareness from corner to corner.
- C. Factory-applied finishes on wood veneer panels to be uniform, smooth, and without blemishes.

## **2.03 ACCESSORIES**

- A. Ceiling-Suspended Accessories: Manufacturer's standard accessories at locations indicated on each acoustical unit, sized appropriately for weight of acoustical unit.
- B. Fixing Clips: Manufacturer's standard for application as indicated.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Examine substrates for conditions detrimental to installation of acoustical units. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.02 INSTALLATION**

- A. Install acoustical units in locations indicated, following manufacturer's installation instructions.
- B. Align panels accurately, with edges plumb and top edges level. Scribe to fit accurately at adjoining work and penetrations.
- C. Suspend ceiling clouds at locations and heights indicated.
- D. Install acoustical units to construction tolerances of plus or minus 1/16 inch for the following:
1. Plumb and level.
  2. Flatness.
  3. Width of joints.

### **3.03 CLEANING**

- A. Clean fabric facing upon completion of installation from dust and other foreign materials, following manufacturer's instructions.

### **3.04 PROTECTION**

- A. Provide protection of installed acoustical panels until completion of the work.
- B. Replace panels that cannot be cleaned and repaired to satisfaction of the Architect.

**END OF SECTION**

**SECTION 099000  
PAINTING AND COATING**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Surface preparation.
- B. Field application of paints.
- C. Scope: Finish all interior and exterior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated, including the following:
  - 1. Exposed surfaces of steel lintels and ledge angles.
  - 2. Mechanical and Electrical:
    - a. In finished areas, paint all insulated and exposed pipes, unless otherwise indicated.
- D. Do Not Paint or Finish the Following Items:
  - 1. Items fully factory-finished unless specifically so indicated; materials and products having factory-applied primers are not considered factory finished.
  - 2. Items indicated to receive other finishes.
  - 3. Items indicated to remain unfinished.
  - 4. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.
  - 5. Floors, unless specifically so indicated.
  - 6. Glass.
  - 7. Concealed pipes, ducts, and conduits.

**1.02 RELATED REQUIREMENTS**

- A. Section 055000 - Metal Fabrications: Shop-primed items.

**1.03 REFERENCE STANDARDS**

- A. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications; 2024.
- B. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials; 2020.

**1.04 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide complete list of all products to be used, with the following information for each:
  - 1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
  - 2. MPI product number (e.g. MPI #47).
  - 3. Cross-reference to specified paint system(s) product is to be used in; include description of each system.
- C. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches in size, illustrating range of colors available for each finishing product specified.
  - 1. Where sheen is specified, submit samples in only that sheen.
- D. Samples: Submit two painted samples, illustrating selected colors and textures for each color and system selected with specified coats cascaded. Submit on aluminum sheet, 4 x 8 inch in size.
- E. Manufacturer's Instructions: Indicate special surface preparation procedures.
- F. Maintenance Data: Submit data on cleaning, touch-up, and repair of painted and coated surfaces.

**1.05 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum three years documented experience.

**1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.



- B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

### **1.07 FIELD CONDITIONS**

- A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.
- B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
- C. Do not apply exterior coatings during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.
- D. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Provide all paint and coating products used in any individual system from the same manufacturer; no exceptions.
- B. Paints:
  1. Diamond Vogel Paints: [www.diamondvogel.com/#sle](http://www.diamondvogel.com/#sle).
  2. Duron, Inc: [www.duron.com/#sle](http://www.duron.com/#sle).
  3. Glidden Professional, a product of PPG Architectural Coatings: [www.gliddenprofessional.com](http://www.gliddenprofessional.com).
  4. Benjamin Moore & Co: [www.benjaminmoore.com/#sle](http://www.benjaminmoore.com/#sle).
  5. PPG Paints: [www.ppgpaints.com/#sle](http://www.ppgpaints.com/#sle).
  6. Pratt & Lambert Paints: [www.prattandlambert.com/#sle](http://www.prattandlambert.com/#sle).
  7. Sherwin-Williams Company: [www.sherwin-williams.com/#sle](http://www.sherwin-williams.com/#sle).
- C. Primer Sealers: Same manufacturer as top coats.
- D. Block Fillers: Same manufacturer as top coats.
- E. Substitutions: See Section 016000 - Product Requirements.

### **2.02 PAINTS AND COATINGS - GENERAL**

- A. Paints and Coatings: Ready mixed, unless intended to be a field-catalyzed coating.
  1. Provide paints and coatings of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
  2. Supply each coating material in quantity required to complete entire project's work from a single production run.
  3. Do not reduce, thin, or dilute coatings or add materials to coatings unless such procedure is specifically described in manufacturer's product instructions.
- B. Primers: As follows unless other primer is required or recommended by manufacturer of top coats; where the manufacturer offers options on primers for a particular substrate, use primer categorized as "best" by the manufacturer.
- C. Flammability: Comply with applicable code for surface burning characteristics.
- D. Colors: To be selected from manufacturer's full range of available colors.
  1. In finished areas, finish pipes, ducts, conduit, and equipment the same color as the wall/ceiling they are mounted on/under.

### **2.03 PAINT SYSTEMS - EXTERIOR**

- A. Paint ME-OP-2A - Ferrous Metals, Primed, Alkyd, 2 Coat:
  1. Touch-up with rust-inhibitive primer recommended by top coat manufacturer.
  2. Semi-gloss: Two coats of alkyd enamel; Devoe's DevGuard Semi-Gloss Alkyd 4306-xxxx.

### **2.04 PAINT SYSTEMS - INTERIOR**

- A. Paint I-OP-DF - Dry Fall: Metals; exposed structure and overhead-mounted services in utilitarian spaces, including shop primed steel deck.

1. Shop primer by others.
  2. Intermediate Coat: same as finish.
  3. Top Coat: Waterborne Flat Dryfall: P&L Industrial Waterborne Flat Dryfall Z5900
  4. Flat: MPI gloss level 1; use this sheen at all locations.
- B. Paint WI-OP-3L - Wood, Opaque, Institutional Low-Odor/VOC Latex System MPI INT 6.4R, 3 Coat:
1. Prime Coat: Primer Latex, for interior wood, MPI #39.
  2. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
  3. Topcoat: Latex, interior, institutional low odor/VOC, flat (MPI Gloss Level 1), MPI #143 and Latex, interior, institutional low odor/VOC, eggshell (Gloss Level 2), MPI #144.
- C. Paint CI-OP-3L - Concrete/Masonry, Opaque, Latex, 3 Coat:
1. One coat of block filler, latex, interior/exterior, MPI #4.
  2. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
  3. Topcoat: Latex, interior, institutional low odor/VOC, eggshell (MPI Level 2), MPI #144.
- D. Paint MI-OP-2A - Ferrous Metals, Primed, Alkyd, 2 Coat:
1. Touch-up with alkyd primer.
  2. Semi-gloss: Two coats of alkyd enamel; P&L Pro-Hide Gold Interior Alkyd Semi-Gloss S889xseries.
- E. Paint MGI-OP-3A - Galvanized Metals, Water-based light industrial coating over waterborne primer system MPI INT 5.3K, 3 Coat:
1. Prime Coat: Latex, fire-retardant, matching topcoat.
  2. Intermediate Coat: Light industrial coating, interior, water based, matching topcoat.
  3. Topcoat: Light industrial coating, interior, water based, semi-gloss (Gloss level 5), MPI #153.
- F. Paint GI-OP-3L - Gypsum Board/Plaster, Latex, 3 Coat:
1. Prime Coat: Primer sealer, interior, institutional low odor/VOC, MPI #149.
  2. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
  3. Topcoat: Latex, interior, institutional low odor/VOC, flat (MPI Gloss Level 1), MPI #143; Latex, interior, institutional low odor/VOC, (Gloss Level 2), MPI #144 and Latex, interior, institutional low odor/VOC, gloss (MPI Gloss Level 6), MPI #148.

## **2.05 ACCESSORY MATERIALS**

- A. Accessory Materials: Provide all primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials required to achieve the finishes specified whether specifically indicated or not; commercial quality.
- B. Patching Material: Latex filler.
- C. Fastener Head Cover Material: Latex filler.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Do not begin application of coatings until substrates have been properly prepared.
- B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
- C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.
- D. Test shop-applied primer for compatibility with subsequent cover materials.
- E. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
  1. Gypsum Wallboard: 12 percent.
  2. Masonry, Concrete, and Concrete Unit Masonry: 12 percent.
  3. Interior Wood: 15 percent, measured in accordance with ASTM D4442.

### **3.02 PREPARATION**

- A. Clean surfaces thoroughly and correct defects prior to coating application.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

- C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.
- D. Seal surfaces that might cause bleed through or staining of topcoat.
- E. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
- F. Concrete and Unit Masonry Surfaces to be Painted: Remove dirt, loose mortar, scale, salt or alkali powder, and other foreign matter. Remove oil and grease with a solution of tri-sodium phosphate; rinse well and allow to dry. Remove stains caused by weathering of corroding metals with a solution of sodium metasilicate after thoroughly wetting with water. Allow to dry.
- G. Gypsum Board Surfaces to be Painted: Fill minor defects with filler compound. Spot prime defects after repair.
- H. Galvanized Surfaces to be Painted: Remove surface contamination and oils and wash with solvent. Apply coat of etching primer.
- I. Corroded Steel and Iron Surfaces to be Painted: Prepare using at least SSPC-SP 2 (hand tool cleaning) or SSPC-SP 3 (power tool cleaning) followed by SSPC-SP 1 (solvent cleaning).
- J. Uncorroded Uncoated Steel and Iron Surfaces to be Painted: Remove grease, mill scale, weld splatter, dirt, and rust. Where heavy coatings of scale are evident, remove by hand wire brushing or sandblasting; clean by washing with solvent. Apply a treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned. Prime paint entire surface; spot prime after repairs.
- K. Shop-Primed Steel Surfaces to be Finish Painted: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.

### **3.03 APPLICATION**

- A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
- B. Apply products in accordance with manufacturer's instructions.
- C. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- D. Apply each coat to uniform appearance.
- E. Sand metal surfaces lightly between coats to achieve required finish.
- F. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- G. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

### **3.04 CLEANING**

- A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

### **3.05 PROTECTION**

- A. Protect finished coatings until completion of project.
- B. Touch-up damaged coatings after Substantial Completion.

**END OF SECTION**

**SECTION 099600  
HIGH-PERFORMANCE COATINGS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. High performance coatings.
- B. Surface preparation.

**1.02 REFERENCE STANDARDS**

- A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023b.
- B. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition.
- C. SSPC V1 (PM1) - Good Painting Practice: Painting Manual Volume 1; 2016.
- D. SSPC V2 (PM2) - Systems and Specifications: Steel Structures Painting Manual Volume 2; 2021.
- E. SSPC-PA 1 - Shop, Field, and Maintenance Coating of Metals; 2016.
- F. SSPC-PA 2 - Procedure for Determining Conformance to Dry Coating Thickness Requirements; 2022.
- G. SSPC-SP 1 - Solvent Cleaning; 2015, with Editorial Revision (2016).

**1.03 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide complete list of all products to be used, with the following information for each:
  - 1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
  - 2. MPI product number (e.g. MPI #47).
  - 3. Cross-reference to specified coating system(s) product is to be used in; include description of each system.
  - 4. Manufacturer's installation instructions.
- C. Samples: Submit two samples 8 by 8 inch in size illustrating colors available for selection.
- D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- E. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.
- F. Maintenance Data: Include cleaning procedures and repair and patching techniques.
- G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 016000 - Product Requirements, for additional provisions.
  - 2. Extra Coating Materials: 5 gallons of each color of top coat.
  - 3. Label each container with manufacturer's name, product number, color number, and room names and numbers where used.

**1.04 QUALITY ASSURANCE**

- A. Maintain one copy of each referenced document that applies to application on site.
- B. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum five years documented experience.

**1.05 MOCK-UPS**

- A. See Section 014000 - Quality Requirements for general requirements for mock-ups.
- B. Provide mock-up , 4 feet long by 1 feet wide, illustrating coating and color , for each specified coating.
- C. Locate where directed.
- D. Mock-up may remain as part of the work.

**1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
- B. Container Label: Include manufacturer's name, type of coating, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and

instructions for mixing and reducing.

- C. Coating Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

### **1.07 FIELD CONDITIONS**

- A. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
- B. Do not apply exterior coatings during rain or snow, or when relative humidity is outside the humidity ranges required by the coating product manufacturer.
- C. Do not install materials when temperature is below 55 degrees F or above 90 degrees F.
- D. Maintain this temperature range, 24 hours before, during, and 72 hours after installation of coating.
- E. Restrict traffic from area where coating is being applied or is curing.

### **1.08 WARRANTY**

- A. See Section 017800 - Closeout Submittals for additional warranty requirements.
- B. Correct defective Work within a five year period after Date of Substantial Completion.
- C. Warranty: Include coverage for bond to substrate.

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Provide high performance coating products from the same manufacturer to the greatest extent possible.
- B. High-Performance Coatings: Basis of Design: PPG Paints.
  - 1. Sherwin-Williams Company: [www.protective.sherwin-williams.com/industries/#sle](http://www.protective.sherwin-williams.com/industries/#sle).
  - 2. Tnemec Company, Inc: [www.tnemec.com/#sle](http://www.tnemec.com/#sle).
  - 3. Substitutions: Section 016000 - Product Requirements.

### **2.02 HIGH-PERFORMANCE COATINGS**

- A. Provide coating systems that meet the following minimum performance criteria, unless more stringent criteria are specified:
  - 1. Surface Burning Characteristics: Flame spread/Smoke developed index of 0/0, maximum, when tested in accordance with ASTM E84.
  - 2. Lead Content: None.

### **2.03 FINISH COAT MATERIALS**

- A. Coatings - General: Provide complete multi-coat systems formulated and recommended by manufacturer for the applications indicated, in the thicknesses indicated; number of coats specified does not include primer or filler coat.
- B. Urethane Coating:
  - 1. Finish Coat System: One coat urethane over two coats epoxy.
    - a. Prime Coat: Two-component, high solids epoxy coating.
      - 1) Basis of Design: PPG Amerlock 2/400 AK2-3 Series.
      - 2) Application: 4-8 mils DFT.
    - b. Intermediate Coat: Same as Prime
    - c. Finish Coat: Two-component, gloss acrylic aliphatic urethane.
      - 1) Basis of Design: PPG Pitthane Ultra Gloss Urethane 95-812/95-819.
      - 2) Application: 4 mils DFT.

### **2.04 ACCESSORY MATERIALS**

- A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of coated surfaces.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify existing conditions before starting work.
- B. Do not begin application of coatings until substrates have been properly prepared.

- C. Verify that substrate surfaces are ready to receive work as instructed by the coating manufacturer. Obtain and follow manufacturer's instructions for examination and testing of substrates.
- D. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.
- E. Test shop-applied primer for compatibility with subsequent cover materials.
- F. Proceed with coating application only after unacceptable conditions have been corrected.
  - 1. Commencing coating application constitutes Contractor's acceptance of substrates and conditions.

### **3.02 PREPARATION**

- A. Protect adjacent surfaces and materials not receiving coating from spatter and overspray; mask if necessary to provide adequate protection. Repair damage.
- B. Clean surfaces of loose foreign matter.
- C. Remove substances that would bleed through finished coatings. If unremovable, seal surface with shellac.
- D. Remove finish hardware, fixture covers, and accessories and store.
- E. Ferrous Metal:
  - 1. Solvent clean according to SSPC-SP 1.
  - 2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces.

### **3.03 COATING APPLICATION**

- A. Apply coatings in accordance with manufacturer's written instructions, to thicknesses specified and recommendations in MPI - Architectural Painting and Specification Manual.
- B. Apply in uniform thickness coats, without runs, drips, pinholes, brush marks, or variations in color, texture, or finish. Finish edges, crevices, corners, and other changes in dimension with full coating thickness.

### **3.04 CLEANING**

- A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.
- B. Clean surfaces immediately of overspray, splatter, and excess material.
- C. After coating has cured, clean and replace finish hardware, fixtures, and fittings previously removed.

### **3.05 PROTECTION**

- A. Protect finished work from damage.

**END OF SECTION**

**SECTION 101100  
VISUAL DISPLAY UNITS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Markerboards.

**1.02 RELATED REQUIREMENTS**

- A. Section 061000 - Rough Carpentry: Blocking and supports.
- B. Section 09 2116 - Gypsum Board Assemblies: Concealed supports in metal stud walls.

**1.03 REFERENCE STANDARDS**

- A. ANSI A208.1 - American National Standard for Particleboard; 2022.
- B. ASTM A424/A424M - Standard Specification for Steel, Sheet, for Porcelain Enameling; 2018.
- C. ASTM F793/F793M - Standard Classification of Wall Coverings by Use Characteristics; 2020.

**1.04 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's data on chalkboard, markerboard, tackboard, tackboard surface covering, trim, and accessories.
- C. Shop Drawings: Indicate wall elevations, dimensions, joint locations , special anchor details.
- D. Samples: Submit color charts for selection of color and texture of markerboard, tackboard, tackboard surface covering, and trim.
- E. Manufacturer's printed installation instructions.
- F. Maintenance Data: Include data on regular cleaning, stain removal .

**1.05 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

**1.06 WARRANTY**

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. Provide five year warranty for markerboard to include warranty against discoloration due to cleaning, crazing or cracking, and staining.

**1.07 MANUFACTURERS**

- A. Visual Display Boards: Basis of Design: Steelcase Edge Series
  - 1. MooreCo, Inc: [www.moorecoinc.com](http://www.moorecoinc.com).
  - 2. Claridge Products and Equipment, Inc: [www.claridgeproducts.com](http://www.claridgeproducts.com).
  - 3. Polyvision Corporation (Nelson Adams): [www.polyvision.com](http://www.polyvision.com).
  - 4. Substitutions: See Section 016000 - Product Requirements.

**1.08 VISUAL DISPLAY BOARDS**

- A. Markerboards: Porcelain enamel on steel, laminated to core.
  - 1. Color: White.
  - 2. Steel Face Sheet Thickness: 24 gage, 0.0239 inch .
  - 3. Core: Particleboard, manufacturer's standard thickness, laminated to face sheet.
  - 4. Backing: Aluminum foil, laminated to core.
  - 5. Size: As indicated on drawings.
  - 6. Frame: Extruded aluminum , with concealed fasteners.
  - 7. Frame Finish: Anodized, natural.
  - 8. Accessories: Provide chalk tray and map rail.
  - 9. Provide Staff lines at Music rooms and court/field lines at Athletic rooms.

**1.09 MATERIALS**

- A. Porcelain Enameled Steel Sheet: ASTM A424/A424M, Type I, Commercial Steel, with fired-on vitreous finish.
- B. Vinyl Coated Fabric: ASTM F793 Category VI.
- C. Particleboard: ANSI A208.1; wood chips, set with waterproof resin binder, sanded faces.

- D. Foil Backing: Aluminum foil sheet, 0.005 inch thick.

#### **1.10 ACCESSORIES**

- A. Map Rail: Extruded aluminum, manufacturer's standard profile, with cork insert and runners for accessories; 1 inch wide overall , full width of frame.
- B. Temporary Protective Cover: Sheet polyethylene, 8 mil thick.
- C. Chalk Tray: Aluminum, manufacturer's standard profile, one piece full length of chalkboard, molded ends, concealed fasteners, same finish as frame.
- D. Mounting Brackets: Concealed.

### **PART 3 EXECUTION**

#### **2.01 EXAMINATION**

- A. Verify that field measurements are as indicated.
- B. Verify that internal wall blocking is ready to receive work and positioning dimensions are as indicated on shop drawings.

#### **2.02 PREPARATION**

- A. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

#### **2.03 INSTALLATION**

- A. Install boards in accordance with manufacturer's instructions.
- B. Secure units level and plumb.

#### **2.04 CLEANING**

- A. Clean board surfaces in accordance with manufacturer's instructions.
- B. Cover with protective cover, taped to frame.
- C. Remove temporary protective cover at Date of Substantial Completion.



## **SECTION 101400 SIGNAGE**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Room and door signs.
- B. Building identification signs.
- C. Illuminated site signage.

#### **1.02 REFERENCE STANDARDS**

- A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines; current edition.
- B. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.
- C. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

#### **1.03 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's printed product literature for each type of sign, indicating sign styles, font, foreground and background colors, locations, overall dimensions of each sign.
- C. Signage Schedule: Provide information sufficient to completely define each sign for fabrication, including room number, room name, other text to be applied, sign and letter sizes, fonts, and colors.
  - 1. When room numbers to appear on signs differ from those on the drawings, include the drawing room number on schedule.
  - 2. When content of signs is indicated to be determined later, request such information from Owner through Architect at least 2 months prior to start of fabrication; upon request, submit preliminary schedule.
  - 3. Submit for approval by Owner through Architect prior to fabrication.
- D. Samples: Submit two samples of each type of sign, of size similar to that required for project, illustrating sign style, font, and method of attachment.
- E. Selection Samples: Where colors are not specified, submit two sets of color selection charts or chips.
- F. Manufacturer's Installation Instructions: Include installation templates and attachment devices.
- G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

#### **1.04 DELIVERY, STORAGE, AND HANDLING**

- A. Package signs as required to prevent damage before installation.
- B. Package room and door signs in sequential order of installation, labeled by floor or building.
- C. Store tape adhesive at normal room temperature.

#### **1.05 FIELD CONDITIONS**

- A. Do not install tape adhesive when ambient temperature is lower than recommended by manufacturer.
- B. Maintain this minimum temperature during and after installation of signs.

### **PART 2 PRODUCTS**

#### **2.01 MANUFACTURERS**

- A. Flat Signs: Basis of Design: Inpro corporation Aspen Collection with back plate.
  - 1. Best Sign Systems, Inc: [www.bestsigns.com/#sle](http://www.bestsigns.com/#sle).
  - 2. Cosco Industries (ADA signs): [www.coscoarchitecturalsigns.com/#sle](http://www.coscoarchitecturalsigns.com/#sle).
  - 3. Inpro; Aspen: [www.inprocorp.com](http://www.inprocorp.com).
  - 4. Substitutions: See Section 016000 - Product Requirements.
- B. Dimensional Letter Signs:
  - 1. Cosco Industries; Cast Aluminum: [www.coscoarchitecturalsigns.com/#sle](http://www.coscoarchitecturalsigns.com/#sle).
  - 2. Inpro: [www.inprocorp.com](http://www.inprocorp.com).
  - 3. Substitutions: See Section 016000 - Product Requirements.

## **2.02 SIGNAGE APPLICATIONS**

- A. Accessibility Compliance: Signs are required to comply with ADA Standards and ICC A117.1 and applicable building codes, unless otherwise indicated; in the event of conflicting requirements, comply with the most comprehensive and specific requirements.
- B. Room and Door Signs: Provide a sign for every doorway, whether it has a door or not, not including corridors, lobbies, and similar open areas.
  - 1. Sign Type: Flat signs with engraved panel media as specified.
  - 2. Provide "tactile" signage, with letters raised minimum 1/32 inch and Grade II braille.
  - 3. Character Height: 1 inch.
  - 4. Sign Height: 2 inches, unless otherwise indicated.
  - 5. Office Doors: Identify with room numbers to be determined later, not the numbers shown on the drawings ; in addition, provide "window" section for replaceable occupant name.
  - 6. Conference and Meeting Rooms: Identify with room numbers to be determined later, not the numbers shown on the drawings; in addition, provide "window" section with sliding "In Use/Vacant" indicator.
  - 7. Rest Rooms: Identify with pictograms, the names "MEN" and "WOMEN", room numbers to be determined later, and braille.
  - 8. Provide blank back panels for signs mounted to glass.
- C. Building Identification Signs:
  - 1. Use individual metal letters.
  - 2. Mount on outside wall in location shown on drawings.

## **2.03 SIGN TYPES**

- A. Flat Signs: Signage media in aluminum frame.
  - 1. Corners: Square.
  - 2. Frame Finish: Natural (clear) anodized.
  - 3. Wall Mounting of One-Sided Signs: Tape adhesive.
- B. Color and Font: Unless otherwise indicated:
  - 1. Character Font: Helvetica, Arial, or other sans serif font.
  - 2. Character Case: Upper case only.
  - 3. Background Color: To be selected from manufacturers full range of colors.
  - 4. Character Color: Contrasting color.

## **2.04 TACTILE SIGNAGE MEDIA**

- A. Applied Character Panels: Acrylic plastic base, with applied acrylic plastic letters and braille.
  - 1. Total Thickness: 1/8 inch.
  - 2. Letter Thickness: 1/8 inch.
  - 3. Letter Edges: Square.

## **2.05 DIMENSIONAL LETTERS**

- A. Metal Letters:
  - 1. Metal: Aluminum casting.
  - 2. Finish: Brushed, satin.
  - 3. Mounting: Concealed screws.

## **2.06 ACCESSORIES**

- A. Concealed Screws: Stainless steel, galvanized steel, chrome plated, or other non-corroding metal.
- B. Tape Adhesive: Double sided tape, permanent adhesive.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that substrate surfaces are ready to receive work.

### **3.02 INSTALLATION**

- A. Install in accordance with manufacturer's instructions.
- B. Install neatly, with horizontal edges level.

- C. Locate signs where indicated:
  - 1. Room and Door Signs: Locate on wall at latch side of door with centerline of sign at 60 inches above finished floor.
  - 2. If no location is indicated obtain Owner's instructions.
- D. Protect from damage until Substantial Completion; repair or replace damage items.

**END OF SECTION**

**SECTION 102113.17  
PHENOLIC TOILET COMPARTMENTS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Phenolic toilet compartments.
- B. Urinal and vestibule screens.

**1.02 RELATED REQUIREMENTS**

- A. Section 061000 - Rough Carpentry: Blocking and supports.
- B. Section 102800 - Toilet, Bath, and Laundry Accessories.

**1.03 REFERENCE STANDARDS**

- A. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2023.
- B. NFPA 286 - Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth; 2019.

**1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination: Coordinate the work with placement of support framing and anchors in walls and ceilings.

**1.05 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on panel construction, hardware, and accessories.
- C. Shop Drawings: Indicate partition plan, elevation views, dimensions, details of wall supports, door swings.
- D. Samples: Submit two samples of partition panels, 2 by 2 inch in size illustrating panel finish, color, and sheen.
- E. Manufacturer's Installation Instructions: Indicate special procedures.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

- A. Phenolic Toilet Compartments: Basis of Design; Bradley Phenolic Privacy Partitions.
  - 1. Substitutions: Section 016000 - Product Requirements.

**2.02 PHENOLIC TOILET COMPARTMENTS**

- A. Toilet Compartments: Factory fabricated doors, pilasters, and divider panels made of solid phenolic core panels with integral melamine finish, floor-mounted headrail-braced.
  - 1. Color: Graphite 837.
- B. Doors:
  - 1. Thickness: 3/4 inch.
  - 2. Width: 24 inch.
  - 3. Width for Handicapped Use: 36 inch, out-swinging.
  - 4. Height: 58 inch.
- C. Panels:
  - 1. Thickness: 1/2 inch.
  - 2. Height: 58 inch.
  - 3. Depth: As indicated on drawings.
- D. Pilasters:
  - 1. Thickness: 3/4 inch.
  - 2. Width: As required to fit space; minimum 3 inch.
- E. Screens: Without doors; to match compartments; mounted to wall with two panel brackets with vertical support/bracing same as compartments.

### **2.03 ACCESSORIES**

- A. Pilaster Shoes: Formed ASTM A666 Type 304 stainless steel with No. 4 finish, 3 inch high, concealing floor fastenings.
  - 1. Provide adjustment for floor variations with screw jack through steel saddles integral with pilaster.
- B. Head Rails: Hollow anodized aluminum, 1 inch by 1-1/2 inch size, with anti-grip profile and cast socket wall brackets.
- C. Attachments, Screws, and Bolts: Stainless steel , tamper proof type.
  - 1. For attaching panels and pilasters to brackets: Through-bolts and nuts ; tamper proof.
- D. Hardware: Polished stainless steel:
  - 1. Pivot hinges, gravity type, adjustable for door close positioning; two per door.
  - 2. Door Latch: Slide type with exterior emergency access feature.
  - 3. Door strike and keeper with rubber bumper; mounted on pilaster in alignment with door latch.
  - 4. Coat hook with rubber bumper; one per compartment, mounted on door.
  - 5. Provide door pull for outswinging doors.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Verify that field measurements are as indicated.
- B. Verify correct spacing of and between plumbing fixtures.
- C. Verify correct location of built-in framing, anchorage, and bracing.

#### **3.02 INSTALLATION**

- A. Install partitions secure, rigid, plumb, and level in accordance with manufacturer's instructions.
- B. Maintain 3/8 inch to 1/2 inch space between wall and panels and between wall and end pilasters.
- C. Attach panel brackets securely to walls using anchor devices.
- D. Attach panels and pilasters to brackets. Locate head rail joints at pilaster center lines.
- E. Field touch-up of scratches or damaged finish will not be permitted. Replace damaged or scratched materials with new materials.

#### **3.03 TOLERANCES**

- A. Maximum Variation From True Position: 1/4 inch.
- B. Maximum Variation From Plumb: 1/8 inch.

#### **3.04 ADJUSTING**

- A. Adjust and align hardware to uniform clearance at vertical edge of doors, not exceeding 3/16 inch.
- B. Adjust hinges to position doors in partial opening position when unlatched. Return out-swinging doors to closed position.
- C. Adjust adjacent components for consistency of line or plane.

**END OF SECTION**

**SECTION 102123  
CUBICLE CURTAINS AND TRACK**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Suspended overhead curtain track and guides.
- B. Surface mounted overhead metal curtain track and guides.
- C. Curtains.

**1.02 RELATED REQUIREMENTS**

- A. Section 061000 - Rough Carpentry: Blocking and supports for track.
- B. Section 095100 - Acoustical Ceilings: Suspended ceiling system to support track.

**1.03 REFERENCE STANDARDS**

- A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023b.
- B. NFPA 701 - Standard Methods of Fire Tests for Flame Propagation of Textiles and Films; 2023, with Errata.

**1.04 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data for curtain fabric characteristics.
- C. Shop Drawings: Indicate a reflected ceiling plan view of curtain track, hangers and suspension points, attachment details, schedule of curtain sizes.
- D. Samples: Submit 12 by 12 inch sample patch of curtain cloth with representative top, bottom, and edge hem stitch detail, heading with reinforcement, bottom weight, and carrier attachment to curtain header.
- E. Samples: Submit 12 inch sample length of curtain track including typical splice, wall and ceiling hanger, and escutcheon.
- F. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention.
- G. Maintenance Data: Include recommended cleaning methods and materials and stain removal methods.
- H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 016000 - Product Requirements, for additional provisions.
  - 2. Extra Carriers: Ten.

**1.05 DELIVERY, STORAGE, AND HANDLING**

- A. Accept curtain materials on site and inspect for damage.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

- A. Cubicle Track and Curtains:
  - 1. C/S General Cubicle: [www.c-sgroup.com/cubicle-track-curtains/#sle](http://www.c-sgroup.com/cubicle-track-curtains/#sle).
  - 2. Inpro: [www.inprocorp.com/#sle](http://www.inprocorp.com/#sle).
  - 3. Substitutions: See Section 016000 - Product Requirements.

**2.02 TRACKS AND TRACK COMPONENTS**

- A. Track: Extruded aluminum sections; one piece per cubicle track run; 1/2"H x 5/8"W profile.
  - 1. Structural Performance: Capable of supporting vertical test load of 50 lbs without visible deflection of track or damage to supports, safely supporting moving loads, and sufficiently rigid to resist visible deflection and without permanent set.
  - 2. Track End Stop, Tees, Y's, and Switches: To fit track section.
  - 3. Track Bends: Minimum 12 inch radius; fabricated without deformation of track section or impeding movement of carriers.
  - 4. Suspension Rods: Tubular Aluminum sections, sized to support design loads and designed to receive attachment from track and ceiling support.
  - 5. Escutcheons to Suspension Rods: Aluminum.

6. Finish on Exposed Surfaces: White enamel finish.
7. Products:
  - a. Traditional Track 6062 by C/S.
  - b. Substitutions: See Section 016000 - Product Requirements.
- B. Curtain Carriers: Nylon slider to accurately fit track; designed to eliminate bind when curtain is pulled; fitted to curtain to prevent accidental curtain removal; 2.2 carriers per foot of track length.
- C. Installation Accessories: Types required for specified mounting method and substrate conditions.

## **2.03 CURTAINS**

- A. Curtain Materials:
  1. Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.
  2. Naturally flame resistant or flameproofed; capable of passing NFPA 701 test.
  3. Curtain: Close weave polyester; anti-bacterial, self deodorizing, sanitized, and preshrunk.
  4. Open Mesh Cloth: Open weave to permit air circulation; flameproof material, same color as curtain.
  5. Products:
    - a. Spunk by Inpro.
    - b. Substitutions: See Section 016000 - Product Requirements.
- B. Curtain Fabrication:
  1. Manufacture curtains of one piece, sized 10 percent wider than track length. Terminate curtain 15 inches from floor.
  2. Length of curtain to end 15 inches above finished floor.
  3. Include open mesh cloth at top 20 inches of curtain for room air circulation.
  4. Curtain Heading: Fabric band matching curtain panel with metal grommet holes for carriers spaced 6 inches on center.
  5. Seams and Hems: Manufacturer's standard fabrication method for securely sewn and finished seams and hems.
  6. Curtain Heading: Triple thickness 2 inches wide, with stitched button holes for carriers 6 inches on center, double fold bottom hem 2 inches wide with lead weights included. Lock stitch seams in two rows. Turn seam edges and lock stitch.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that surfaces and supports above ceiling are ready to receive work of this Section.
- B. Verify that field measurements are as indicated.

### **3.02 INSTALLATION**

- A. Install curtain track to be secure, rigid, and true to ceiling line.
- B. Install end cap and stop device.
- C. Secure track to ceiling system.
- D. Install curtains on carriers ensuring smooth operation.

**END OF SECTION**

**SECTION 102241  
OPERABLE GLASS PARTITIONS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Operable glass partitions, manually operated.

**1.02 RELATED REQUIREMENTS**

- A. Section 087100 - Door Hardware: Mortise cylinders.

**1.03 REFERENCE STANDARDS**

- A. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.
- B. ASTM C1036 - Standard Specification for Flat Glass; 2021.
- C. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2018.
- D. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.

**1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Preinstallation Meeting: Convene at project site seven calendar days prior to scheduled beginning of construction activities of this section to review section requirements.
  - 1. Require attendance by representatives of installer.

**1.05 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's descriptive literature for each component in partition assembly.
- C. Design Data: Design calculations, bearing seal and signature of structural engineer licensed to practice in the State in which the Project is located, showing loads at points of attachment to the building structure.
- D. Shop Drawings: Indicate layout, dimensions, identification of components, and interface with adjacent construction.
  - 1. Include field measurements of openings.
  - 2. Include elevations showing:
    - a. Locations and identification of manufacturer-supplied door hardware and fittings.
    - b. Locations and sizes of cut-outs and drilled holes for other door hardware.
  - 3. Include details of:
    - a. Requirements for support and bracing of overhead track.
    - b. Installation details.
    - c. Appearance of manufacturer-supplied door hardware and fittings.
- E. Verification Samples: Two samples, minimum size 2 by 3 inches, representing actual material and finish of exposed metal.
- F. Certificates: Contractor to certify that installer of partition assemblies meets specified qualifications.
- G. Operation and Maintenance Data: For manufacturer-supplied operating hardware.
- H. Manufacturer's Installation Instructions: Include complete preparation, installation, and cleaning requirements.

**1.06 QUALITY ASSURANCE**

- A. Fabricator Qualifications: Minimum five of experience designing, assembling, and installing partition assemblies similar to those specified in this section.

**1.07 DELIVERY, STORAGE, AND HANDLING**

- A. Store products in manufacturer's unopened packaging until installation.

**1.08 WARRANTY**

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within a two year period after Date of Substantial Completion.



- C. Provide five year manufacturer warranty against excessive degradation of metal finishes. Include provision for replacement of units with excessive fading, chalking, or flaking.

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Operable Glass Partitions: Basis of Design: Modernfold Acousti-Clear.
  - 1. DORMA USA, Inc; Sliding Wall Systems: [www.dorma.com/#sle](http://www.dorma.com/#sle).
  - 2. Moderco, Inc: [www.moderco.com/#sle](http://www.moderco.com/#sle).
  - 3. NanaWall Systems, Inc; Folding Panel System: [www.nanawall.com/#sle](http://www.nanawall.com/#sle).
  - 4. Substitutions: See Section 016000 - Product Requirements.

### **2.02 OPERABLE GLASS PARTITIONS**

- A. Operable Glass Partitions - Framed: Top hung, factory fabricated assemblies consisting of double-glazed framed glass panels in configuration indicated on drawings.
  - 1. Acoustical ratings of panels when tested in accordance with ASTM E90: 51 STC.
  - 2. Frame Finish: RAL Classics powder coating.
  - 3. Tempered Glass Thickness: 3/8 inch.
  - 4. Maximum Support Capacity: Manufacturers standard load with two carriers on each panel.
  - 5. Glass: Clear.
  - 6. Final Clousre: Non-locking Rail Handle.
  - 7. Verticle Seals Between Panels: Extruded aluminum astragals with interlocking convex/concave resilient quad-lip gaskets.
  - 8. Horizontal Top and Bottom Seals: Automatic operable seals providing 7/8 inch operating clearance. Seals shall operate automatically without tools or cranks and shall extend as panels are positioned.
  - 9. Panel hardware finish to match frame.
  - 10. Designed to withstand normal operation without damage, racking, sagging, or deflection.
  - 11. Prepared for all specified hardware whether specified in this section or not.
  - 12. Finished metal surfaces protected with strippable film.
  - 13. Factory assembled to greatest extent practicable; may be disassembled to accommodate shipping constraints.
- B. Overhead Track: Extruded aluminum box track, factory fabricated; corner, intersection, and hanger access fittings to suit partition movement and stacking indicated; track joints reinforced with stainless steel junction plates.
  - 1. Track Suspension System: Provide brackets, hanger rods, and hardware for attachment to structure, with at least 6 inch vertical adjustment range and capable of adjustments without removing panels from tracks.
- C. Operable Panel Hardware:
  - 1. Lever handle with profile cylinder, manufacturer's standard.
- D. Convertible Door Panel Fittings and Hardware:
  - 1. Top and bottom pivots concealed in full width top and bottom rails.
  - 2. Closer mounted in bottom rail.
  - 3. Push/pulls: Finish to match panel frame.
  - 4. Deadbolt mounted in bottom rail.
- E. Other Hardware: Specified in Section 087100.
- F. Acoustic Seals: Provide acoustic seals in accordance with project requirements.

### **2.03 MATERIALS**

- A. Glass: Tempered float glass meeting requirements of ASTM C1036, Type I, Quality Q3, fully tempered in accordance with ASTM C1048, Kind FT, and as follows:
  - 1. Prepare glazing panels for indicated fittings and hardware before tempering.
  - 2. Provide exposed glazing edges with flat polished/ground glass finish.
  - 3. Temper glass materials horizontally; visible tong marks or tong mark distortions are not permitted.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that field measurements are as indicated.
- B. Verify track supports are laterally braced and will permit track to be level within 1/4 inch of required position and parallel to the floor surface.
- C. Verify floor flatness of 1/8 inch in 10 feet, non-cumulative.
- D. Do not begin installation until supports and adjacent substrates have been properly prepared.
- E. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

### **3.02 PREPARATION**

- A. Clean substrates thoroughly prior to installation.
- B. Prepare substrates using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

### **3.03 INSTALLATION**

- A. Install in accordance with track and fitting manufacturer's instructions.
- B. Fit and align partition assembly and pocket doors level and plumb.

### **3.04 ADJUSTING**

- A. Adjust partition to operate smoothly from stacked to fully extended position.

### **3.05 CLEANING**

- A. Thoroughly clean surfaces and materials installed as part of this work.

### **3.06 CLOSEOUT ACTIVITIES**

- A. See Section 017800 - Closeout Submittals, for closeout submittals.
- B. Demonstrate operation of partition and identify potential operational problems.

### **3.07 PROTECTION**

- A. Protect installed products and materials until Date of Substantial Completion.
- B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

**END OF SECTION**

**SECTION 102250  
VERTICAL OPERABLE PARTITION**

**PART 1 – GENERAL**

**1.01 WORK INCLUDED**

- A. Supply and installation of Automatic Vertically Retractable Acoustical Wall(s) as shown on the architectural drawings. All necessary hardware, seals, lifting machinery, electrical controls are included.

**1.02 SYSTEM DESCRIPTION**

A. Definition

1. Automatic Vertically Retractable Acoustical Wall (from here on called Operable Wall) shall refer specifically to acoustical operable walls that, when in the down position (closed) are hard, rigid, flat, plumb walls, made of a grid of rectangular acoustical panels, and when are lifted (opened), fold upward (vertically) without the use of any manual labor, in a manner similar to an accordion, into a pocket in the ceiling, between roof joists, or up between built in bulkheads. In the down (closed) position, the wall shall be comprised of two vertical planes of acoustical panels, separated by an acoustical air space.
2. The operable wall shall open and close in a manner similar to an accordion, in that all wall panels fold and unfold at the exact same time, at the exact same rate.
3. The motor drive assembly is mounted directly above the centre line of the operable wall. Support steel is only required in one location. The size restriction for the system is maximum 36'-0" (10,975mm) long x 9'-0" (2745 mm) to the finished ceiling (or smaller). Minimum wall length is 11'-10" (3605 mm).
4. The operable wall shall be opened and closed, in the standard scenario, using two push button switches wired in series with power controlled by a single, three position key switch, Or, in the optional scenario, using two touch screen operator stations. In the standard, push button scenario, turning the key from the "off" position shall cause the wall to move in the designated direction "up" or "down" once both push buttons are depressed. In the optional, touch screen scenario, pressing and holding the up or down directional arrow symbol on one touch screen while simultaneously pressing and holding the button symbol on the second screen shall cause the wall to move in the selected direction. In both scenarios, when hand pressure is removed, the wall shall immediately stop. The operable wall shall stop in a quick and positive fashion without coasting. As a normal part of the operation, it shall be possible to partially open (or close) the wall, stop it and then reverse the operation. There shall be two (2) switches per operable wall, located on opposite sides of the wall at opposite ends of the wall, wired in series. In the standard condition, one switch shall be equipped with an LED that flashes fault codes in case of a failure with the electrical system. In the optional, touch screen scenario, the screens will display faults in case of a failure with the electrical system.
5. From a fully open position, the operable wall shall be able to go through its entire cycle of closing and/or opening without any manual intervention.
6. When the operable wall is being lowered (closed) it shall come automatically to rest once it has reached the fully down (closed) position.
7. When the operable wall is being lifted (opened) it shall come automatically to rest once it has reached the fully up (open) position.
8. The operable wall shall automatically and acoustically seal against the floor without the need for any manual intervention. The floor seals shall leave a joint between the floor and the bottom acoustical panels of not more than approximately 2" (51 mm).
9. The operable wall shall automatically and acoustically seal against the two end walls without the need for any manual intervention. The end seals shall act in such a way as not to come into contact with the end walls while the operable wall is in motion. The end seals shall leave a joint between the acoustical panels and the end walls of no more than approximately 1" (25 mm). Seals that rub or brush against the end walls are not acceptable. Once the wall reaches the full down position, the end seals shall activate automatically. The key switch does not need to be held during the deployment of the ends seals.

10. The operable wall shall automatically and acoustically seal against the ceiling without any manual intervention. The top seals shall leave a joint between the top acoustical panels and the ceiling of the pocket of not more than approximately 2" (51 mm).
11. The operable wall shall open and close at an average speed of approximately 5 to 10 vertical feet per minute (1.5 to 3 meters per minute).
12. When the operable wall is being lowered (closed), it shall stop if the leading (bottom) edge comes into firm contact with any object between it and the floor. The wall will then automatically reverse its direction and ascend for approximately 3 seconds to clear the object. The regular operation of the wall can resume once the obstruction has been removed.
13. The operable wall shall be visibly flat and rigid in the down (closed) position.
14. There shall be no exposed hinges, brackets, screws, and no part of the mechanical system shall be visible when the operable wall is in the down (closed) position.
15. All of the panel edges shall be right angled, with a minimum radius not more than 1/16" (1.6 mm).
16. All of the panels shall be rectangular, nominally of the same size, unless requested otherwise by the architect.
17. Joints between panel, vertical and horizontal, shall be no more than approximately 1/2" (12.7 mm) wide.
18. For operable walls using the Micro Drive System, the operable wall shall stack in the up (open) position into a space no greater than 69" (1750mm) wide. For operable walls using the Standard Drive System, the operable wall shall stack in the up (open) position into a space no greater than 65" (1650mm) wide. The operable wall shall have a stacking height ratio in the range of 1:5 to 1:10, depending on the height of the wall.
19. Each acoustical panel shall be individually removable using only a screw driver. No special tools or equipment shall be required. The removal of a single acoustical panel shall not affect, dislocate or cause the removal of any adjacent panels or other acoustical panels.
20. A completely functioning operable wall, tested in full accordance and compliance with ASTM C423 (ISO 354) shall achieve, from an independent laboratory, a Noise Reduction Coefficient (NRC)\*\* rating of up to the following:
  - a. Skyfold® Classic NRC™ system: NRC 0.65 (SAC 0.65)
21. The operable wall shall be designed to have a design life of at least 10,000 complete closed to opened to closed cycles.

### 1.03 . QUALITY ASSURANCE

- A. The products herein specified established the standard of quality for the operable wall based on the following Skyfold® Classic™ Automatic Vertically Retractable Acoustic Walls by Skyfold Inc. of Baie d'Urfe (Montréal), Québec, Canada:
- B. Proposals for substitution of products or techniques not conforming to these specifications must be submitted at least ten (10) days prior to bidding. Independent test reports which meet the requirements and design specified herein must be submitted to obtain approval.
- C. All work and materials specified herein, shall be installed only by qualified representatives and/or installers and/or distributors of the manufacturer, according to the manufacturers written instructions.
- D. The operable wall must be manufactured by a certified ISO-9001-2008 company or an equivalent quality control system.

### 1.04 REFERENCES

- A. ASTM E90, Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions.
  - a. Annex A1.15.3 Operation – "The specimen shall not be designated an operable wall unless it opens and closes in a normal manner. It shall be fully opened and closed at least five times after installation is completed and tested without further adjustments."
- B. ASTM E413, Classification for Rating Sound Insulation.
- C. ASTM E557, Standard Practice for Architectural Application and Insulation of Operable Partitions.

- D. ISO 354, Measurement of Sound Absorption
- E. ISO 140-3, Measurement of Airborne Sound Insulation
- F. ASTM C423, Measurement of Sound Absorption

#### **1.05 SUBMITTALS**

- A. Submit manufacturers' technical data for each type of operable wall specified herein.
- B. Submit shop drawings showing complete layout of operable wall system based on field verified dimensions. The drawings shall include dimensional relationship to adjoining work. Include details indicating materials, finishes, tolerances, and methods of attachment to building steel and electrical requirements.
- C. Submit certified test reports evidencing compliance to acoustical STC (Rw) requirements as specified in paragraph 1.3.2.19 and in accordance to references listed in paragraphs 1.5.1 and 1.5.5.

#### **1.06 SITE CONDITIONS**

- A. The floor underneath the operable wall along its axis, shall be flat to within +/- 1/4" (6 mm) over the entire length of an operable wall. The peak to valley undulation of +/- 1/4" (6 mm) shall not be closer together than 24" (610 mm) and a peak to valley undulation of +/- 1/8" (3 mm) shall not be closer than 12" (305 mm).
- B. Support steel above the operable wall along its axis shall be parallel to the floor within +/- 1/2" (12.7 mm) for the entire length of the operable wall. This includes loaded deflection. The beam must also be parallel to the centre line of the wall within + 1/8" (3 mm), left to right.
- C. The fixed walls at either end of the operable wall shall be within +1/4" (6 mm)-0", from plumb vertical.
- D. The fixed walls at either end of the operable wall shall be flat to within +0", -1/4" (6 mm).

#### **1.07 WARRANTY**

- A. Basic Warranty: The operable wall shall be warranted free from defects in material and workmanship for a period of two (2) years or five thousand (5,000) cycles, whichever occurs first, from the date of shipment. Extended Parts Warranty (optional): An extended warranty on parts (excluding touch screen operator stations) is available in addition to the basic warranty. It includes coverage on all parts for a period of ten (10) years or five thousand (5,000) cycles, whichever occurs first from date of shipment. Refer to Owner's manual for full warranty details.
- B. Acoustical Performance: The operable wall shall retain its acoustical properties for 10 years from the date of shipment providing proper maintenance has been performed on the operable wall.

### **PART 2 – PRODUCTS**

#### **2.01 MANUFACTURER**

- A. Basis of Design: Skyfold Classic Automatic Vertically Retractable Acoustic Walls as manufactured by Skyfold Inc. of Baie d'Urfe, Québec, Canada
- B. Web-site: [www.skyfold.com](http://www.skyfold.com)
  - 1) System STC 50 (Rw 49), Panel Construction STC 60 (Rw 58)
  - 2) NRC up to 0.65 /SAC up to 0.65

#### **2.02 MATERIALS**

- A. Acoustical Panels
  - 1. Finish: Carnegie Xorel; Twine 33.
  - 2. Acoustical panels, together with all of the sound insulation, shall be, as much as possible, made of non-combustible or fire-treated materials.
  - 3. Acoustical panels shall be fabricated to be as stiff as possible in order to satisfy the rigid criteria when the operable wall is down (closed) and to ensure that there is no interference between panels when the wall is in motion.
  - 4. Acoustical panels shall be architecturally flat with no bowing, oil canning, warping, waviness or any other surface deformation and discontinuity.
  - 5. Acoustical panels shall have the finish of the architect's choice, provided that the finish has been approved by the operable wall manufacturer to ensure compatibility with the wall panels. The following criteria must be met:

- a. Maximum weight of material: 0.111 lbs/ft<sup>2</sup> (0.542 kg/m<sup>2</sup>)
  - 6. Finishes are railroaded onto the panels, applied horizontally along the panel length. Pricing will vary depending on finish selection.
  - 7. Acoustical panels shall meet the following STC ratings in accordance with ASTM E90 (ISO 140-3) specification as reported by an independent laboratory.
- B. Folding Mechanism
- 1. The hanging, folding and extension mechanism shall be, as much as possible, made from structural grade aluminum extrusions and structural shapes, in order to minimize the weight of the system.
  - 2. All wear surfaces, such as bushings, spacers, pins, discs, bearings, and sleeves shall be designed to function quietly and with minimum wear, over the 10,000 cycle design life of the operable wall.
  - 3. The hangers, which fasten the lifting mechanism to the support steel, shall be fabricated from steel and shall be welded or bolted to the support steel supplied by others.
- C. Motor Drive
- 1. The motor drive shall be sized properly so that it can open and close the wall effectively over the 10,000 cycle design life of the wall, at the minimum design speed specified in point 1.3.2.8.
  - 2. The folding mechanism shall be designed to function as smoothly, quietly and safely as possible. Wherever possible, ball bearings shall be used instead of bushings and wear surfaces. In no circumstance shall chain or belt drive systems be acceptable.
  - 3. There shall be a wire rope cable for every set of folding mechanism. This cable shall be of 6 x 31 construction aircraft cable and shall be made of galvanized steel. The diameter of the cables shall be sized so that they shall be able to hold the entire weight of the wall, with the appropriate safety factor.
  - 4. The cable wraps on yoyo drums with 2 safety wraps and multiple layers of cable.
  - 5. The line shaft, sized to deliver the required torque with minimum deflection, shall support and rotate the cable drums.
  - 6. Flange bearings shall be used for the drive system, located immediately on both sides of the drum assembly.
  - 7. The motor drive shall be sized to deliver sufficient amount of torque to safely and effectively raise and lower the operable wall over its design life.
  - 8. The motor drive shall use the latest in industry standards in thermal protection, overload protection, quick acting fuses, etc., in order to ensure the safety and reliability of the system.
- D. Safety Equipment
- 1. The operable wall shall employ an electromagnetic type of brake which shall activate firmly, without hesitation, when power is lost to the system. This brake shall have a minimum retarding torque rating equal to 200% of the motor drive's full load torque. The drive system shall be equipped with a manual override and a brake release lever.
  - 2. The operable wall shall employ a dynamic brake, distinct and separate from the brake in 2.2.4.1, in order to lower the wall at a controlled speed of no more than approximately 150% of the normal down speed, in the case of a catastrophic failure in the motor drive's power train. Alternately, the operable wall shall employ a brake, distinct and separate from the brake in 2.2.4.1, in order to completely halt the downward motion of the wall in the case of a catastrophic failure in the power train.
  - 3. The operable wall shall employ electrical or other limit switches in order to stop the wall at its up and down travel limits.
  - 4. The operable wall shall employ an over torque detector in order to sense a jam in the system and to act as an over travel limit in the up direction should the primary limit switch fail to act in 1.3.2.4. This over torque sensor shall be mechanical, using the motor's torque arm in its over torque detection.
  - 5. The entire length of the bottom edge of the operable wall shall be equipped with a continuous pressure sensing strip which shall cut power to the motor drive and shall activate the brake outlined in 2.2.4.1, if the sensing edge comes in firm contact with an object, before the operable wall is in the full down (closed) position. The operable wall will

automatically reverse direction and ascend for approximately 3 seconds to clear the obstruction. The power shall remain cut to the motor drive until the switches have been released. The operation of the operable wall can resume once the obstruction is removed.

E. Electrical

1. The operable wall shall be equipped for a three phase power supply to the electrical control box.
2. Standard electrical control box will be NEMA 1. NEMA 4 is also available upon request.
3. Low voltage wiring (by others). 18 gauge wiring from the switches to the control box.
4. Switches (standard): Two (2) push button switches wired in series with power controlled by a single, three position key switch. One push button switch shall be equipped with an LED that flashes fault codes in case of an electrical system failure. (Installation and wiring by others).
  - a. Touch Screen Operator Stations (optional): Two (2), 4.3" resistive LCD touch screens, wired in series with multilingual capabilities and 4-digit adjustable user pin. The screens will display faults in case of a failure with the electrical system. (wiring by others)

**2.03 FABRICATION**

- A. Factory assemble all components, assemblies and systems into the largest possible assemblies in order to minimize the amount of assembly on site.

**PART 3 – EXECUTION**

**3.01 INSPECTION**

- A. Inspect the relevant aspects of the site such as the evenness of the floor, walls, structural steel, etc., and ensure that these are within the tolerances stated in Part – 1 of this specification.
- B. Confirm in writing to the General Contractor or contract manager any deviations from these tolerances. Do not proceed until these conditions are made good.
- C. Carry out all appropriate field measurements before manufacturing any components or assemblies.

**3.02 INSTALLATION**

- A. Install operable walls in accordance with the manufacturer's printed instructions.
- B. The operable wall supplier shall not deliver or install this product until the General Contractor can ensure in writing safe storage and protection for the operable wall for the duration of the project.

**3.03 ADJUSTING AND CLEANING**

- A. Adjust and fine-tune the operable walls to ensure that all seals are operating and sealing properly and that the operable walls are in correct and smooth operation.
- B. Clean up any dirt, oil, grime, etc., that may have found its way onto the acoustical panels. Leave the wall in a state of architectural cleanliness.

**END OF SECTION**

**SECTION 102600  
WALL AND DOOR PROTECTION**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Corner guards.
- B. Protective wall covering.

**1.02 RELATED REQUIREMENTS**

- A. Section 092116 - Gypsum Board Assemblies: Placement of supports in stud wall construction.

**1.03 REFERENCE STANDARDS**

- A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023b.
- B. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2022.
- C. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015, with Editorial Revision (2021).

**1.04 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Indicate physical dimensions, features, anchorage details, and rough-in measurements.
- C. Shop Drawings: Include plans, elevation, sections, and attachment details.
- D. Samples: Submit samples illustrating component design, configurations, joinery, color and finish.
  - 1. Submit two samples of protective wall covering and door surface protection, 6 by 6 inches square.
- E. Manufacturer's Instructions: Indicate special procedures, perimeter conditions requiring special attention.
- F. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
- G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project:
  - 1. See Section 016000 - Product Requirements, for additional provisions.
  - 2. Extra Stock Materials: 32 square feet of each kind of protective wall covering.
- H. Maintenance Data: Manufacturer's instructions for care and cleaning of each type of product. Include information about both recommended and potentially detrimental cleaning materials and methods.

**1.05 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver wall and door protection items in original, undamaged protective packaging. Label items to designate installation locations.
- B. Protect work from moisture damage.
- C. Protect work from UV light damage.
- D. Do not deliver products to project site until areas for storage and installation are fully enclosed, and interior temperature and humidity are in compliance with manufacturer's recommendations for each type of item.
- E. Store products in either horizontal or vertical position, in compliance with manufacturer's instructions.

**1.06 WARRANTY**

- A. See Section 017800 - Closeout Submittals for additional warranty requirements.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

- A. Corner Guards:
  - 1. Babcock-Davis: [www.babcockdavis.com/#sle](http://www.babcockdavis.com/#sle).



2. Construction Specialties, Inc: [www.c-sgroup.com/#sle](http://www.c-sgroup.com/#sle).
  3. Inpro: [www.inprocorp.com/#sle](http://www.inprocorp.com/#sle).
  4. Koroseal Interior Products: [www.koroseal.com/#sle](http://www.koroseal.com/#sle).
  5. Substitutions: See Section 016000 - Product Requirements.
- B. Protective Wall Covering: Basis of Design: Koroseal Korogard.
1. Construction Specialties, Inc: [www.c-sgroup.com/#sle](http://www.c-sgroup.com/#sle).
  2. Inpro: [www.inprocorp.com/#sle](http://www.inprocorp.com/#sle).
  3. MDC Interior Solutions: [www.mdcwall.com/#sle](http://www.mdcwall.com/#sle).
  4. Pawling Corp: [www.pawling.com/#sle](http://www.pawling.com/#sle).
  5. Substitutions: See Section 016000 - Product Requirements.

## 2.02 PRODUCT TYPES

- A. Corner Guards - Flush Mounted:
1. Material: Type 304 stainless steel, No. 4 finish, 16 gauge, 0.064 inch thick.
  2. Performance: Resist lateral impact force of 100 lbs at any point without damage or permanent set.
  3. Width of Wings: 2 inches.
  4. Corner: Square.
  5. Color: As selected from manufacturer's standard colors.
  6. Length: One piece.
- B. Protective Wall Covering:
1. Material: High-impact acrylic-modified vinyl.
  2. Thickness: 0.040 inch.
  3. Surface Burning Characteristics: Provide assemblies with flame spread index of 25 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.
  4. Color: As scheduled.
  5. Accessories: Provide manufacturer's standard color-matched trim and moldings.
    - a. Inside Corner Trim: Standard angle
    - b. Outside Corner Trim: Standard angle.
  6. Mounting: Adhesive.

## 2.03 FABRICATION

- A. Fabricate components with tight joints, corners and seams.

## PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Verify that rough openings, concealed blocking, and anchors are correctly sized and located.
- B. Verify that field measurements are as indicated on drawings.
- C. Verify that substrate surfaces for adhered items are clean and smooth.
  1. Test painted or wall covering surfaces for adhesion in inconspicuous area, as recommended by manufacturer. Follow adhesive manufacturer's recommendations for remedial measures at locations and/or application conditions where adhesion test's results are unsatisfactory.
- D. Start of installation constitutes acceptance of project conditions.

### 3.02 INSTALLATION

- A. Install components in accordance with manufacturer's instructions, level and plumb, secured rigidly in position to supporting construction.
- B. **Position corner guard 4 inches above finished floor to ceiling.**
- C. Position protective wall covering no less than 1 inch above finished floor to allow for floor level variation.
  1. Wainscot Installation: Establish a level line at the specified height for entire length of run. Install by aligning top of edge of covering with this line.
  2. Apply adhesive with 1/8 inch V-notch trowel to an area of wall surface that can be completed within cure time of the adhesive.

3. Install trim pieces as required for a complete installation. Allow tolerance for thermal movement.
4. At inside and outside corners cut covering sheets to facilitate installation of trim pieces or corner guards.

### **3.03 TOLERANCES**

- A. Maximum Variation From Required Height: 1/4 inch.
- B. Maximum Variation From Level or Plane For Visible Length: 1/4 inch.

### **3.04 CLEANING**

- A. Clean wall and door protection items of excess adhesive, dust, dirt, and other contaminants.

**END OF SECTION**

**SECTION 102800  
TOILET, BATH, AND LAUNDRY ACCESSORIES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Commercial toilet accessories.
- B. Residential toilet, shower, and bath accessories.
- C. Accessories for toilet rooms, showers, residential bathrooms, and utility rooms.
- D. Paper towel dispensers.
- E. Utility room accessories.
- F. Grab bars.

**1.02 RELATED REQUIREMENTS**

- A. Section 088300 - Mirrors: Other mirrors.

**1.03 REFERENCE STANDARDS**

- A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.
- B. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.
- C. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service; 2022.
- D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.
- E. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2023.
- F. ASTM C1036 - Standard Specification for Flat Glass; 2021.
- G. ASTM C1503 - Standard Specification for Silvered Flat Glass Mirror; 2024.

**1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Coordinate the work with the placement of internal wall reinforcement and concealed ceiling supports to receive anchor attachments.

**1.05 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Submit data on accessories describing size, finish, details of function, and attachment methods.
- C. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

- A. Toilet Accessories:
  - 1. AJW Architectural Products: [www.ajw.com/#sle](http://www.ajw.com/#sle).
  - 2. ASI - American Specialties, Inc: [www.americanspecialties.com/#sle](http://www.americanspecialties.com/#sle).
  - 3. Bradley Corporation: [www.bradleycorp.com/#sle](http://www.bradleycorp.com/#sle).
  - 4. Bobrick Washroom Equipment, Inc..
- B. All items of each type to be made by the same manufacturer.

**2.02 MATERIALS**

- A. Accessories - General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.
- B. Stainless Steel Sheet: ASTM A666, Type 304.
- C. Stainless Steel Tubing: ASTM A269/A269M, Grade TP304 or TP316.
- D. Galvanized Sheet Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with G90/Z275 coating.
- E. Mirror Glass: Annealed float glass, ASTM C1036 Type I, Class 1, Quality Q2, with silvering, protective and physical characteristics complying with ASTM C1503.

- F. Adhesive: Two component epoxy type, waterproof.
- G. Fasteners, Screws, and Bolts: Hot dip galvanized; tamper-proof; security type.

### **2.03 FINISHES**

- A. Stainless Steel: No. 4 Brushed finish, unless otherwise noted.
- B. Chrome/Nickel Plating: ASTM B456, SC 2, satin finish, unless otherwise noted.
- C. Galvanizing for Items Other than Sheet: Comply with ASTM A123/A123M; galvanize ferrous metal and fastening devices.

### **2.04 TOILET ROOM ACCESSORIES**

- A. Toilet Paper Dispenser: Double roll, surface mounted bracket type, chrome-plated zinc alloy brackets, spindleless type for tension spring delivery designed to prevent theft of tissue roll.
  - 1. Products:
    - a. Bobrick B-265.
- B. Paper Towel Dispenser: Folded paper type, stainless steel, semi-recessed, with viewing slots on sides as refill indicator and tumbler lock.
  - 1. Products:
    - a. Bobrick B-262.
- C. Combination Towel Dispenser/Waste Receptacle: Semi-Recessed recesses 3-7/8"; projects 4-1/8", stainless steel; seamless wall flanges, continuous piano hinges, tumbler locks on upper and lower doors.
  - 1. Waste receptacle liner: Reusable, heavy-duty vinyl.
  - 2. Towel dispenser capacity: 600 C-fold.
  - 3. Waste receptacle capacity: 12 gallons.
  - 4. Products:
    - a. Basis of Design: Bobrick Model B-3942.
    - b. Substitutions: Section 016000 - Product Requirements.
- D. Soap Dispenser: Liquid soap dispenser, wall-mounted, surface, with stainless steel cover and horizontal stainless steel tank and working parts; push type soap valve, check valve, and window gage refill indicator, tumbler lock.
  - 1. Minimum Capacity: 40 ounces.
  - 2. Products:
    - a. Bobrick B-2111.
- E. Grab Bars: Stainless steel, nonslip grasping surface finish.
  - 1. Standard Duty Grab Bars:
    - a. Push/Pull Point Load: 250 pound-force, minimum.
    - b. Dimensions: 1-1/4 inch outside diameter, minimum 0.05 inch wall thickness, exposed flange mounting, 1-1/2 inch clearance between wall and inside of grab bar.
    - c. Length and Configuration: As indicated on drawings.
    - d. Products:
      - 1) Substitutions: Section 016000 - Product Requirements.
- F. Sanitary Napkin Disposal Unit: Stainless steel, surface-mounted, self-closing door, locking bottom panel with full-length stainless steel piano-type hinge, removable receptacle.
  - 1. Products:
    - a. Bobrick B-254.
    - b. Substitutions: Section 016000 - Product Requirements.
- G. Robe Hook: Stainless steel, surface-mounted, Bright-polished stainless steel. Flange is 2" x 2" (50 x 50mm). Projects 3 3/8" (85mm) from wall..
  - 1. Products:
    - a. Bobrick B-677.
    - b. Substitutions: Section 016000 - Product Requirements.

### **2.05 UTILITY ROOM ACCESSORIES**

- A. Combination Utility Shelf/Mop and Broom Holder: 0.05 inch thick stainless steel, Type 304, with 1/2 inch returned edges, 0.06 inch steel wall brackets.

1. Drying rod: Stainless steel, 1/4 inch diameter.
2. Hooks: Two, 0.06 inch stainless steel rag hooks at shelf front.
3. Mop/broom holders: Three spring-loaded rubber cam holders at shelf front.
4. Length: 36 inches.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Verify existing conditions before starting work.
- B. Verify exact location of accessories for installation.
- C. For electrically-operated accessories, verify that electrical power connections are ready and in the correct locations.
- D. Verify that field measurements are as indicated on drawings.

#### **3.02 PREPARATION**

- A. Deliver inserts and rough-in frames to site for timely installation.
- B. Provide templates and rough-in measurements as required.

#### **3.03 INSTALLATION**

- A. Install accessories in accordance with manufacturers' instructions in locations indicated on drawings.
- B. Install plumb and level, securely and rigidly anchored to substrate.
- C. Mounting Heights: As required by accessibility regulations, unless otherwise indicated.
  1. Grab Bars: As indicated on the drawings.
  2. Mirrors: 3' 4" inch, measured to bottom of mirrored surface.
  3. Other Accessories: As indicated on the drawings.

#### **3.04 PROTECTION**

- A. Protect installed accessories from damage due to subsequent construction operations.

**END OF SECTION**

**SECTION 104400  
FIRE PROTECTION SPECIALTIES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Fire extinguishers.
- B. Fire extinguisher cabinets.
- C. Accessories.

**1.02 RELATED REQUIREMENTS**

- A. Section 061000 - Rough Carpentry: Wood blocking product and execution requirements.

**1.03 REFERENCE STANDARDS**

- A. FM (AG) - FM Approval Guide; Current Edition.
- B. NFPA 10 - Standard for Portable Fire Extinguishers; 2022.
- C. UL (DIR) - Online Certifications Directory; Current Edition.

**1.04 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate locations of cabinets and cabinet physical dimensions.
- C. Product Data: Provide extinguisher operational features.
- D. Maintenance Data: Include test, refill or recharge schedules and re-certification requirements.

**1.05 FIELD CONDITIONS**

- A. Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

- A. Fire Extinguishers:
  - 1. Ansul, a Tyco Business; Cleanguard: [www.ansul.com/#sle](http://www.ansul.com/#sle).
  - 2. Kidde, a unit of United Technologies Corp: [www.kidde.com/#sle](http://www.kidde.com/#sle).
  - 3. Nystrom, Inc: [www.nystrom.com/#sle](http://www.nystrom.com/#sle).
  - 4. Potter-Roemer: [www.potterroemer.com/#sle](http://www.potterroemer.com/#sle).
  - 5. Pyro-Chem, a Tyco Business: [www.pyrochem.com/#sle](http://www.pyrochem.com/#sle).
  - 6. Strike First Corporation of America; Water Fire Extinguisher: [www.strikefirstusa.com](http://www.strikefirstusa.com).
  - 7. Substitutions: See Section 016000 - Product Requirements.
  - 8. Ansul, a Tyco Business: [www.ansul.com/#sle](http://www.ansul.com/#sle).
  - 9. JL Industries, Inc: [www.jlindustries.com](http://www.jlindustries.com).
  - 10. Larsen's Manufacturing Co: [www.larsensmfg.com/#sle](http://www.larsensmfg.com/#sle).
  - 11. Potter-Roemer: [www.potterroemer.com/#sle](http://www.potterroemer.com/#sle).
  - 12. Pyro-Chem, a Tyco Business: [www.pyrochem.com/#sle](http://www.pyrochem.com/#sle).
  - 13. Strike First Corporation of America; EL-Elite Architectural Series Fire Extinguisher Cabinet, Non-Fire Rated: [www.strikefirstusa.com](http://www.strikefirstusa.com).

**2.02 FIRE EXTINGUISHERS**

- 1. Provide extinguishers labeled by UL (DIR) or FM (AG) for purpose specified and as indicated.
- B. Multipurpose Dry Chemical Type Fire Extinguishers: Carbon steel tank, with pressure gauge.
  - 1. Class: A:B:C type.
  - 2. Size: 10 pound.
  - 3. Finish: Baked polyester powder coat Red color.
  - 4. Temperature range: Minus 40 degrees F to 120 degrees F.
- C. Dry Chemical Type Fire Extinguishers: Stainless steel tank, with pressure gauge.
  - 1. Class: K type.
  - 2. Size: 1.6 gallons.
  - 3. Finish: Polished stainless steel.

4. Temperature range: Minus 20 degrees F to 120 degrees F.

### **2.03 FIRE EXTINGUISHER CABINETS**

- A. Metal: Formed aluminum.
- B. Cabinet Configuration: Recessed type.
  1. Size to accommodate accessories.
- C. Door: 0.036 inch metal thickness, reinforced for flatness and rigidity with nylon catch. Hinge doors for 180 degree opening with two butt hinge.
- D. Door Glazing: Acrylic plastic, clear, 1/8 inch thick, flat shape and set in resilient channel glazing gasket.
- E. Cabinet Mounting Hardware: Appropriate to cabinet, with pre-drilled holes for placement of anchors.
- F. Weld, fill, and grind components smooth.
- G. Finish of Cabinet Exterior Trim and Door: No. 4 - Brushed stainless steel.
- H. Finish of Cabinet Interior: White colored enamel.

### **2.04 ACCESSORIES**

- A. Cabinet Signage: FIRE EXTINGUISHER.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify existing conditions before starting work.
- B. Verify rough openings for cabinet are correctly sized and located.

### **3.02 INSTALLATION**

- A. Install in accordance with manufacturer's instructions.
- B. Install cabinets plumb and level in wall openings, 48 inches maximum from finished floor to center of pull.
- C. Secure rigidly in place.
- D. Place extinguishers in cabinets.

**END OF SECTION**

**SECTION 105129  
PHENOLIC LOCKERS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Phenolic lockers.

**1.02 RELATED REQUIREMENTS**

- A. Section 061000 - Rough Carpentry Wood base construction, blocking and nailers.

**1.03 REFERENCE STANDARDS**

- A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023b.

**1.04 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's published data on locker construction, sizes and accessories.
- C. Shop Drawings: Indicate locker plan layout, numbering plan.
- D. Samples: Submit two samples 3 by 6 inches in size, of each color scheduled.
- E. Manufacturer's Installation Instructions: Indicate component installation assembly.

**1.05 DELIVERY, STORAGE, AND HANDLING**

- A. Protect locker finish and adjacent surfaces from damage.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

- A. Phenolic Lockers: Basis of Design: Phenolic Traditional Collect by ASI Storage Solutions
  1. Columbia Lockers, a division of PSiSC: [www.psiscc.com/#sle](http://www.psiscc.com/#sle).
  2. Grid: [www.builtbygrid.com/#sle](http://www.builtbygrid.com/#sle).
  3. List Industries, Inc: [www.listindustries.com/#sle](http://www.listindustries.com/#sle).
  4. Summit Lockers, Inc: [www.summitlockers.com/#sle](http://www.summitlockers.com/#sle).
  5. Substitutions: See Section 016000 - Product Requirements.

**2.02 LOCKER APPLICATIONS**

- A. Student Lockers: Phenolic lockers, recessed mounted.
  1. Width: 12 inches.
  2. Depth: 18 inches.
  3. Height: 72 inches.
  4. Locker Configuration: Two tier.
  5. Fittings: Size and configuration as indicated on drawings.
    - a. Hooks: Two single prong.
  6. Ventilation: By open space between the back of the door and locker body.
  7. Locking: Padlock hasps, for padlocks provided by Owner.

**2.03 PHENOLIC LOCKERS**

- A. Lockers: Factory assembled, made of phenolic core panels with mortise and tenon joints and stainless steel mechanical joint fasteners; fully finished inside and out; each locker capable of standing alone.
  1. Doors: Full overlay, covering full width and height of locker body; square edges.
  2. Panel Core Exposed at Edges: Machine polished, without chips or tool marks; square edge unless otherwise indicated.
  3. Where locker ends or sides are exposed, finish the same as fronts or provide extra panels to match fronts.
  4. Door Color: As selected by Architect.
  5. Body Color: Manufacturer's standard white or light color.
  6. Fasteners for Accessories and Locking Mechanisms: Tamperproof type.
- B. Component Thicknesses:



1. Doors: 1/2 inch minimum thickness.
  2. Locker Body: One of the following combinations:
    - a. Tops, bottoms, and shelves 1/2 inch; sides 3/8 inch; backs 3/8 inch; minimum.
  3. End Panels and Filler Panels: 1/2 inch minimum thickness.
  4. Toe Kick Plates: 1/2 inch minimum thickness.
- C. Phenolic Core Panels: Nonporous phenolic resin and paper core formed under high pressure, with natural colored finished edges, integral melamine surface, matte finish, and uniform surface appearance; glued laminated panels not acceptable.
1. Surface Burning Characteristics: Flame spread index of 75 or less, and smoke developed index of 450 or less; when tested in accordance with ASTM E84.
- D. Hinges: Stainless steel, black powder coat finish; minimum of 180 degree opening; either exposed barrel 5-knuckle hinge attached to back of door and inside of body with tamperproof screws, or concealed cabinet style hinge attached with tamperproof screws.
- E. Coat Hooks: Stainless steel or reinforced nylon; attached with tamperproof screws.
- F. Number Plates: Manufacturer's standard, minimum 4-digit, permanently attached with adhesive; may be field installed.
- G. Lock Strike: Stainless steel, or black high impact ABS plastic strike plate attached to locker body with throughbolts.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Verify that prepared bases are in correct position and configuration.
- B. Verify bases and embedded anchors are properly sized.

#### **3.02 INSTALLATION**

- A. Install in accordance with manufacturer's instructions.
- B. Place and secure on prepared base.
- C. Install lockers plumb and square.
- D. Secure lockers with anchor devices to suit substrate materials. Minimum Pullout Force: 100 pounds.
- E. Bolt adjoining locker units together to provide rigid installation.
- F. Install end panels, filler panels, and sloped tops.
- G. Install accessories.
- H. Replace components that do not operate smoothly.

#### **3.03 CLEANING**

- A. Clean locker interiors and exterior surfaces.

**END OF SECTION**

## **SECTION 117311 PATIENT LIFTS**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Patient lift equipment with powered operating system and overhead-supported tracks.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 095100 - Acoustical Ceilings.

#### **1.03 REFERENCE STANDARDS**

- A. AISI S100 - North American Specification for the Design of Cold-Formed Steel Structural Members; 2016, with Supplement (2020).
- B. AISI S240 - North American Standard for Cold-Formed Steel Structural Framing; 2015, with Errata (2020).
- C. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.
- D. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.
- E. ITS (DIR) - Directory of Listed Products; Current Edition.
- F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- G. UL (DIR) - Online Certifications Directory; Current Edition.

#### **1.04 ADMINISTRATIVE REQUIREMENTS**

- A. See Section 017000 - Execution and Closeout Requirements for preinstallation meeting requirements.
- B. Preinstallation Meeting: Convene one week before starting work of this section.

#### **1.05 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's data sheets of operating system components, track system components, track depth, track maneuverability systems, slings, and accessories. Indicate dimensions, performance requirements, service requirements, materials, finishes, and options
- C. Shop Drawings: Indicate dimensions, reflected ceiling plan track layouts, above-ceiling support requirements, attachment-to-support details, point loads, and power-supply connections.
  - 1. Scale of Drawings: 1-1/2 inch to 1 foot, minimum.
- D. Delegated Design Data:
  - 1. Shop drawings of overhead structural support system signed and sealed by a professional structural engineer.
  - 2. Calculations for loadings and stresses of cold-formed steel overhead structural support system, signed and sealed by a professional structural engineer.
  - 3. Details and calculations for factory-made framing connectors, signed and sealed by a professional structural engineer.
- E. Manufacturer's Qualification Statement.
- F. Installer's Qualification Statement.
- G. Operation Data: Include description of equipment operation and required adjusting and testing.
- H. Maintenance Data: Identify system maintenance requirements, servicing cycles, lubrication types required and local spare part sources.
- I. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

#### **1.06 QUALITY ASSURANCE**

- A. Designer Qualifications: Design overhead structural support system under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located.

- B. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, with minimum five years of documented experience.
- C. Installer Qualifications: Company specializing in performing work of the type specified and with minimum five years of documented experience and approved by manufacturer.

### **1.07 DELIVERY, STORAGE, AND HANDLING**

- A. Package equipment to project site in protective packaging.
- B. Protect finished surfaces during handling and installation with protective covering of polyethylene film or another suitable material.

### **1.08 WARRANTY**

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within a two year period after Date of Substantial Completion.

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Patient Lifts: Basis of Design: Goldman GH3
  - 1. Substitutions: See Section 016000 - Product Requirements.

### **2.02 OPERATING SYSTEM**

- A. Battery-operated patient lift mounted in track system to transfer patients along track system; capable of both powered and manual traverse movement.
  - 1. Lifts per Charge: 55 lifts, nominal.
  - 2. Lifting Speed: 1.6 inch/sec.
  - 3. Features: Overload protection, dual pawl emergency brake system, battery protection, and emergency down control.
  - 4. Motor-Track Trolley: Component of motor housing for integration with track system.
  - 5. Hand-control remote control.
  - 6. Lifting Strap: 2 inches wide; 94 inches spoolable length.
- B. Electrical Components, Devices, and Accessories: Listed and labeled by ITS (DIR), UL (DIR), or testing agency acceptable to authorities having jurisdiction and installed in compliance with NFPA 70, and marked for intended application.

### **2.03 TRACK SYSTEM**

- A. Description: Manufacturer's standard track systems capable of varying track configuration layouts:
  - 1. Track Depth:
    - a. Extra Tall Track: 2.31 inches wide by 5.34 inches high; 650 lbs capacity.
  - 2. Track Maneuverability Systems:
    - a. Single Rail Track System; with 45-degree bend curved tracks and 650 lbs capacity.
    - b. Gantry Rail Track System; 650 lbs capacity.
    - c. Refer to drawings for layout.
- B. Materials:
  - 1. Track: Extruded aluminum, ASTM B221 (ASTM B221M), 6063 alloy, T6 temper.
- C. Finish: Anodized.

### **2.04 OVERHEAD STRUCTURAL SUPPORT SYSTEM**

- A. Metal Channel (Strut) Framing Systems:
  - 1. Manufacturers:
    - a. Cooper B-Line, a division of Eaton Corporation: [www.cooperindustries.com/#sle](http://www.cooperindustries.com/#sle).
    - b. Thomas & Betts Corporation: [www.tnb.com/#sle](http://www.tnb.com/#sle).
    - c. Unistrut, a brand of Atkore International Inc: [www.unistrut.com/#sle](http://www.unistrut.com/#sle).
    - d. Substitutions: See Section 016000 - Product Requirements.
    - e. Source Limitations: Provide channels (struts) and associated fittings, accessories, and hardware produced by a single manufacturer.
- B. Description:

1. Structural, overhead-supported, cold-formed framing system for supporting patient lift equipment track system.
  2. Factory-fabricated continuous-slot metal channel (strut) and associated fittings, accessories, and hardware required for field-assembly of patient lift overhead support system.
  3. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for a complete installation that supports the associated patient lift track and operating systems.
- C. Design Criteria: Provide cold-formed steel overhead structural support system.
1. Structural Performance: Cold-formed structural members and systems capable of withstanding design loads, and in compliance with design reference standards.
  2. Design Reference Standards: Provide system components in compliance with AISI S100 and AISI S240.
  3. Design Loads: Provide system components in compliance with applicable codes.
- D. Provide classified products, listed and labeled as suitable for intended purpose, where applicable.
- E. Channel Materials:
1. Thickness: Steel sheet, 12 gauge, 0.1046 inch minimum; but not less than thickness required to meet performance requirements.
  2. Size: 1-5/8 inch wide 13/16 inch by 13/16 inch high minimum, but not less than size required to meet performance requirements.
  3. Corrosion Protection Coating Designation: CP 60 in compliance with AISI S240.

## **2.05 ACCESSORIES**

- A. Lifting Hanger: Manufacturer's standard with capacity up to 825lbs.
- B. Slings: Manufacturer's standard sling with load rating equal to or greater than load rating of lift.
- C. Installation Accessories: Provide necessary accessories and closure trim as required for complete installation.
- D. Fasteners: Manufacturer's standard inserts, anchors, bolts, rivets, and screws appropriate for project conditions; corrosion-resistant.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verification of Conditions: Examine areas and conditions, with installer present, for compliance with requirements of supporting structural members, installation tolerances, and other conditions that may impact performance of equipment.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.02 INSTALLATION**

- A. Install equipment in accordance with manufacturer's instructions and approved shop drawings.
- B. Set components plumb, level, and rigid.
- C. Install anchors in accordance with anchor manufacturer's installation guidelines.
- D. Interface With Other Work: Use pop rivets or screws to attach L-shaped perimeter moldings of ceiling to lift equipment track.
- E. Track System Interface with Finish Ceiling: Install track system relative to finish ceiling for semi-recessed track installation.
  1. Coordinate track system interface with components of Section 095100 - Acoustical Ceilings.

### **3.03 ADJUSTING**

- A. Adjust operating equipment for smooth and efficient operation throughout full operating cycle.

### **3.04 CLOSEOUT ACTIVITIES**

- A. See Section 017800 - Closeout Submittals, for closeout submittals.
- B. See Section 017900 - Demonstration and Training, for additional requirements.
- C. Demonstration: Demonstrate operation of equipment to Owner's personnel.
  1. Use operation and maintenance data as reference during demonstration.

2. Briefly describe function, operation, and maintenance of each component.
- D. Training: Train Owner's personnel on operation and maintenance of system.
1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
  2. Provide minimum of two hours of training.
  3. Instructor: Manufacturer's training personnel.
  4. Location: At project site.
- E. Final Acceptance: Remove labels, fingerprints; clean surfaces. Repair any marred or damaged surfaces that effect appearance in manner not acceptable to Owner. Replace any parts that cannot be repaired in such a manner.

### **3.05 PROTECTION**

- A. Protect installed equipment from subsequent construction operations.

**END OF SECTION**

## **SECTION 122400 WINDOW SHADES**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Window shades and accessories.
- B. Electric motor operators.
- C. Motor controls.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 061000 - Rough Carpentry: Concealed wood blocking for attachment of headrail brackets.
- B. Section 092116 - Gypsum Board Assemblies: Substrate for window shade systems.
- C. Section 262726 - Wiring Devices: Finish requirements for wall controls specified in this section.

#### **1.03 REFERENCE STANDARDS**

- A. ASTM D4674 - Standard Practice for Accelerated Testing for Color Stability of Plastics Exposed to Indoor Office Environments; 2019.
- B. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015, with Editorial Revision (2021).
- C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- D. NFPA 701 - Standard Methods of Fire Tests for Flame Propagation of Textiles and Films; 2023, with Errata.
- E. UL 325 - Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems; Current Edition, Including All Revisions.
- F. WCMA A100.1 - Standard for Safety of Window Covering Products; 2022.

#### **1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination:
  - 1. Where motorized shades are to be controlled by control systems provided under other sections, coordinate the work with other trades to provide compatible products.
  - 2. Coordinate the work with other trades to provide rough-in of electrical wiring as required for installation of hardwired motorized shades.
- B. Preinstallation Meeting: Convene one week prior to commencing work related to products of this section; require attendance of all affected installers.
- C. Sequencing:
  - 1. Do not fabricate shades until field dimensions for each opening have been taken.
  - 2. Do not install shades until final surface finishes and painting are complete.

#### **1.05 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets including materials, finishes, fabrication details, dimensions, profiles, mounting requirements, and accessories.
  - 1. Motorized Shades: Include power requirements and standard wiring diagrams.
- C. Shop Drawings: Include shade schedule indicating size, location and keys to details.
- D. Certificates: Manufacturer's documentation that line voltage components are UL listed or UL recognized.
- E. Selection Samples: Include fabric samples in full range of available colors and patterns.
  - 1. Motorized Shades: Include finish selections for controls.
- F. Manufacturer's Instructions: Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- G. Operation and Maintenance Data: List of all components with part numbers, sources of supply, and operation and maintenance instructions; include copy of shop drawings.

- H. Warranty: Submit sample of manufacturer's warranty and documentation of final executed warranty completed in Owner's name and registered with manufacturer.

#### **1.06 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than five years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of this type with minimum five years of documented experience.

#### **1.07 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver shades in manufacturer's unopened packaging, labeled to identify each shade for each opening.
- B. Handle and store shades in accordance with manufacturer's recommendations.

#### **1.08 FIELD CONDITIONS**

- A. Do not install products under environmental conditions outside manufacturer's absolute limits.

#### **1.09 WARRANTY**

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. Provide manufacturer's warranty from Date of Substantial Completion, covering the following:
  - 1. Shade Hardware: 25 years.
  - 2. Electric Motors: One year.
  - 3. Electronic Control Equipment: One year.
  - 4. Fabric: 25 years.
  - 5. Aluminum and Steel Coatings: One year.

### **PART 2 PRODUCTS**

#### **2.01 MANUFACTURERS**

- A. Manually operated and motorized roller shades shall be provided from the same manufacturer.
  - 1. Manually Operated Roller Shades: Basis of Design: Mecho Shade
    - a. Draper, Inc; Clutch Operated FlexShade: [www.draperinc.com/#sle](http://www.draperinc.com/#sle).
    - b. Lutron Electronics Co., Inc: [www.lutron.com/#sle](http://www.lutron.com/#sle).
    - c. Hunter Douglas: [www.hunterdouglas.com](http://www.hunterdouglas.com).
    - d. SWFcontract, a division of Springs Window Fashions, LLC.: [www.swfcontract.com/#sle](http://www.swfcontract.com/#sle).
    - e. Substitutions: See Section 016000 - Product Requirements.
  - 2. Motorized Roller Shades, Motors and Motor Controls: Basis of Design: Mecho Shade
    - a. Draper, Inc: [www.draperinc.com/#sle](http://www.draperinc.com/#sle).
    - b. Lutron Electronics Co., Inc; Sivoia QS Roller Shades: [www.lutron.com/sle](http://www.lutron.com/sle).
    - c. SWFcontract, a division of Springs Window Fashions, LLC: [www.swfcontract.com](http://www.swfcontract.com).

#### **2.02 WINDOW SHADE APPLICATIONS**

- A. Shades: Solar Screen Fabric.
  - 1. Type: Roller shades.
  - 2. Fabric: Basis of Design: Soho Collection; Manual- 1600 Series, Electric- 1100 & 1900 Series.
  - 3. Color: As selected by Architect from manufacturer's full range of colors.
  - 4. Mounting: Inside (between jambs).
  - 5. Operation: Manual and motorized, in locations indicated.

#### **2.03 ROLLER SHADES**

- A. Roller Shades: Fabric roller shades complete with mounting brackets, roller tubes, hembars, hardware and accessories; fully factory-assembled.
  - 1. Drop: Regular roll.
  - 2. Size: As indicated on drawings.
- B. Fabric: Non-flammable, color-fast, impervious to heat and moisture, and able to retain its shape under normal operation; PVC-free; 100 percent recycled.

1. Privacy Shades: Soften the light yet still reveal some details to the outside; moderate privacy; Openness Factor approximately equal to 1 percent.
  2. Blackout Shades: Block virtually all the light; Openness Factor equal to zero (0).
  3. Flammability: Pass NFPA 701 large and small tests.
  4. Fungal Resistance: No growth when tested according to ASTM G21.
- C. Roller Tube: As required for type of operation, extruded aluminum with end caps.
1. Fabric Attachment: Utilize extruded channel in tube to accept vinyl spline welded to fabric edge.
  2. Finish: Baked enamel; color from manufacturer's standards.
- D. Hembars and Hembar Pockets: Wall thickness designed for weight requirements and adaptation to uneven surfaces, to maintain bottom of shade straight and flat.
- E. Manual Operation: Clutch operated continuous loop; beaded ball chain.
- F. Motor Operation: Motor system housed inside roller tube, controlling shade movement via motor controls indicated; listed to UL 325.
1. Audible Noise: Maximum 39 dBA measured 3 feet from the motor unit; no audible clicks when motor starts and stops.
  2. Motors: Size and configuration as recommended by manufacturer for the type, size, and arrangement of shades to be operated; integrated into shade operating components and concealed from view.
  3. Motor Type: Both AC and DC motors are acceptable; provide required transformers for DC motors.
  4. Coupling of Multiple Shades: Where possible, minimize number of motors by coupling adjacent shades.
  5. Control Compatibility: Fully compatible with the controls to be installed.

#### **2.04 MOTOR CONTROLS**

- A. Motorized shades to be controlled by wall-mounted controls, wireless (RF) handheld remote controls, infrared handheld remote controls, and automatic solar-tracking controls as specified below.
- B. Control Requirements:
1. Unless specifically indicated to be excluded, provide all required equipment, conduit, boxes, wiring, connectors, hardware, supports, accessories, software, system programming, etc. as necessary for a complete operating system that provides the control intent indicated.
- C. Wall-Mounted Controls: UV stabilized visible parts meeting ASTM D4674; furnished with backlit buttons; provided by shade manufacturer.
1. Control Functions:
    - a. Open: Automatically open controlled shade(s) to fully open position when button is pressed.
    - b. Close: Automatically close controlled shade(s) to fully closed position when button is pressed.
    - c. Raise: Raise controlled shade(s) only while button is pressed.
    - d. Lower: Lower controlled shade(s) only while button is pressed.
    - e. Stop shade(s) in motion by tap on any button.
  2. Finish: As specified in Section 262726.
  3. Button Engraving: Manufacturer's standard engraving, unless otherwise indicated.
- D. Wireless (Radio Frequency) Handheld Remote Control: Battery-powered; provided by shade manufacturer.
1. Wireless Range: 30 feet.
  2. Finish: White.
- E. Infrared Handheld Remote Control: Battery-powered; provided by shade manufacturer.
1. Control Functions:
    - a. Open: Automatically open controlled shade(s) to fully open position when button is pressed.



- b. Close: Automatically close controlled shade(s) to fully closed position when button is pressed.
  - c. Raise: Raise controlled shade(s) only while button is pressed.
  - d. Lower: Lower controlled shade(s) only while button is pressed.
  - e. Stop shade(s) in motion by tap on any button.
- 2. Finish: White.
- F. Automatic Solar-Tracking Controls:
  - 1. Calculates the sun's position in the sky relative to the building and then calculates when shade movement is necessary by facade.
  - 2. Calculates the position of the shade to limit direct sunlight penetration to a predetermined limit.
  - 3. Shades along same facade to start, stop and track in unison to maintain a consistent exterior aesthetic.
  - 4. Provides a preset, also referred to as visor position, to limit maximum amount of light entering a space.
  - 5. Uses the following inputs for startup:
    - a. Building location.
    - b. Facade orientation.
    - c. Window dimensions.
    - d. Solar depth of penetration.
    - e. Number of shade movements per day.
    - f. Visor position of shades.
  - 6. Requires minimal long term maintenance and service. Does not require user to make daily changes to programming or overall system functionality, unless desired by owner.
  - 7. Override Capability:
    - a. Manual: Temporary override, using wall controls as specified above.
    - b. Automatic: When sensors detect dark cloudy conditions, shades to go to predetermined visor position to maximize view and available daylight.

## 2.05 ACCESSORIES

- A. Fascias: Size as required to conceal shade mounting.
  - 1. Style: As selected by Architect from shade manufacturer's full selection.
- B. Brackets and Mounting Hardware: As recommended by manufacturer for mounting configuration and span indicated.
- C. Interior Side Channels: As required for light sealing blackout shade applications.
- D. Fasteners: Non-corrosive, and as recommended by shade manufacturer.

## 2.06 FABRICATION

- A. Field measure finished openings prior to ordering or fabrication.
- B. Fabricate shades to fit openings within specified tolerances.
  - 1. Vertical Dimensions: Fill openings from head to sill with 1/2 inch space between bottom bar and window stool.
  - 2. Horizontal Dimensions - Inside Mounting: Fill openings from jamb to jamb.
- C. Dimensional Tolerances: As recommended in writing by manufacturer.
- D. At openings requiring continuous multiple shade units with separate rollers, locate roller joints at window mullion centers; butt rollers end-to-end.

## PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Examine finished openings for deficiencies that may preclude satisfactory installation.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- C. Start of installation shall be considered acceptance of substrates.

### **3.02 PREPARATION**

- A. Prepare surfaces using methods recommended by manufacturer for achieving best result for substrate under the project conditions.
- B. Coordinate with window installation and placement of concealed blocking to support shades.

### **3.03 INSTALLATION**

- A. Install in accordance with manufacturer's instructions and approved shop drawings, using mounting devices as indicated.
- B. Installation Tolerances:
  - 1. Maximum Offset From Level: 1/16 inch.
- C. Replace shades that exceed specified dimensional tolerances at no extra cost to Owner.
- D. Adjust level, projection and shade centering from mounting bracket. Verify there is no telescoping of shade fabric. Ensure smooth shade operation.

### **3.04 SYSTEM STARTUP**

- A. Motorized Shade System: Provide services of a manufacturer's authorized representative to perform system startup.

### **3.05 CLEANING**

- A. Clean soiled shades and exposed components as recommended by manufacturer.
- B. Replace shades that cannot be cleaned to "like new" condition.

### **3.06 PROTECTION**

- A. Protect installed products from subsequent construction operations.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

**END OF SECTION**

## **SECTION 123600 COUNTERTOPS**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Countertops for architectural cabinet work.
- B. Wall-hung counters and vanity tops.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 064100 - Architectural Wood Casework.

#### **1.03 REFERENCE STANDARDS**

- A. ANSI A161.2 - Performance Standards for Fabricated High Pressure Decorative Laminate Countertops; 1998.
- B. ANSI A208.1 - American National Standard for Particleboard; 2022.
- C. ANSI A208.2 - Medium Density Fiberboard (MDF) for Interior Applications; 2022.
- D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023b.
- E. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition; 2014, with Errata (2016).
- F. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards; 2021, with Errata.
- G. IAPMO Z124 - Plastic Plumbing Fixtures; 2022, with Editorial Revision.
- H. ISFA 2-01 - Classification and Standards for Solid Surfacing Material; 2013.
- I. ISFA 3-01 - Classification and Standards for Quartz Surfacing Material; 2013.
- J. MIA (DSDM) - Dimensional Stone Design Manual, Version VIII; 2016.
- K. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.
- L. PS 1 - Structural Plywood; 2019.

#### **1.04 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
  - 1. Preparation instructions and recommendations.
  - 2. Storage and handling requirements and recommendations.
  - 3. Specimen warranty.
- C. Shop Drawings: Complete details of materials and installation ; combine with shop drawings of cabinets and casework specified in other sections.
- D. Selection Samples: For each finish product specified, color chips representing manufacturer's full range of available colors and patterns.
- E. Verification Samples: For each finish product specified, minimum size 6 inches square, representing actual product, color, and patterns.
- F. Test Reports: Chemical resistance testing, showing compliance with specified requirements.
- G. Installation Instructions: Manufacturer's installation instructions and recommendations.
- H. Maintenance Data: Manufacturer's instructions and recommendations for maintenance and repair of countertop surfaces.

#### **1.05 QUALITY ASSURANCE**

- A. Installer Qualifications: Company specializing in performing work of the type specified in this section, with not less than three years of documented experience.
- B. Fabricator Qualifications: Same fabricator as for cabinets on which tops are to be installed.

#### **1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

#### **1.07 FIELD CONDITIONS**

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under

environmental conditions outside manufacturer's absolute limits.

## **PART 2 PRODUCTS**

### **2.01 COUNTERTOPS**

- A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.
- B. Plastic Laminate Countertops: High-pressure decorative laminate (HPDL) sheet bonded to substrate.
  - 1. Laminate Sheet: NEMA LD 3, Grade HGS, 0.048 inch nominal thickness.
    - a. Surface Burning Characteristics: Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.
    - b. Finish: Matte or suede, gloss rating of 5 to 20.
    - c. Surface Color and Pattern: As indicated on drawings.
    - d. Manufacturers:
      - 1) Basis of Design: Formica.
      - 2) Substitutions: See Section 016000 - Product Requirements.
  - 2. Exposed Edge Treatment: Square, substrate built up to minimum 1-1/4 inch thick; covered with matching laminate.
  - 3. Back and End Splashes: Same material, same construction.
- C. Solid Surfacing Countertops: Solid surfacing sheet or plastic resin casting over continuous substrate.
  - 1. Flat Sheet Thickness: 1/2 inch, minimum.
  - 2. Solid Surfacing Sheet and Plastic Resin Castings: Complying with ISFA 2-01 and NEMA LD 3; acrylic or polyester resin, mineral filler, and pigments; homogenous, non-porous and capable of being worked and repaired using standard woodworking tools; no surface coating; color and pattern consistent throughout thickness.
    - a. Manufacturers: Basis of Design: Corian.
      - 1) Substitutions: See Section 016000 - Product Requirements.
    - b. Sinks and Bowls: Integral castings; minimum 3/4 inch wall thickness; comply with IAPMO Z124.
    - c. Finish on Exposed Surfaces: Matte, gloss rating of 5 to 20.
    - d. Color and Pattern: As indicated on drawings.
  - 3. Other Components Thickness: 3/4 inch, minimum.
  - 4. Exposed Edge Treatment: Built up to minimum 1-1/4 inch thick; square edge; use marine edge at sinks.
  - 5. Back and End Splashes: Same sheet material, square top; minimum 4 inches high.
  - 6. Skirts: As indicated on drawings.
- D. Natural Quartz and Resin Composite Countertops: Sheet or slab of natural quartz and plastic resin self-supporting over structural members.
  - 1. Flat Sheet Thickness: 1-1/4 inch, minimum.
  - 2. Natural Quartz and Resin Composite Sheets, Slabs and Castings: Complying with ISFA 3-01 and NEMA LD 3; orthophthalic polyester resin, mineral filler, and pigments; homogenous, non-porous and capable of being worked and repaired using standard woodworking tools; no surface coating; color and pattern consistent throughout thickness.
    - a. Manufacturers: Basis of Design: Ceasarstone.
      - 1) Substitutions: See Section 016000 - Product Requirements.
    - b. Factory fabricate components to the greatest extent practical in sizes and shapes indicated; comply with the MIA Dimension Stone Design Manual.
    - c. Surface Burning Characteristics: Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.
    - d. Finish on Exposed Surfaces: Polished.
    - e. Color and Pattern: As indicated on drawings.
  - 3. Other Components Thickness: 3/4 inch, minimum.
  - 4. Exposed Edge Treatment: Built up to minimum 1-1/4 inch thick; square edge.
  - 5. Back and End Splashes: Same sheet material, square top; minimum 4 inches high.
  - 6. Skirts: As indicated on drawings.

7. Fabricate in accordance with manufacturer's standard requirements.

## **2.02 MATERIALS**

- A. Plywood for Supporting Substrate: PS 1 Exterior Grade, A-C veneer grade, minimum 5-ply; minimum 3/4 inch thick; join lengths using metal splines.
- B. Particleboard for Supporting Substrate: ANSI A208.1 Grade 2-M-2, 45 pcf minimum density; minimum 3/4 inch thick; join lengths using metal splines.
- C. Adhesives: Chemical resistant waterproof adhesive as recommended by manufacturer of materials being joined.

## **2.03 FABRICATION**

- A. Fabricate tops and splashes in the largest sections practicable, with top surface of joints flush.
  1. Join lengths of tops using best method recommended by manufacturer.
  2. Fabricate to overhang fronts and ends of cabinets 1 inch except where top butts against cabinet or wall.
  3. Prepare all cutouts accurately to size; replace tops having improperly dimensioned or unnecessary cutouts or fixture holes.
- B. Provide back/end splash wherever counter edge abuts vertical surface unless otherwise indicated.
  1. Secure to countertop with concealed fasteners and with contact surfaces set in waterproof glue.
  2. Height: 4 inches, unless otherwise indicated.
- C. Solid Surfacing: Fabricate tops and wall panels up to 144 inches long in one piece; join pieces with adhesive sealant in accordance with manufacturer's recommendations and instructions.
  1. Integral sinks: Shop-mount securely to countertop with adhesives, using flush configuration, as per manufacturer's instructions, and as detailed on drawings.
- D. Wall-Mounted Counters: Provide skirts, aprons, brackets, and braces as indicated on drawings, finished to match.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- C. Verify that wall surfaces have been finished and mechanical and electrical services and outlets are installed in proper locations.

### **3.02 PREPARATION**

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

### **3.03 INSTALLATION**

- A. Securely attach countertops to cabinets using concealed fasteners. Make flat surfaces level; shim where required.
- B. Attach plastic laminate countertops using screws with minimum penetration into substrate board of 5/8 inch.
- C. Seal joint between back/end splashes and vertical surfaces.

### **3.04 TOLERANCES**

- A. Variation From Horizontal: 1/8 inch in 10 feet, maximum.
- B. Offset From Wall, Countertops: 1/8 inch maximum; 1/16 inch minimum.
- C. Field Joints: 1/8 inch wide, maximum.

### **3.05 CLEANING**

- A. Clean countertops surfaces thoroughly.

### **3.06 PROTECTION**

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

**END OF SECTION**

**SECTION 142100  
ELECTRIC TRACTION ELEVATORS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Electric traction elevator systems.

**1.02 RELATED REQUIREMENTS**

- A. Section 033000 - Cast-in-Place Concrete.
- B. Section 034100-Precast Structural Concrete.
- C. Section 096500 - Resilient Flooring.
- D. Section 211300 - Fire-Suppression Sprinkler Systems.
- E. Section 220513 - Common Motor Requirements for Plumbing Equipment.
- F. Section 260533.13 - Conduit for Electrical Systems: Electrical conduit requirements.
- G. Section 260583 - Wiring Connections: Wiring connection requirements.

**1.03 REFERENCE STANDARDS**

- A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.
- B. AISC 360 - Specification for Structural Steel Buildings; 2022.
- C. ASME A17.1 - Safety Code for Elevators and Escalators Includes Requirements for Elevators, Escalators, Dumbwaiters, Moving Walks, Material Lifts, and Dumbwaiters with Automatic Transfer Devices; 2019, with Errata (2021).
- D. ASME A17.2 - Guide for Inspection of Elevators, Escalators, and Moving Walks Includes Inspection Procedures for Electric Traction and Winding Drum Elevators, Hydraulic Elevators, Inclined Elevators, Limited-Use/Limited-Application Elevators, Private Residence Elevators, Escalators, Moving Walks, and Dumbwaiters; 2020.
- E. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.
- F. ASTM A276/A276M - Standard Specification for Stainless Steel Bars and Shapes; 2023.
- G. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2023.
- H. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.
- I. ASTM B455/B455M - Standard Specification for Copper-Zinc-Lead Alloy (Leaded-Brass) Extruded Shapes; 2020.
- J. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification; 2021.
- K. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020, with Errata (2023).
- L. NEMA MG 1 - Motors and Generators; 2021.
- M. NFPA 13 - Standard for the Installation of Sprinkler Systems; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- N. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- O. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2022.
- P. PS 1 - Structural Plywood; 2019.

**1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Preinstallation Meeting: Convene meeting at least one week prior to start of this work.
  - 1. Review schedule of installation, proper procedures and conditions, and coordination with related work.
  - 2. Review use of elevator for construction purposes, hours of use, scheduling of use, cleanliness of car, employment of operator, and maintenance of system.
- B. Construction Use of Elevator: Not permitted.

**1.05 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Submit data on following items:
  - 1. Signal and operating fixtures, operating panels, and indicators.
  - 2. Car design, dimensions, layout, and components.

3. Car and hoistway door and frame details.
  4. Electrical characteristics and connection requirements.
- C. Shop Drawings: Include appropriate plans, elevations, sections, diagrams, and details on following items:
1. Elevator Equipment and Machines: Size and location of driving machines, power units, controllers, governors, and other components.
  2. Hoistway Components: Size and location of car machine beams, guide rails, buffers, ropes, and other components.
  3. Rail bracket spacing; maximum loads imposed on guide rails requiring load transfer to building structural framing.
  4. Individual weight of principal components; load reaction at points of support.
  5. Loads on hoisting beams.
  6. Clearances and over-travel of car and counterweight.
  7. Locations in hoistway of traveling cables and connections for car lighting and telephone.
  8. Location and sizes of hoistway and car doors and frames.
  9. Interface with building security system.
  10. Electrical characteristics and connection requirements.
  11. Indicate arrangement of elevator equipment and allow for clear passage of equipment through access openings.
- D. Samples: Submit samples illustrating car interior finishes, car and hoistway door and frame finishes, and handrail material and finish in the form of cut sheets, finish color selection brochures, or finish samples.
- E. Manufacturer's Qualification Statement.
- F. Welders' Qualification Statement: Welders' certificates in accordance with AWS B2.1/B2.1M and dated no more than 12 months before start of scheduled welding work.
- G. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
- H. Initial Maintenance Contract.
- I. Maintenance Contract: Submit proposal to Owner for standard one year continuing maintenance contract agreement in accordance with ASME A17.1 and requirements as indicated, starting on date initial maintenance contract is scheduled to expire.
1. Indicate in proposal the services, obligations, conditions, and terms for agreement period and for renewal options.
- J. Operation and Maintenance Data:
1. Parts catalog with complete list of equipment replacement parts; identify each entry with equipment description and identifying code.
  2. Operation and maintenance manual.
  3. Schematic drawings of equipment, and wiring diagrams of installed electrical equipment with list of corresponding symbols to identify markings on machine room and hoistway apparatus.

#### **1.06 QUALITY ASSURANCE**

- A. Designer Qualifications: Design guide rails under direct supervision of a licensed Professional Structural Engineer experienced in design of this type of work and licensed in the State in which the Project is located.
- B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum ten years documented experience.
- C. Installer Qualifications: Supervisor along with trained elevator installation personnel on staff of elevator equipment manufacturer.

#### **1.07 WARRANTY**

- A. See Section 017800 - Closeout Submittals for additional warranty requirements.
- B. Provide manufacturer's warranty for elevator operating equipment and devices for one year from Date of Substantial Completion.



## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Electric Traction Elevators:
  - 1. Basis of Design: ThyssenKrupp Elevator; Evolution 200 MRL: [www.us.schindler.com/#sle](http://www.us.schindler.com/#sle).
- B. Substitutions: See Section 016000 - Product Requirements.
- C. Source Limitations: Provide elevator and associated equipment and components produced by the same manufacturer as the other elevator equipment used for this project and obtained from a single supplier.

### **2.02 ELECTRIC TRACTION ELEVATORS**

- A. Electric Traction Passenger Elevator, No. 1:
  - 1. Electric Traction Elevator Equipment:
    - a. Gearless Traction Machine: Single wrapped traction driving sheave, with dual brake.
  - 2. Drive System:
    - a. Solid-state electronic device with alternating current (AC) with regenerative drive.
  - 3. Service Control Types:
    - a. Standard service control only.
  - 4. Interior Car Height: 90 inch.
  - 5. Electrical Power: 480 volts; alternating current (AC); three phase; 60 Hz.
  - 6. Rated Net Capacity: 3500 pounds.
  - 7. Rated Speed: 150 feet per minute.
  - 8. Hoistway Size: As indicated on drawings.
  - 9. Interior Car Platform Size: As indicated on drawings.
  - 10. Elevator Pit Depth: 60 inch.
  - 11. Overhead Clearance at Top Floor: 140 inch.
  - 12. Travel Distance: As indicated on drawings.
  - 13. Number of Stops: As indicated on drawings.
  - 14. Traction Machine Location: Top of hoistway shaft.

### **2.03 COMPONENTS**

- A. Elevator Equipment:
  - 1. Motors, Controllers, Controls, Buttons, Wiring, Devices, and Indicators: Comply with NFPA 70 requirements, and see Section 260583 for additional information.
  - 2. Guide Rails, Cables, Counterweights, Sheaves, Buffers, Attachment Brackets and Anchors: Design criteria for components includes safety factors in accordance with applicable requirements of Elevator Code, ASME A17.1.
  - 3. Buffers:
    - a. Spring type for elevators with speed less than or equal to 200 feet per minute.
    - b. Oil type for elevators with speed greater than 200 feet per minute.
  - 4. Lubrication Equipment:
    - a. Provide grease fittings for periodic lubrication of bearings.
    - b. Grease Cups: Automatic feed type.
    - c. Lubrication Points: Visible and easily accessible.
- B. Electrical Equipment:
  - 1. Motors: NEMA MG 1.
  - 2. Boxes, Conduit, Wiring, and Devices: Comply with NFPA 70 requirements.
  - 3. Sump Pump in Pit:
  - 4. Spare Conductors: Provide ten percent in extra conductors and two pairs of shielded audio cables in traveling cables.
  - 5. Include wiring and connections to elevator devices remote from hoistway.

### **2.04 PERFORMANCE REQUIREMENTS**

- A. Regulatory Requirements: Comply with ASME A17.1, applicable local codes, and authorities having jurisdiction (AHJ).
- B. Accessibility Requirements: Comply with ADA Standards.

- C. Perform structural steel design, fabrication, and installation in accordance with AISC 360.
- D. Perform welding of steel in accordance with AWS D1.1/D1.1M.
- E. Fabricate and install door and frame assemblies in accordance with NFPA 80 and complying with requirements of authorities having jurisdiction (AHJ).
- F. Perform electrical work in accordance with NFPA 70.
- G. Comply with venting or pressurization of hoistway design in accordance with HVAC system requirements and authorities having jurisdiction (AHJ).
- H. Comply with fire protection sprinkler system of hoistway design in accordance with NFPA 13 requirements and authorities having jurisdiction (AHJ).

## **2.05 OPERATION CONTROLS**

- A. Elevator Controls: Provide landing operating panels and landing indicator panels.
  - 1. Landing Operating Panels: Metallic type, one for originating "Up" and one for originating "Down" calls, one button only at terminating landings; with illuminating indicators.
  - 2. Landing Indicator Panels: Illuminating.
  - 3. Comply with ADA Standards for elevator controls.
- B. Interconnect elevator control system with building security, fire alarm, card access, smoke alarm, and building management control systems.
- C. Door Operation Controls:
  - 1. Program door control to open doors automatically when car arrives at floor landing.
  - 2. Render "Door Close" button inoperative when car is standing at dispatch landing with doors open.
  - 3. Door Safety Devices: Moveable, retractable safety edges, quiet in operation; equipped with photo-electric light rays.
- D. Lobby Monitoring Panel:
  - 1. Locate status indicator and control panel for each individual elevator and group of elevators as indicated on drawings.
  - 2. Etch face plate markings in panel, and fill with paint of contrasting color.
  - 3. Include direction indicator displaying landing "Up" and "Down" calls registered at each landing floor.
  - 4. Include position and motion display for direction of travel of each elevator; display appropriate graphic characters on non-glare screen; indicate position of cars at rest and in motion.

## **2.06 OPERATION CONTROL TYPE**

- A. Selective Collective Automatic Operation Control: Applies to car in single elevator shaft.
  - 1. Refer to description provided in ASME A17.1.
  - 2. Automatic operation by means of one button in the car for each landing served and by "UP" and "DOWN" buttons at the landings.
  - 3. Stops are registered by momentary actuation of landing car buttons without consideration of the number of buttons actuated or the sequence buttons are actuated, but the stops are made in the order that landings are reached in each direction of travel.
  - 4. All "UP" landing calls are made when car is traveling in the up direction.
  - 5. All "DOWN" landing calls are made when car is traveling in the down direction.
  - 6. Uppermost and lowermost calls are answered as soon as they are reached without consideration of the car travel direction.

## **2.07 EMERGENCY POWER**

- A. Elevator Emergency Power Supply: Supplied by battery backup; provide elevator system components as required for emergency power characteristics.
- B. Emergency Lighting: Comply with ASME A17.1 elevator lighting requirements.
- C. Provide operational control circuitry for adapting the change from normal to emergency power.
- D. Upon transfer to emergency power, advance one elevator at a time to a pre-selected landing, stop car, open doors, disable operating circuits, and hold in standby condition.

## **2.08 MATERIALS**

- A. Rolled Steel Sections, Shapes, Rods: ASTM A36/A36M.

- B. Stainless Steel Sheet: ASTM A666, Type 304; No. 4 Brushed finish unless otherwise indicated.
- C. Stainless Steel Bars, Shapes and Moldings: ASTM A276/A276M, Type 304.
- D. Extruded Brass Shapes: ASTM B455/B455M, Copper Alloy UNS C38500, Architectural Bronze, 57 percent copper, polished finish.
- E. Aluminum Sheet: ASTM B209/B209M, 3105 alloy, O temper.
- F. Plywood: PS 1, Structural I, Grade C-D or better, sanded.
- G. Resilient Flooring: Vinyl tile flooring, Resilient base, and Resilient flooring by others.

## 2.09 CAR AND HOISTWAY ENTRANCES

- A. Elevator, No. 1:
  - 1. Car and Hoistway Entrances, Each Elevator Floor Lobby:
    - a. Hoistway Fire Rating: 1 Hour. As indicated on drawings.
    - b. Elevator Door Fire Rating: 1 Hour. As indicated on drawings.
    - c. Framed Opening Finish and Material: Brushed stainless steel.
    - d. Car Door Material: Stainless steel, with rigid sandwich panel construction.
    - e. Hoistway Door Material: Stainless steel, with rigid sandwich panel construction.
    - f. Door Type: Single leaf.
    - g. Door Operation: Side opening, two speed.
    - h. Sills: Manufacturer's standard.
    - i. Hall Lantern: Kone KSS 570.
    - j. Landing Call Station: Kone KSS 570.
  - B. Sills/Thresholds: Configure to align with frame return and coordinate with floor finish.
  - C. Gasketing: Provide acoustic type gasketing at hoistway doors and frames to eliminate audible noise due to car activities in the hoistway, and air pressure differential between hoistway and landing floors.

## 2.10 CAR EQUIPMENT AND MATERIALS

- A. Elevator Car, No. 1:
  - 1. Car Operating Panel: Kone KSS 570; Provide main and auxiliary; flush-mounted applied face plate, with illuminated call buttons corresponding to floors served with "Door Open/Door Close" buttons, "Door Open" button, "Door Close" button, and alarm button.
    - a. Panel Material: Integral with front return; one per car.
    - b. Car Floor Position Indicator: Above car operating panel with illuminating position indicators.
    - c. Locate alarm button where it is unlikely to be accidentally actuated; not more than 54 inch above car finished floor.
    - d. Service Panel: Kone KSS 570; Provide following within service cabinet as part of car operating panel:
      - 1) Switch for each auxiliary operational control, keyed.
      - 2) Switches for fan, light, and inspection control.
      - 3) Emergency light.
      - 4) Telephone cabinet and hard-wired connection with telephone.
      - 5) Convenience outlet receptacle; 110 VAC, 15 amps.
  - 2. Flooring: Resilient vinyl tile.
  - 3. Wall Base: Brushed stainless steel, 4 inch high.
  - 4. Front Return Panel: Match material of car door.
  - 5. Door Wall: Stainless steel.
  - 6. Side Walls: Stainless steel.
  - 7. Rear Wall (Elevators 1, 2, & 3): Pearl Silver, pearlescent laminate..
  - 8. Rear Wall (Elevator 4): Stainless steel.
  - 9. Hand Rail: Stainless steel, at three side walls. Provide open clearance space 1-1/2 inch (38 mm) wide to face of wall.
    - a. Kone HR61: Round, straight ends.
      - 1) Stainless Steel Finish: No. 4 Brushed.
  - 10. Ceiling:
    - a. Kone CL88: Round, LED spotlights; brushed stainless steel.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify existing conditions before starting this work.
- B. Verify that hoistway and pit are ready for work of this section.
- C. Verify hoistway shaft and openings are of correct size and within tolerance.
- D. Verify location and size of machine foundation and position of machine foundation bolts.
- E. Verify that electrical power is available and of correct characteristics.

### **3.02 PREPARATION**

- A. Arrange for temporary electrical power for installation work and testing of elevator components. See Section 015000 - Temporary Facilities and Controls for additional requirements.
- B. Maintain elevator pit excavation free of water.

### **3.03 INSTALLATION**

- A. Coordinate this work with installation of hoistway wall construction.
- B. Install system components, and connect equipment to building utilities.
- C. Provide conduit, electrical boxes, wiring, and accessories; see Sections 260533.13 and 260583.
- D. Mount machines and motors on vibration and acoustic isolators.
  - 1. Place on structural supports and bearing plates.
  - 2. Securely fasten to building supports.
  - 3. Prevent lateral displacement.
- E. Install hoistway, elevator equipment, and components in accordance with approved shop drawings.
- F. Install guide rails to allow for expansion and contraction movement of guide rails.
- G. Accurately machine and align guide rails, forming smooth joints with machined splice plates.
- H. Install hoistway door sills, frames, and headers in hoistway walls; grout sills in place, set hoistway floor entrances in alignment with car openings, and align plumb with hoistway.
- I. Structural Metal Surfaces: Clean surfaces of rust, oil or grease; wipe clean with solvent; prime with two coats.
- J. Wood Surfaces not Exposed to Public View: Finish with one coat primer; one coat enamel.
- K. Adjust equipment for smooth and quiet operation.

### **3.04 TOLERANCES**

- A. Guide Rail Alignment: Plumb and parallel to each other in accordance with ASME A17.1 and ASME A17.2.
- B. Car Movement on Aligned Guide Rails: Smooth movement, without any objectionable lateral or oscillating movement or vibration.

### **3.05 ADJUSTING**

- A. Adjust for smooth acceleration and deceleration of car to minimize passenger discomfort.
- B. Adjust with automatic floor leveling feature at each floor landing to reach 1/4 inch maximum from flush with sill.

### **3.06 CLEANING**

- A. See Section 017000 - Execution and Closeout Requirements for additional requirements.
- B. Remove protective coverings from finished surfaces.
- C. Clean surfaces and components in accordance with manufacturers written instructions.

### **3.07 CLOSEOUT ACTIVITIES**

- A. See Section 017800 - Closeout Submittals for closeout submittals.
- B. See Section 017900 - Demonstration and Training for additional requirements.
- C. Demonstration: Demonstrate operation of system to Owner's personnel.
  - 1. Use operation and maintenance data as reference during demonstration.
  - 2. Briefly describe function, operation, cleaning and maintenance of each component.
- D. Training: Train Owner's personnel on cleaning and operation and maintenance of system.

1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
2. Provide minimum of two hours of training.
3. Instructor: Manufacturer's training personnel.
4. Location: At project site, unless otherwise indicated.

### **3.08 PROTECTION**

- A. Do not permit construction traffic within car after cleaning.
- B. Protect installed products until Date of Substantial Completion.
- C. Touch-up, repair, or replace damaged products and materials before Date of Substantial Completion.

### **3.09 MAINTENANCE**

- A. See Section 017000 - Execution and Closeout Requirements for additional requirements relating to initial maintenance service.
- B. Provide Initial Maintenance Contract of elevator system and components in accordance with ASME A17.1 and requirements as indicated for three months from Date of Substantial Completion.
- C. Submit proposal for continuation of Maintenance Contract in accordance with ASME A17.1 and requirements as indicated for installed elevator equipment.
- D. Include systematic examination, adjustment, and lubrication of elevator equipment.
- E. Perform work without removing cars from use during peak traffic periods.
- F. Provide emergency call back service during regular working hours throughout period of this maintenance contract.

**END OF SECTION**

Table of Contents

Division	Section Title	Pages
----------	---------------	-------

**DIVISION 21 – FIRE PROTECTION**

21 1000	Fire Suppression Systems	10
---------	--------------------------	----

**DIVISION 22 - PLUMBING**

22 0500	General Plumbing Requirements	7
22 0510	Basic Plumbing Materials and Methods	6
22 0700	Plumbing Systems Insulation	3
22 4000	Plumbing	8

**DIVISION 23 – HEATING, VENTILATION AND AIR CONDITIONING**

23 0500	General HVAC Requirements	7
23 0510	Basic HVAC Materials and Methods	4
23 0593	Testing, Adjusting, and Balancing (Air and Water)	3
23 0700	HVAC Systems Insulation	6
23 0900	Controls & Control Sequences	20
23 2113	Hydronic Piping Systems	19
23 2123	HVAC Hydronic Pumps	6
23 7000	Ventilation and Air Conditioning	19

**FIRE PROTECTION WORK SHALL INCLUDE:**

SECTION 21 1000

**PLUMBING, & HYDRONICS WORK SHALL INCLUDE:**

SECTION 22 4000, 23 2113, & 23 2123

& SECTIONS 22 0500, 22 0510, 22 0700, 23 0500, 23 0510, & 23 0700 AS APPLIES

**VENTILATION AND AIR CONDITIONING WORK SHALL INCLUDE:**

SECTION 23 0593, & 23 7000

& SECTIONS 23 0500, 23 0510 & 23 0700 AS APPLIES

**TEMPERATURE CONTROL WORK SHALL INCLUDE:**

SECTION 23 0900

& SECTIONS 23 0500, 23 0510 & 23 0700 AS APPLIES

**SECTION 21 1000  
FIRE SUPPRESSION SYSTEMS**

**PART 1 GENERAL**

**1.01 DEFINITIONS**

- A. Contractor – Defined as the Contractor, Subcontractor and/or Subcontractors which are responsible for all or any part of the fire suppression system installation specified in Division 21 and/or as shown on the Contract Drawings.
- B. Wet Pipe Sprinkler System – A system in which automatic sprinklers are attached to piping filled with water allowing water to discharge immediately from sprinklers when activated. Sprinklers activate when heat bursts a frangible glass bulb or melts a fusible link. System activation or incidental flow is monitored by flow switches and/or alarm valves. Hose connections are included when required by code.

**1.02 SCOPE**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 shall apply to this section.
- B. Where any requirements specified on the plans conflict with the specifications of this section, the specifications indicated on the plans shall govern.
- C. The Contractor shall provide all items, articles, materials, operations or methods listed, mentioned or scheduled on the Drawings and/or herein specified, including all labor, materials, equipment, accessories, wiring and incidentals necessary to be installed in accordance with manufacturer's recommendations except as otherwise approved.
- D. The fire protection system shall be a wet-pipe system consisting of a single zone to protect the entire Lincoln Hall facility as defined by the plans. The system in office, classroom, commons, and circulations areas shall be designed for light hazardous classification. The storage, custodial, lockers, laundry, and mechanical areas shall be designed for ordinary hazard, group 1 or 2 classification as defined by the plans. In addition, a 4" bulk main will be required to be installed through the Student Center into Graham Hall for future use in providing sprinkler protection to Graham Hall.
- E. System(s) will be supplied by an 6" underground dedicated fire sprinkler service located in Water Entry 160.
- F. The system(s) shall be complete with, but not limited to, sprinklers, piping, valves, alarm bell/horn, fire department connection, backflow preventer test connection, and controls necessary for a complete system.
- G. See the plans for water supply flow test information.

**1.03 CONTRACTOR QUALIFICATIONS**

- A. The Contractor for the fire protection installation shall be a qualified Fire Protection Contractor licensed in the State of South Dakota that has been regularly engaged in the installation of similar Automatic Fire Sprinkler Systems and associated fire protection equipment for a minimum of 5 years.

**1.04 PERMITS AND SERVICE CHARGES**

- A. All permits and service charges necessary for execution of the work under this Contract shall be obtained by and paid for by the Contractor. It shall be the responsibility of the Contractor to determine the permit requirements of the local authorities and utility companies and the cost of required permits, service charges, tap fees and development fees shall be included in the Contractor's bid.
- B. All work shall be executed in accordance with all local, state and national rules, regulations, codes, etc., which are applicable and shall be subject to inspection by the proper authorities.

## **1.05 CODES AND STANDARDS**

- A. All work performed and all equipment furnished under this Division of the Contract shall be manufactured and installed in strict accordance with the most recent editions of all applicable codes and standards, including the applicable provisions of the following codes and standards:
  - 1. Local and State Codes, Standards and Regulations
  - 2. National Fire Protection Association (NFPA)
    - a. NFPA 13 –Installation of Sprinkler Systems
    - b. NFPA 25 – Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems
    - c. NFPA 72 – National Fire Alarm and Signaling Code
  - 3. National Electric Code (NEC) (NFPA 70)
  - 4. International Fire Code (IFC)
  - 5. Underwriter's Laboratory (UL)
  - 6. Uniform Plumbing Code
  - 7. International Mechanical Code
  - 8. American Waterworks Association (AWWA)
  - 9. Williams-Steiger Occupational Safety and Health Act of 1970 (OSHA)
  - 10. International Building Code
  - 11. Americans with Disabilities Act (ADA)
- B. Where specific requirements of any code vary with the requirements of another code, the higher standard as determined by the Architect/Engineer shall govern the installation.
- C. All equipment manufactured in accordance with the provisions of the above codes and standards shall bear the label of the respective association bureau thereon.
- D. All materials installed shall have composite fire and smoke hazard ratings as tested by procedures ASTM 84, NFPA 255 and UL 723 not to exceed 25 Flame Spread and 50 Smoke Developed.

## **1.06 AUTHORITIES AND AGENCIES**

- A. All work will be installed for the approval and acceptance of the following:
  - 1. Office of the South Dakota State Engineer
  - 2. Fire Protection Engineer

## **1.07 DRAWINGS**

- A. In general, the Drawings of the fire protection systems and equipment are to scale. However, to determine exact locations of walls and partitions, the Contractor shall consult the architectural and/or structural drawings which are dimensioned. Drawings shall not take precedence over field measurements.
- B. Drawings of piping and sprinklers, although shown on scale drawings, are diagrammatic only. They are intended to indicate size and/or capacity where stipulated, approximate location and/or direction, and approximate general arrangement of one phase of work to another, but not the exact detail or exact arrangement of construction. If it is found, before installation of any or all construction phases, that a more convenient, suitable or workable arrangement of any or all phases of the project would result by varying or altering the arrangement indicated on the Drawings, the Architect/Engineer may require the Contractor to change the location or arrangement of the work without additional cost to the Owner. Such rearrangement shall be in accordance with directions from the Architect/Engineer.
- C. Where discrepancies are discovered after certain portions or phases of the work have been installed, the Architect/Engineer reserves the right to require the Contractor to make changes in pipe, duct, fixture or equipment locations or arrangements to avoid conflicts with work at no additional cost to the Owner.
- D. Because the Drawings are to a relatively small scale to show as large a portion as is practical, the fact that only certain features of the system are indicated does not mean that other similar or different features or details will not be required. The Contractor shall furnish all incidental



labor, material or equipment for the systems so that each system is a complete and operating one unless otherwise specifically stipulated in the detailed body of the specifications.

- E. The Contractor, Subcontractor's and their respective trades shall cooperate in laying out their work so it will fit properly into the space provided. Promptly report to the Architect/Engineer any delay or difficulties encountered in the installation of this work which might prevent prompt and proper installation, or make it unsuitable to connect with or receive the work of others. Failure to so report shall constitute an acceptance of the work of other trades as being fit and proper for the execution of this work.

#### **1.08 SHOP DRAWINGS**

- A. Shop drawings to be submitted in electronic PDF format unless indicated otherwise in the General Conditions.
- B. To the extent practical, complete sets of shop drawings for each specification section shall be submitted. In the case that a particular item is required to be expedited, that particular item may be submitted individually.
- C. Submit shop drawings in electronic PDF format.
- D. Furnish Shop Drawings as follows:
  - 1. For all major items of equipment or materials, regardless of whether the item is to be furnished as specified.
  - 2. For all equipment, systems or devices where Shop Drawings are specifically called for.
  - 3. For all minor items of equipment or materials where the Contractor proposes to deviate from the specified and/or scheduled manufacturer or material.
- E. Shop Drawings will be reviewed by the Architect/Engineer, a review letter will be returned to the Contractor. Shop Drawings shall be submitted sufficiently in advance of the construction schedule to allow time for checking Drawings, resubmittal and rechecking when necessary.
- F. Shop Drawings will be reviewed by the Architect/Engineer, and copies of Shop Drawings will be returned to the Contractor. Shop Drawings shall be submitted sufficiently in advance of the construction schedule to allow time for checking Drawings, resubmittal and rechecking when necessary.
- G. Any equipment or material which is installed without authorization by properly processed Shop Drawings will be subject to removal by the Contractor and reinstallation as directed, without cost to the Owner. All cost for repair for damages as may be incurred to the structure as a result of the above correction shall be paid by this Contractor.
- H. Shop drawing material quantities will not be checked by the Architect/Engineer, and review of Shop Drawings by the Architect/Engineer shall not be construed to be verification of the material quantities and sizes shown on the Shop Drawings. Quantities, sizes, dimensions and locations shown on the Drawings and as specified shall determine material requirements.
- I. Hydraulic calculations proving the system is capable of providing the required design densities to accommodate the use and occupancy of each shall be performed by the contractor. The contractor is required to perform and submit hydraulic calculations as part of their submittal packages.

#### **1.09 COORDINATION**

- A. The Contractor shall communicate with all other Contractors on this project and shall arrange his work in proper relation to the work of others. Work made necessary as a result of failure to coordinate with other Contractors shall be the responsibility of this contractor and shall first be approved by the Architect/Engineer. The contractor shall coordinate with the General Contractor to maximize the efficiency of the onsite placement and to ensure the safe delivery and storage of the materials.

#### **1.10 CLEANING**

- A. The Contractor and/or Subcontractors for the various phases of the work shall clear away all debris, surplus materials, etc., resulting from their work or operations, leaving the job and equipment furnished under any or all contracts in a clean first class condition.

### **1.11 PAINTING**

- A. Painting of materials and equipment furnished shall be as described in DIVISION 9. Contractor shall refinish and restore to the original condition and appearance, all equipment which has sustained damage to the manufacturer's prime and finish coats of enamel or paint. Materials and workmanship shall be equal to the requirements described in DIVISION 9.
- B. Where sprinklers are installed on exposed piping and in other locations where sprinklers are susceptible to paint spray or over-spray, contractor shall cover sprinklers in preparation for painting.

### **1.12 ACCESS TO EQUIPMENT**

- A. Access shall be provided to all motors, valves, controls, specialties, etc., for maintenance purposes. All access doors, access panels, removable sections, etc., required for access shall be provided. The location of the access openings relative to the equipment shall be coordinated to assure proper access to the equipment. The door shall maintain any ratings of the wall, ceiling, etc. that it penetrates.
- B. Access openings are required for valves and other devices requiring access and shall be provided in the housings, tanks, walls, ceilings, etc., under this portion of the Contract.

### **1.13 INSPECTIONS, TESTING, CERTIFICATES, & WARRANTY**

- A. All inspections, examinations and tests required by the authorities and agencies specified shall be arranged and paid for by the Fire Protection Contractor as necessary, to obtain complete and final acceptance of the Fire Protection System per the requirements of NFPA 13 and any other applicable codes. The Contractor shall provide a minimum 1 year warranty on the system effective starting the day of final system acceptance and also at that time be required to provide instruction to the owner or his representative to acquaint that person thoroughly with all system equipment.
- B. After completion of the fire protection installation and at the start of the guarantee year, the Fire Protection Contractor shall execute and file five (5) copies of the "Contractor's Material and Test Certificate, Sprinkler systems - Water Spray Systems" with the Architect/Engineer.

### **1.14 RECORD DRAWINGS**

- A. The Contractor shall keep a complete set of all drawings in the jobsite office for purpose of showing the installation of mechanical systems and equipment. This set of drawings shall be used for no other purpose. Where any equipment or system components are installed different from that shown on the Architect/Engineer's drawings, such differences shall be clearly and neatly shown on this set of drawings using ink or indelible pencil. At the completion of the project, the record set of drawings shall be turned over to the Architect/Engineer and shall become his property. Record drawings may be inspected by the Architect/Engineer at site visits.

### **1.15 OPERATING INSTRUCTIONS**

- A. The Contractor shall furnish the Owner two (2) sets of complete catalog data, manufacturer's literature and detailed manuals covering the operation and maintenance of all equipment specified under this Section. All such literature shall be bound in an amply sized three-ring binder and submitted to the Architect/Engineer for approval and for eventual transmittal to the Owner. The manual shall have a Table of Contents at the front of the manual. In addition to a hard copy of the operating instruction, provide an electronic copy in PDF format to the Owner.
- B. The Contractor shall also supervise the initial operation of all equipment and instruct the operator selected by the Owner in such operation as required to acquaint him thoroughly with the equipment.

## **PART 2 - PRODUCTS**

### **2.01 PRODUCT OPTIONS**

- A. Materials or equipment specified by name of manufacturer, brand, trade name or catalog reference, shall be furnished under the contract unless changed by Addenda or a Contract modification.
- B. Where two (2) or more materials are named, the choice of these shall be limited to the items named. Where the material or equipment named is followed by the phrase "or equal" the required function, dimension, appearance and quality to be met by any proposed substitute is all that is intended to be established.
- C. Proposed substitutions for any named items shall be submitted to the Fire Protection Engineer for approval. No substitution shall be made without the approval of the Fire Protection Engineer. Any proposed substitution requests shall be submitted at least 10 days prior to bid to the Architect/Engineer for approval. Bidders shall not rely upon substitutions made in any other manner.
- D. Should a proposed substitution wish to be made within 10 days of bid the Contractor shall attach his proposed substitution along with the appropriate add or deduct to the Contract amount, should the substitution be accepted. Substitutions proposed by the Contractor will not be considered in the award of the Contract.
- E. All products shall be new and listed for fire protection use and be rated in excess of the maximum expected pressure that will be present in the systems.

### **2.02 SPRINKLERS**

- A. Except where designated otherwise on the drawings, sprinklers shall be as follows:
  - 1. Sprinklers shall be standard semi-recessed white-plated pendant type in all locations where piping is concealed above ceilings.
  - 2. Sprinklers shall be standard upright type where piping is installed exposed in storage, garage and other locations as indicated on the Drawings. Upright sprinklers shall be plain brass finish.
  - 3. Sidewall sprinklers, where permitted, shall be white-plated semi-recessed in finished rooms, plain brass elsewhere.
- B. Temperature rating of sprinklers shall be in accordance with requirements of approving authorities, as noted on the Drawings, and per the requirements of NFPA 13.
- C. Sprinklers shall be installed centered in square ceiling tile and in the narrow dimension of rectangular ceiling tile. In rectangular tiles sprinklers shall be centered or at the quarter points along the longer dimension of the tile.
- D. Sprinklers installed in areas where damage may occur, such as gymnasiums, shall have head guards and as otherwise designated on the drawings. Sprinklers installed at elevations below 7'-0" shall have head guards.
- E. Concealed brass sprinklers with flush white-plated concealer plate shall be installed where noted on the Drawings. Sprinklers shall be Tyco, Reliable, Victaulic, Viking, or equal.

### **2.03 ESCUTCHEONS**

- A. Escutcheons shall be installed as designated on the drawings and shall be the same make as the sprinkler head that is used.
- B. Escutcheons shall be Tyco, Reliable, Victaulic, Viking, or equal.

### **2.04 PIPE AND PIPE FITTINGS**

- A. Furnish and install where shown on the Drawings and required for a complete system, pipe and fittings of type and material for the various services as noted below.
- B. Piping not shown on the Drawings, which is obviously necessary for complete systems, shall be provided and shall be amply sized in accordance with applicable codes and standards.

- C. Wet fire sprinkler system (water-filled) and deluge system (open-type) piping shall be ASTM A-135 standard-weight, black, Schedule 40 with factory or field formed threaded ends for sizes up to 2 inch size. Fittings used on threaded end piping shall be ASME B16.3 Class 150, ductile iron threaded fittings with NPT threads that conform to ANSI B1.20.1. Wet fire sprinkler piping shall be ASTM A-135 Schedule 10, black with factory or field formed roll-grooved ends for sizes 1-1/4" and greater. Grooved fittings shall be standard or short radius ASTM A-536, Grade 65-45-12, ductile iron fittings with cut-grooved ends and non-lead orange enamel coated. Grooved couplings shall include ductile iron, ASTM A-536, Grade 65-45-12, housings with non-lead orange enamel coatings, ASTM A-449 and ASTM A-183 bolts and nuts, and Grade "E" EPDM Type A gaskets. Grooved pipe outlets shall be tee-let, ASTM A-53, ANSI B1.20.1 threaded or cut groove, factory welded outlet fittings. Field installed outlets shall be permitted to be mechanical "T", bolted, ASTM A-536, orange enamel coated ductile iron, with ANSI B1.20.1 threaded or cut groove outlets, Grade "E" EPDM gaskets, and ASTM A-449 and ASTM A-183 bolts and nuts.
- D. All piping that penetrates an exterior wall shall be galvanized Schedule 40 minimum.
- E. Plastic CPVC Schedule 80 piping and fittings are not allowed for this installation.
- F. Copper piping shall be installed where designated on the drawings and as per its listing. Copper piping shall be soldered when installed concealed and brazed when installed exposed. Piping shall be Type M Mueller, Cerro, or equal.
- G. Flexible drop piping to pendent sprinklers is allowed for this project where approved by its listing and proven hydraulically.
- H. All wet and dry system grooved pipe fittings and couplings shall be Victaulic, Anvil Gruvlok, Tyco, Star or equal. Grooved pipe fittings and couplings shall be ductile iron with an orange enamel coating for wet systems and galvanized coating for dry systems. All components shall be supplied by one manufacturer. Pipe fittings and couplings shall be standard or short radius.
- I. All threaded fittings shall be black ductile iron for wet systems and where otherwise required by the drawings. Threaded fittings shall be supplied by Tyco, Star, Anvil, or equal.
- J. All welded outlet fittings shall be Merit, Island, or equal.
- K. All flanged fittings shall be ductile iron per ASTM A536. Flanged fittings shall be Anvil, Star, or equal.
- L. Plastic CPVC fittings are not allowed for this installation.
- M. Copper fittings shall be installed where designated on the drawings and as per its listing.
- N. All pipe ends shall be smooth and burr free and cleaned of any loose debris or pipe hole cutouts prior to installation.

## **2.05 HANGERS AND ATTACHMENTS**

- A. All piping 1/2" through 8" shall be hung through the use of galvanized ring style band hangers with a knurled swivel nut. Hangers, spacing, and rod diameters shall be per NFPA 13 requirements.
- B. 3/8" all thread rod shall be used to attach the ring to the structural attachment device for pipe sizes 1/2" through 4", 1/2" all thread rod shall be used for pipe sizes 6" through 8", and 5/8" all thread rod shall be used for pipe sizes 10" through 12".
- C. Rings shall be Tolco, Hilti, Anvil, or equal.
- D. Structural Attachments shall be Sammy, Tolco, Hilti, or equal.

## **2.06 FIRESTOPPING**

- A. Firestopping materials shall be 3M, Hilti, MetaCaulk, Nelson or equal. Firestopping material shall have a rating resistance rating equal to or greater than the wall in the penetration exists that will be sealed with said firestopping.

## **2.07 WALL, FLOOR AND CEILING PLATES**

- A. Furnish and install chrome-plated wall, floor and ceiling plates on all exposed pipes where they pass through walls, floors, or ceilings in finished areas. Finished areas shall be those areas which are painted or have special finishes within the room. The wall plates shall be a minimum of 3/32 inch thickness and shall have set screws or spring locks for clamping to the piping. Flush valves shall have set screw type wall plates. The plates shall be chrome-plated steel, cast iron or brass and shall set tight against the wall.

## **2.08 CONTROL VALVES**

- A. All valves shall be new and listed for fire protection use.
- B. Furnish and install valves in piping where so indicated on the Drawings.
- C. Of the several manufacturers listed, the Contractor is to standardize on one make as much as practical but not to the extent of sacrificing quality listed. Valves shall be Tyco, Milwaukee, Victaulic, Ames, Watts, Wilkins, or equal.
- D. Butterfly valves shall be of the indicating type with two sets of factory installed internal supervisory switches. Valves shall be ductile iron conforming to ASTM A-395 with Grade EPDM "E" encapsulated rubber disc seals. Valves shall be Tyco, Victaulic, or Equal.
- E. Outside Screw and Yoke (OS&Y) gate valves shall be ductile iron, raised face with bolted bonnets. Valve shall be Kennedy, Mueller, Nibco, Watts, or equal.
- F. Ball Valves 1-1/2" and smaller shall be standard port, end entry valves with a brass valve body. The ball shall be chrome plated brass with a stainless steel stem. Valves shall be Watts, Nibco, Milwaukee, Victaulic, or equal.

## **2.09 WALL POST INDICATOR VALVE**

- A. Wall mount indicator post assembly butterfly valve with internal supervisory switch, painted steel wall plate, and grooved ends. Valve to be Nibco GD-4765-8WP or equal.

## **2.10 RISER MANIFOLDS**

- A. Riser manifolds shall be provided for each wet zone designated on the drawings. The manifold shall include a 300 psi water gauge, water flow alarm switch with paddle, Schedule 40 pipe body, ductile iron angle valve with site glass, and pressure relief valve.
- B. Riser manifolds shall be Tyco, Viking, Reliable, or equal.

## **2.11 AUTOMATIC AIR VENT**

- A. Furnish and install an automatic air vent for each wet zone. Automatic air vent shall be located near a high point in the wet system that allows for the maximum amount of air removal from that system. Automatic air vent shall have a minimum connection size of 1/2" and a minimum pressure rating of 175 psi.
- B. The device shall meet the requirements of UL 2573.
- C. Automatic air vent shall be Tyco, Viking, Reliable, or equal.

## **2.12 WATER FLOW SWITCHES AND ALARMS**

- A. Water flow switches for alarm bell/horn and tamper switches shall be furnished and installed by this Contractor. All required wiring shall be installed by the Electrical Contractor.
- B. Water flow and tamper switches shall be Potter.

## **2.13 EXTERNAL BACKFLOW PREVENTER TEST CONNECTION**

- A. Furnish and install a Guardian Series 6500 or equal flush outlet connection where shown on the Drawings. Wall plate shall read "BACKFLOW PREVENTER TEST CONNECTION." Finish shall be rough brass. Outlets shall be 2-1/2 inch size and inlet shall be 4 inch size.
- B. Connections shall have rough brass plugs and chains. Outlets shall be 36 inches above finished grade or as specified on the drawings. Threads for Fire Department connections shall be National Standard. Verify threads and plug type with the local Fire Department.

- C. External backflow preventer test connection shall be Guardian, Potter Roemer, Central, Elkhart, or equal.

#### **2.14 FIRE DEPARTMENT CONNECTION**

- A. Furnish and install a Guardian Series 6000 or equal flush connection where shown on the Drawings. Wall plate shall read "AUTOMATIC SPRINKLER." Finish shall be rough brass. Inlets shall be 2-1/2 inch size and outlet shall be 4 inch size. Install an automatic ball drips between the connection and the check valve.
- B. Connections shall have rough brass plugs and chains. Locking Fire Department connection plugs shall be provided where required by the fire code official and where the responding fire department carries appropriate key wrenches for removal. Outlets shall be 36 inches above finished grade. Threads for Fire Department connections shall be National Standard. Verify threads and plug type with the local Fire Department.
- C. Fire department connection shall be Guardian, Potter Roemer, Central, Elkhart, or equal.

#### **2.15 DOUBLE CHECK VALVE BACKFLOW PREVENTER**

- A. Furnish and install an Ames Fire & Waterworks Colt Series C200 or equal double check backflow preventer where shown on the Drawings. The backflow preventer shall be a complete assembly including tight closing shut-off valves before and after the device and also be protected by a strainer. It shall be a complete assembly including four ball type test cocks.
- B. The device shall meet the requirements of A.S.S.E. standard 1015 and A.W.W.A. standard C506.
- C. Double check valve backflow preventer shall be Ames, Watts, Hersey, Conbraco, Febco, Wilkins or equal.

#### **2.16 PRESSURE GAUGES**

- A. Furnish and install U.S. Gauge Model 5105 or equal pressure gauges in pipelines and on equipment as indicated herein and/or where shown on the Drawings. Gauges shall have phosphor bronze bourdon tube with brass movement.
- B. Gauges shall be compound, pressure or vacuum as required with 4-1/2 inch diameter dial. Each gauge shall be complete with Trerice No. 872 pressure snubbers, and brass ball valves.
- C. The normal operating pressure of each gauge shall be 50-70 percent of full scale. The range of the scale shall be suitable for the application.
- D. The gauges shall be located and mounted such that they can be conveniently read by a person standing on the equipment room floor. Accuracy shall be Grade "A". Case shall be aluminum.
- E. Pressure gauges shall be U.S. Gauge, Trerice, Weksler, Ashcroft, Weiss or equal.

### **PART 3 - EXECUTION**

#### **3.01 PIPING CONNECTIONS**

- A. Pipe connection shall be through the use of grooved couplings attached to roll or cut grooves on the piping, female threaded fittings screwed on to threaded end pipe, and flanged fittings with bolts, nuts and rubber gaskets. Mechanical joint couplings may be used only with the approval of the Fire Protection Engineer.

#### **3.02 PIPE HANGERS, SUPPORTS AND ANCHORS**

- A. Anchors and other attachments to the building structure shall be installed where designated and as detailed on the Drawings and specified herein and/or as required. The hangers shall adequately support the piping system. They shall be located near or at changes in piping direction and as otherwise required by NFPA 13. They shall provide vertical adjustment to maintain pitch required for proper drainage. They shall allow for expansion and contraction of the piping. Hangers shall bear directly on piping.
- B. Pipe hangers shall not be attached to the roof deck. Hangers shall be attached to the structure with beam clamps, beam attachment and brackets bolted to joists and beams, wood lag bolts,

steel self tapping screws, and any other approved means of attachment that is rated to support five times the weight of the water filled pipe plus 250 lbs of additional load.

- C. Hanging from one pipe to another is prohibited.

### **3.03 PIPING INSTALLATION**

- A. All pipes shall be round and straight, of required size. Cutting shall be done with proper tools and pipes shall be reamed to full size after cutting.
- B. Piping shall be properly enclosed, supported, guided, anchored, sway braced, connected, tested, cleaned and flushed out and shall be properly insulated and protected where required.
- C. All pipes shall be run with proper grade to provide for easy draining and in group runs where applicable and in a neat and orderly manner, to the satisfaction of the Architect/Engineer. Lines required to be enclosed in ceiling, chase ways or similar spaces shall be installed to permit such enclosure as intended. All pipe runs shall be carefully laid out and scheduled to avoid necessary interferences with other work. If shown, pipe sizes on the Drawings are nominal pipe sizes and not outside diameters.
- D. Pipes shall be run substantially as indicated on the Drawings. However, the Architect/Engineer reserves the right to require this Contractor to make changes in pipe locations where conflicts occur with other trades. Such changes shall be made without extra cost to the Owner.
- E. Piping shall be installed with ample provisions for expansion and contraction to prevent injury to the same and to the building construction. Such provision shall be made by means of piping offsets, changes in direction, expansion loops and/or suitable expansion joints. Suitable anchors and guides shall be provided to permit proper deflection and compression of offset loops and expansion joints. Expansion joints shall not be used in lieu of offsets, changes in direction or loops, except where specified and/or indicated on the Drawings or where otherwise obviously necessary.
- F. Exposed piping shall be installed in a sanitary manner for ease in cleaning. Pipe shall be cut and threaded to fit the installation. Wherever possible, rough-in exposed pipe connections at the wall rather than the floor for ease in cleaning.

### **3.04 SLEEVES**

- A. Any pipe passing through building construction including walls, floors, roofs or masonry partitions or as noted on the Drawings shall be encompassed with sleeves. Piping passing through any fire rated barrier, walls, or floor shall be installed as follows:
  - 1. Sleeves shall have an inside diameter 1/2 inch greater than the outside diameter of pipe passing through. All sleeves shall be fabricated from new Schedule 40 steel pipe material cut square and reamed.
  - 2. Sleeves shall be provided in all masonry partition walls including locations above suspended ceilings where masonry partition walls extend from floor slab to slab above. Sleeves shall be Schedule 40 steel pipe finishing flush with the wall surface.
  - 3. Sleeves through exterior building walls shall be Schedule 40 steel pipe with welded flange in the middle of the sleeve and ends finishing flush with finished surfaces. Space between pipe and sleeve shall be packed to provide a watertight joint.
  - 4. Sleeves through roof slabs and floor slabs in concealed locations shall be Schedule 40 galvanized steel or linear polyethylene. Concealed sleeves shall be considered as pipe sleeves in shafts, pipe chases and within walls and partitions.
  - 5. Sleeves through floor slabs in exposed areas shall be Schedule 40 steel pipe and sleeves shall extend 1/4 inch above the finished floor surface. For slabs in equipment rooms and in other wet areas, sleeves shall be Schedule 40 steel pipe and shall extend 2 inches above finished floor surface.
  - 6. Floor sleeves in membraned floors shall be furnished with flashing rings and clamps.
  - 7. All sleeves in exposed locations, except equipment rooms, shall be set so plates specified will cover the sleeves.
  - 8. All pipe sleeves where wet conditions exist, except sleeves through exterior walls, shall be caulked with a plastic caulking, including sleeves in concealed locations. The space

between the pipe and the sleeves shall be caulked in both ends of sleeve, even with the ends of the sleeve. The sealer shall be suitable for temperatures from minus 50 degrees to 300 degrees, suitable for painting, non-corrosive and have good adhesion.

- B. Sleeves in fire rated construction, equipment rooms, and/or where designated on the Drawings shall consist of schedule 40 steel pipe. Seal sleeves with a fire retardant sealant. When applied according to manufacturer's recommendations, sealant shall have a 3-hour U.L. fire rating.
- C. All sleeves shall be set and maintained in place by this Contractor during the progress of the work. This Contractor shall be responsible for locating all sleeves at the proper location.
- D. Sleeves are not required for core drilled masonry wall and floor holes, masonry wall and floor holes formed by polyethylene plastic (removable) sleeves, or for masonry holes made in another neat manner except in equipment rooms and other wet areas.
- E. Sleeves are not required in metal or wood stud wall construction. Rated systems shall be provided as required to provide the necessary rating of the penetration.

### **3.05 DRAINS**

- A. Drains shall be located and piped to discharge to the locations designated on the plans. Where required drains are not noted on the plans system drains shall be piped to a floor drain or mop sink where said drains or sinks are capable of accepting full system flow without excessive deflection of discharging water. Drain shall be piped through the wall of the building to atmosphere when a floor drain or mop sink is not available and where piping through the wall of the building to atmosphere is most convenient and has been approved by the Architect/Engineer.

**END OF SECTION**



**SECTION 22 0500  
GENERAL PLUMBING REQUIREMENTS**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. The mechanical contractor shall perform all work and furnish all materials as indicated in the mechanical plans and specifications as necessary for the successful completion of this project.
- B. This section specifies a system or part of a system being commissioned as defined in 01 9113 General Commissioning Requirements. Testing of these systems, as well as Operations & Maintenance (O&M) Manuals and Training of the Owner's personnel, is required in cooperation with the Owner, General Contractor, and the Commissioning Professional. Project Closeout is dependent on successful completion of all commissioning procedures, documentation, and issue closure. Refer to 01 9113 General Commissioning Requirements for detailed commissioning requirements.

**1.3 PERMITS AND SERVICES**

- A. The mechanical contractor shall obtain all permits and arrange all inspections, give notices and pay all fees as required by the Authority Having Jurisdiction.
- B. This contractor shall coordinate any necessary site utilities including water, natural gas, and sewer work with local utility, owner, and other contractors to minimize disruption and downtime. With the exception of natural gas, ANY AND ALL CHARGES ASSESSED BY THE UTILITY OR CITY TO ACCOMMODATE THE REQUIREMENTS OF THIS PROJECT ARE THE SOLE RESPONSIBILITY OF THE MECHANICAL CONTRACTOR. VERIFY ALL CHARGES AND COORDINATE ALL EQUIPMENT NECESSARY WITH THE UTILITY BEFORE SUBMITTING BID.

**1.4 DRAWINGS AND MEASUREMENTS**

- A. Verify all dimensions and conditions with Architectural and Structural drawings. The small scale of the drawings prohibits the indication of all offsets, fittings and accessories necessary and shall be furnished by this Contractor and required for complete and proper operation.
- B. "Existing Conditions" shown on drawings are based on existing plans and limited field investigation. The field survey was conducted to verify, as much as possible, the accuracy of the locations shown. The Contractor shall verify the accuracy of the "Existing Conditions" as shown on the drawings. As the demolition work progresses perform modifications and additions as necessary to correct for these hidden conditions and allow for the completion of the new work.
- C. The general arrangement of the mechanical systems shall be as shown on the drawings. Field changes shall have the written acceptance of the Engineer.
- D. Consult the drawings and specifications of all other trades. Layout work and coordinate with other trades, before installing any equipment, to avoid interfering with these trades or conflicting with applicable codes.
- E. The mechanical contractor shall bear full responsibility for coordinating his work with other trades to avoid conflicts in space requirements, clearances, etc. Problems arising due to lack of coordination will be the responsibility of the mechanical contractor to resolve. Extra work and/or equipment as a result of not coordinating work shall be the responsibility of the installing contractor and at no cost to the Owner.

**1.5 INSPECTION OF SITE AND DOCUMENTS**

- A. Before submitting a proposal on the work contemplated, the bidder shall thoroughly familiarize himself with the contract documents, the site, and all existing conditions and limitations that

may affect the performance of his work. Any conflict noted shall be brought to the attention of the Engineer before bidding. If there is not sufficient time prior to bidding, the Contractor shall bid the larger quantity or better quality of work.

- B. No extra compensation will be allowed, because of misunderstanding the amount of work involved or the bidder's lack of knowledge, for obvious conflicts which could have been discovered or reasonably anticipated prior to bidding.

#### **1.6 REGULATIONS AND CODES**

- A. All work, materials, and equipment in this contract shall comply with all applicable local, city, state and federal ordinances, regulations, and codes.

#### **1.7 INSTRUCTIONS & TRAINING**

- A. Each trade shall provide training to the owner's representative with engineer's representative present.
- B. Training of the Owner's operation and maintenance personnel is required in cooperation with the Owner, General Contractor, and the Commissioning Professional. Provide competent, factory-authorized personnel to provide instruction to operation and maintenance personnel concerning the location, operation, troubleshooting, routine servicing and maintenance of the installed systems. The instruction shall be scheduled in coordination with the Owner and the Commissioning Professional after submission and approval of formal training agendas. Refer to Sections 01 9113 General Commissioning Requirements.

#### **1.8 OPERATING AND MAINTENANCE MANUALS (3 Hard Copies & 1 Electronic Submittal via Submittal Exchange)**

- A. PRIOR TO FINAL INSPECTION, The mechanical contractor shall furnish (3) hard copies (including 1 USB drive containing electronic copy) and (1) electronic submittal via Submittal Exchange of the O&M Manuals to the Engineer, containing all pertinent data to the mechanical systems. Information shall be indexed and labeled per system and shall include catalog cuts, installation manuals, maintenance manuals, manufacturer's names, replacement parts list. Include balancing reports as specified. Include written instructions and warranty info as specified.
- B. The first section shall be indexed/labeled "WRITTEN INSTRUCTIONS & TRAINING" noting written instructions with company service contact info and shall include a list of filters for each unit. Also include document with owners signature attesting to date and satisfaction of training.
- C. The second section shall be indexed/labeled "WARRANTY INFO" and shall include a statement of guarantee on the contractors company letter head and shall include warranty statements of all equipment provided/installed under his contract with specific dates. This will note any longer/special warranties.

#### **1.9 AS-CONSTRUCTED DRAWINGS (Red Lined on Plans & USB Drive containing scanned PDF)**

- A. During construction, each trade shall keep track of the major changes in the rerouting of piping and equipment, and shall note these in red on one set of drawings. This set of drawings shall be submitted with the Operation and Maintenance Manuals along with a USB drive containing a single PDF file with these same red line plans in electronic form. Most printing shops will be able to scan your trade's large plan sheets into electronic form. Contact the engineer's office if there are any questions.

#### **1.10 WORKMANSHIP**

- A. Qualified individuals that are properly licensed to perform the work involved shall perform all mechanical work.

#### **1.11 CUTTING AND PATCHING**

- A. This Contractor shall be responsible for all cutting and patching of holes required for passage of piping, equipment, and ducts. This also applies to the removal or installation of new equipment.
- B. All cutting of existing construction required to install or join new work, except where otherwise indicated on the plans, shall be the responsibility of this Contractor and coordinated with the

General Contractor. Before making any cuts, verify exact locations and sizes with the General Contractor to confirm that no structural members will be cut. Contractor shall make every effort to minimize extent of cutting existing construction.

- C. The mechanical contractor shall be responsible for patching any openings left in floors, walls, and ceilings that were caused by his/her actions. Patching shall match existing surface in color, texture and quality so that patch is indistinguishable from original surface.

#### 1.12 PAINTING

- A. Any equipment which becomes rusted or damaged during construction shall be repaired, cleaned, and repainted by this Contractor. Painting shall always be applied in two coats, one primer and one finish.

#### 1.13 EQUIPMENT AND PIPE SUPPORTS

- A. Provide all structural supporting frames, steel stands, concrete bases, and hangers as required for mechanical equipment. All floor equipment shall be set on 4" high concrete bases furnished by this Contractor, unless otherwise noted.
- B. Paint all unprotected metal, except galvanized and copper, with metal protective paint.
- C. **Hangers for piping shall be large enough to encompass insulation. It shall not be acceptable for insulation to envelope hangers/saddles, or for insulation to stop on either side of hangers.**
- D. Provide saddles at all hangers or supports of insulated piping. Saddles for 4" and larger piping shall be fabricated of 14 gauge galvanized iron, and for smaller piping shall be fabricated of 16 gauge galvanized iron. Saddles shall be one-half the circumference of the pipe insulation and 4" shorter than the insulation inserts.
- E. Under no condition shall any pipe or duct structure be used to support another.

#### 1.14 ACCESS TO EQUIPMENT

- A. Access shall be provided to all motors, valves, dampers, controls, specialties, etc., for maintenance purposes. All access doors, access panels, removable sections, etc., required for access shall be provided. The location of the access openings relative to the mechanical equipment shall be coordinated to assure proper access to the equipment.
- B. Access openings are required for manual, motorized, fire, and smoke dampers and other devices requiring access and shall be provided in the ductwork, plenums, housings, tanks, etc., under this portion of the contract.

#### 1.15 EXCAVATING AND BACKFILLING

- A. When work to be completed by this contractor requires trenching, digging, etc. this contractor shall be responsible for properly protecting open trenches in accordance with required safety procedures. Backfill shall be placed in horizontal layers, not exceeding 9 inches in thickness. Moisten and hand or machine compact to 95% of standard proctor density. Bring fill to elevations indicated. If backfill fails the proctor density test in accordance with ASTM D-2049 and conducted by an independent testing laboratory retained by the owner, Contractor shall recompact and retest until satisfactory density is reached. This contractor shall restore the surface (whether grass, asphalt, concrete, etc.) to its original condition. Grass shall be seeded to match surrounding turf.
- B. When work is in public street, paving repairs shall be equal to and comply with municipal agency requirements. If repairs are done by municipal agency, make necessary arrangement with such agency to make the repairs. Contractor shall include cost for permits, inspection fees, work, etc. in Mechanical Bid.

#### 1.16 TESTING AND ADJUSTING

- A. At the completion of work, all parts of the installation under Division 22 shall be cleaned, lubricated, tested, and adjusted for proper operation.
- B. All piping and ductwork shall be tested and cleaned as required, by all local, state and federal codes. Tests shall be performed in the presence of the authority having jurisdiction. Written

notification of test, date, and results shall be furnished to the Engineer before concealing or covering the installation.

- C. All controls shall be tested and adjusted for proper operation. Adjustments shall be made when all systems are operating which may affect the control system.
- D. An Independent Testing & Balancing Agent shall test and balance all mechanical systems as specified in Section 23 0593.

### **1.17 GUARANTEE**

- A. Warranty: The mechanical contractor shall warrant his work against failure and workmanship for a period of at least one year from the date of substantial completion, for all new work. Any work that is defective within that one-year period shall be replaced by the Contractor without charge. If longer/special warranties are noted elsewhere in the specifications, those warranties shall apply.

### **1.18 EQUIPMENT IDENTIFICATION**

- A. Major mechanical equipment, rooftop units, energy recovery ventilators, electric duct heaters, heat pumps, exhaust fans, etc. shall be provided with identification as designated on the plans. Labels shall be black laminate three-layer plastic with engraved 1/2 inch white letters, adhered, screwed, or riveted to the equipment. Manufactured by Brady, Champion America/Seton.
- B. Piping shall be identified as to contents and flow direction with plastic, color coded, snap-on or adhesive labels. Manufactured by Brady, Champion America/Seton.
  - 1. Labeling shall be located:
    - a. Adjacent to each valve.
    - b. At each side of and at each obstruction.
    - c. At each branch.
    - d. At each cap for future.
    - e. At each takeoff.
    - f. At each side of penetration of structure or enclosure.
    - g. At each equipment connection.
    - h. At all access doors.
    - i. A maximum of every 40 feet on straight runs of piping including rises and drops.
    - j. Minimum one label per room/space.
- C. Valve tags shall be brass with stamped letters, tag size 1-1/2" minimum in diameter.
  - 1. Provide typed valve lists in each O&M binder. Valve lists shall include the valve number, location, and purpose of each valve, and any other necessary information such as the required opening or closing of another valve when one valve is to be opened or closed.
- D. Color coded indicators shall be installed on the ceiling grid or access door to hard lid areas to indicate all valves and other ceiling mounted equipment requiring service (example – VAV's). Each trade shall be responsible for equipment provided under their respectable trade.
  - 1. Each ceiling label shall be color coded laminated engraved plastic, 1/16" thick, 2.5" wide by 0.75" tall, with white lettering centered on each label. Label to be adhered to the acoustic ceiling tile grid. Seton Style AV0175 or similar.

### **1.19 MECHANICAL SUBMITTAL**

- A. All equipment shall be as listed on the equipment schedules or approved equal.
- B. Prior Approval: Manufacturers whose product is not specified or specifically listed on the plans or in the specifications are allowed to submit information on a product that they would like to be considered as an equal to those specified or listed. By submitting this information for consideration, the product representative is indicating that the product being presented for consideration equals or exceeds the specified product in quality, performance and operating parameters. Proof of equality rests with the party making the request. The procedure for this submittal is listed below.

- C. Submit literature on product that is to be considered for prior approval. This literature shall include catalog cuts with all pertinent technical specifications, dimensions and pictures of the product.
- D. Final approval of all equipment shall be contingent on shop drawing acceptance, compliance with the specifications and performance criteria as required. General approval to bid a product does not relieve the supplier or contractor of meeting specific specification requirements.
- E. The Mechanical Contractor shall pay, provide, install and be responsible for any extra materials required due to his use of alternate accepted equipment which has installation requirements different than the specified equipment. This includes paying other trades for any extra work they are involved in due to this substitution of equipment.
- F. Literature shall be submitted so that the engineer receives it no later than 7 days prior to bid date.
- G. All approvals will be in the form of an addendum issued to all plan holders.
- H. List of Acceptable Substitutions:
  - 1. Equipment Identification, Pipe Labeling, Valve Tags, Ceiling Grid Labeling: Seton, Brady Corporation, Marking Services Incorporated
  - 2. All Drains: Wade, Zurn, Smith, Josam, Ancon, Watts.
  - 3. Valves: Crane, Hammond, Watts, Rockwell, Milwaukee Valve Co., Mueller.
  - 4. Plumbing Fixtures: American Standard, Kohler, Crane, Elkay, Just, Zurn, Fiat Products, Gerber, Bradley, Stingray
  - 5. Fixture Brass: American Standard, Kohler, Zurn, Sloan, T & S Brass, Chicago, Bradley, Swan, Woodford Mfg.
  - 6. Flush Valves: Zurn AquaVantage, Sloan, American Standard
  - 7. Lav Premolded Insulation Kit: Plumberex, Truebro, Proflo
  - 8. Toilet Seats: Kohler, Church, Beneke, Bemis, Olsonite, Zurn, Proflo
  - 9. Electric Water Coolers: Elkay
  - 10. Thermostatic Mixing Valves Under Lavs: Lawler, Powers, Watts
  - 11. Digital Water Tempering System: Lawler, PVI, Watts
  - 12. Domestic Natural Gas Water Heater: A.O. Smith, State Ind., PVI, Bradford White, Lochinvar
  - 13. Domestic Hot Water Recirculation Pump: Grundfos, B&G, Armstrong, Taco, Allis-Chalmers, General Signal Pump Group, Thrush, Patterson
  - 14. Domestic Hot Water Recirculation Flow Control and Strainer Valves: Nexus, Pro Hydronics, Griswold, Autoflow, B&G, Flow Design, IMI Flow Design
  - 15. Domestic Water Expansion Tank: B&G, Taco, Wessels, Watts, Armstrong, Thrush
  - 16. Sump Pump System: Zoeller, Little Giant
  - 17. Air Compressor: Ingersoll Rand
  - 18. Compressed Air Dryer: Ingersoll Rand
- I. Refer to Section 01 9113 General commissioning Requirement for commissioning-related submittals and submittal review processes.

#### **1.20 SHOP DRAWINGS**

- A. Before ordering any item, Contractor shall review, stamp with his approval and submit shop drawings of equipment as to be furnished under this contract.
  - 1. Electronic submittals are REQUIRED. Electronic submittals can be one combined .pdf for each of the following mechanical trades: Fire Sprinkler Drawings, Fire Sprinkler Calcs, Fire Sprinkler Materials, Temperature Controls, HVAC, Plumbing, and Hydronics.
- B. Where the contractor is submitting shop drawings that differ from the plans and specifications, the contractor must notify the engineer in writing each variance from the plans and specifications and the Mechanical Contractor shall pay, provide, install and be responsible for any extra materials required due to his use of alternate accepted equipment which has installation requirements different than the specified equipment. This includes paying other trades for any extra work they are involved in due to this substitution of equipment.

- C. Product Data shall include, but are not limited to, the following: Manufacturer's product specifications, Manufacturer's installation instructions, standard color charts, catalog cuts, roughing-in diagrams and templates, and standard wiring diagrams.

#### **1.21 TEMPORARY HEAT**

- A. Temporary heating of the building during construction will be provided as specified in the General Conditions and Supplemental General Conditions. Under no circumstance shall the proposed HVAC equipment be brought into service as temporary heating prior to project completion without written permission from the mechanical engineer & owner.

#### **1.22 EXECUTION**

- A. Remove equipment as indicated. Demolition work shall be coordinated with the Owner. Should questions arise regarding the removal of equipment, confer with the owner before such equipment is demolished.
- B. Materials removed by demolition shall remain the property of the Owner unless specifically noted. Material the Owner does not wish to retain shall be removed and properly disposed of by the Contractor.
- C. The existing building will be in use during this construction. Schedule and carry out the work in such a manner as to cause the Owner a minimum of inconvenience due to service interruptions. Temporary services shall be installed if one area or phase of construction disrupts service to another area of the building or if equipment has to be relocated to allow construction to progress. Service interruptions shall be confined to the smallest area possible at any one time and interruptions shall be scheduled with the Owners site representative. After service has been restored following an interruption, inspect areas affected by the interruption and be responsible for returning automatically controlled equipment to the same operating condition that existed prior to the interruption.
- D. Install equipment and materials to provide required access for servicing and maintenance. Coordinate the final location of concealed equipment and devices requiring access with final location of required access panels and doors. Allow ample space for removal of all parts that require replacement or servicing.
- E. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.
- F. Coordinate mechanical equipment and materials installation with other building components. Verify all dimensions by field measurements. Arrange for chases, slots, and openings in other building components to allow for mechanical installations.
- G. Final locations of equipment may differ slightly from those shown on these plans. Coordinate exact location of equipment with equipment supplier, structural members, furniture layout and other trades before rough in and adjust accordingly. Pricing shall allow for a minimum of 10 ft. of difference in the actual location of items as compared to the location shown on the drawings.
- H. All penetrations for piping, ductwork, etc. which penetrate floors, fire and/or smoke walls, roofs, full height partitions and similar structures shall be sealed by the mechanical contractor with a UL system specifically approved for the application. This system must maintain the required fire rating.
- I. All mechanical systems shall be tested and cleaned as required by Authority Having Jurisdiction.
- J. The mechanical contractor shall have the full responsibility of ensuring that his/her work is performed in a safe manner and shall bear all liability associated with his/her job site safety.
- K. Upon completion of the work, the Contractor shall notify the A/E and make arrangements for a final inspection. Contractor shall provide A/E with copy of all required balance reports prior to the final inspection.
- L. After the final inspection is made, the Contractor will receive a list of items requiring adjustment, correction, replacement, or completion.

- M. The Contractor shall comply completely with all listed requirements within (40) days of receipt of list. Should the Contractor fail to perform within this time limit, the A/E and/or Owner reserves the right to have the work completed by others and the cost deducted from the contract price.

**1.23 FUNCTIONAL PERFORMANCE TESTING**

- A. System functional performance testing is part of the Commissioning Process as detailed in Section 01 9113 General Commissioning Requirements. Functional performance testing shall be performed by the contractor and witnessed and documented by the Commissioning Professional. Installation checklists shall be successfully completed by the contractor and submitted to the Commissioning Professional prior to functional performance testing.

**END OF SECTION 22 0500**

**SECTION 22 0510**  
**BASIC PLUMBING MATERIALS AND METHODS**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. This section includes the following basic mechanical materials and methods to complement other Division 22 Sections.
  1. Piping materials and installation instructions common to most piping systems.
  2. Dielectric fittings.
  3. Mechanical sleeve seals.
  4. Sleeves.
  5. Escutcheons.
  6. Grout.
  7. Concrete bases.
  8. Mechanical Demolition.
  9. Installation requirements common to equipment specification sections.

**1.3 DEFINITIONS**

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

**1.4 QUALITY ASSURANCE**

- A. All piping shall be specified in this section. Material and installation shall also be subject to state, local codes and ordinances of the area encompassing this project.
- B. Welder's Qualifications: All welders shall be qualified in accordance with ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
- C. Potable-water piping and components shall comply with NSF 14 and NSF 61 Annex G. Plastic piping components shall be marked with "NSF-pw."
- D. Uninsulated plastic waste, vent and roof drain piping is not allowed above any ceiling in a return air plenum.
- E. Electrical Characteristics for Mechanical Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.



## **PART 2 - PRODUCTS**

### **2.1 PIPE, TUBE, AND FITTINGS**

- A. Provide piping and factory fabricated fittings as indicated for each service and pipe size. Fitting sizes and types shall match piping or equipment connections. Where not indicated, comply with governing regulations or manufacturer's recommendations.

### **2.2 WATER SERVICE OUTSIDE OF BUILDING**

- A. Domestic water service below ground shall be ductile iron, bell and spigot. Ductile iron shall be Class 52 water pipe with mechanical joint fittings meeting AWWA Standard C153. Pipe and fittings shall be coated with asphaltum and internally cement lined.
- B. Furnish and install thrust blocks and/or tie-rods in accordance with the local water department standards and regulations.
- C. Provide a copy of the plot plan showing exact locations of all underground services direct to the engineer with accurate dimensions from the building such that all the underground service can be located.

### **2.3 WATER PIPING IN BUILDING UNDERGROUND**

- A. Domestic water piping in building below ground shall be ductile iron. The ductile iron shall be AWWA ductile iron, bell and spigot, class B water pipe with fittings being Class D ductile iron AWWA bell and spigot coated with asphaltum and/or Class 150 C.I. mechanical joints, Federal Specification WW-P-421 with rubber gaskets.
- B. Furnish and install thrust blocks and/or tie-rods in accordance with the local water department standards and regulations.
- C. Provide a copy of the plot plan showing exact locations of all underground services direct to the engineer with accurate dimensions from the building such that all the underground service can be located.

### **2.4 SANITARY WASTE AND VENTING PIPING**

- A. Below Grade: Extra heavy weight, coated cast iron soil pipe, hub-&-spigot, ASTM A 74, with TY-seal double seal, premolded one piece Neoprene compression type gasket, ASTM C 564, or lead/oakum joint materials, FSQQ-C-40.
  - 1. Service weight "No-Hub" cast iron soil pipe, FS WW-P-401, with Neoprene gasket, ASTM C564, and stainless steel drawband.
  - 2. Where permitted by plumbing and building codes, schedule 40 Polyvinyl Chloride sewer pipe (PVC), ASTM D 2729, with sewer fittings ASTM D 2729, and solvent cement, ASTM D 2564.
- B. Above Grade: Service weight cast iron soil pipe, Hub-&-Spigot, ASTM A 74, with premolded one piece Neoprene compression type gasket, ASTM C 564, or lead/oakum joint materials, FS QQ-C-40.
  - 1. Service weight "No-Hub" cast iron soil pipe, CISPI standard 301, or FS WW-P-401, with Neoprene gasket, ASTM C564, and stainless steel drawband, conforming to CISPI standard 310.
  - 2. Where permitted by plumbing and building codes, schedule 40 Polyvinyl Chloride (PVC), type DWV, ASTM D 2665; with schedule 40 DWV fittings, ASTM D 2665 and patterns conforming to ASTM D 3311. Solvent cement, ASTM D 3138.
- C. Provide a copy of the plot plan showing exact locations of all underground services direct to the engineer with accurate dimensions from the building such that all the underground service can be located.
- D. Before building footings are formed, this contractor shall start excavating for sewer services.

### **2.5 DOMESTIC WATER (COLD, HOT, & RECIRCULATING HOT WATER) IN BUILDING ABOVE GROUND**

- A. Piping shall be Type "L" hard drawn copper water tube.
  - 1. Fittings wrought copper, solder joints. Joints 95-5 or lead free solder.

2. Pressure-Seal-Joint fittings: wrought copper with EPDM O-ring seal in each end. Sizes NPS 2-1/3" and larger with stainless steel grip ring and EPDM o-ring seal. Minimum 200 psig working pressure rating at 250 F.
- B. Uponor PEX-A potable water piping system with Uponor expandable F1960 fittings (no crimp fittings to be accepted) provided the contractor is trained and following all manufacturer's recommendations thus fulfilling all available Uponor warranty coverage.

## 2.6 NATURAL GAS SYSTEMS

- A. Steel Pipe: ASTM A 53; Type E, electric resistance welded or Type S, seamless; Grade B; Schedule 40; black.
- B. Viega MegaPress fittings may be used above grade provided contractor is trained and following all the manufacturer's recommendations and requirements to fulfill all the available warranty coverage.
- C. Install gas shut-off valves & pressure reducing valves to isolate all equipment.
- D. Install 6" traps (drip legs) prior to gas shut-off valves for all equipment controls. See LP Gas Connection Detail on plans.
- E. All gas piping to comply with AGA and NFPA National Fuel gas Code recommendations and comply with all requirements of the utility supplying the gas.
- F. All piping routed on roofs shall have premanufactured roof blocks with Unistrut support, wood blocking and foam blocking with pipe straps will not be acceptable.
- G. All gas piping in concealed locations shall be welded or shall be CSST.
- ~~H. All underground fuel run piping shall be polyethylene plastic pipe with anodeless risers with full port ball valves, locate tape & locate wire.~~

## 2.7 COMPRESSED AIR & FITTINGS

- A. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade B, black with ends threaded according to ASME B1.20.1.
  1. Steel Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106, Schedule 40, galvanized seamless steel pipe. Include ends matching joining method.
  2. Malleable-Iron Fittings: ASME B16.3, Class 150 or 300, threaded.
  3. Malleable-Iron Unions: ASME B16.39, Class 150 or 300, threaded.
  4. Steel Flanges: ASME B16.5, Class 150 or 300, carbon steel, threaded.
  5. Wrought-Steel Butt-Welding Fittings: ASME B16.9, Schedule 40.
  6. Steel Flanges: ASME B16.5, Class 150 or 300, carbon steel.
  7. See detail for Quick Connects, confirm layout with Owner prior to installation.

## 2.8 DIELECTRIC FITTINGS

- A. General: Assembly or fitting with insulating material isolating joined dissimilar metals, to prevent galvanic action and stop corrosion.
- B. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.
- C. Insulating Material: Suitable for system fluid, pressure, and temperature.
- D. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F.
- E. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.
- F. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.

## 2.9 MECHANICAL SLEEVE SEALS

- A. Description: Modular design, with interlocking rubber links shaped to continuously fill annular space between pipe and sleeve. Include connecting bolts and pressure plates.

## 2.10 SLEEVES

- A. The following materials are for wall, floor, slab, and roof penetrations:
  - 1. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
  - 2. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.
  - 3. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
  - 4. Molded PE: Reusable, PE, tapered-cup shaped, and smooth-outer surface with nailing flange for attaching to wooden forms.

## 2.11 ESCUTCHEONS

- A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
- B. One-Piece, Cast-Brass Type: With set screw.
  - 1. Finish: Polished chrome-plated.
- C. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.
  - 1. Finish: Polished chrome-plated.

## 2.12 GROUT

- A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
  - 1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
  - 2. Design Mix: 5000-psi, 28-day compressive strength.
  - 3. Packaging: Premixed and factory packaged.

## 2.13 CONCRETE BASES

- A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.
  - 1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.
  - 2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.
  - 3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
  - 4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  - 5. Install anchor bolts to elevations required for proper attachment to supported equipment.
  - 6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

## PART 3 - EXECUTION

### 3.1 MECHANICAL DEMOLITION

- A. Refer to Division 1 Sections "Cutting and Patching" and "Selective Demolition" for general demolition requirements and procedures.
- B. Disconnect, demolish, and remove mechanical systems, equipment, and components indicated to be removed.
  - 1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
  - 2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
  - 3. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
  - 4. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material.
  - 5. Equipment to Be Removed: Disconnect and cap services and remove equipment.

6. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
  7. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
- C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

### 3.2 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. Install piping according to the following requirements and Division 22 Sections specifying piping systems.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- D. Do not run piping through electrical or electronic equipment spaces and enclosures unless unavoidable. Install drip pan under piping that must be run through electrical spaces, if approved by local authority.
- E. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- G. Install piping to permit valve servicing.
- H. Install piping to allow maximum possible headroom unless specific mounting heights or slopes are indicated.
- I. Install piping at indicated slopes, or level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- J. Install piping free of sags and bends.
- K. Install fittings for changes in direction and branch connections.
- L. Install piping to allow application of insulation.
- M. Select system components with pressure rating equal to or greater than system operating pressure.
- N. Install escutcheons for penetrations of walls, ceilings, and floors.
- O. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.
- P. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
  1. Install steel pipe for sleeves smaller than 6 inches in diameter.
  2. Install cast-iron "wall pipes" for sleeves 6 inches and larger in diameter.
  3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- Q. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- R. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials conforming to the 25/50 flame spread and smoke developed rating.
- S. Verify final equipment locations for roughing-in.
- T. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

### **3.3 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS**

- A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.
- B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- C. Install mechanical equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
- D. Install equipment to allow right of way for piping installed at required slope.

**END OF SECTION 22 0510**

**SECTION 22 0700  
PLUMBING SYSTEMS INSULATION**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. The work in this section of the specification and the accompanying drawings consists of performing all labor, equipment, accessories, and materials and in performing all operations necessary for the installation of all insulation for the plumbing, circulating hot water heating piping systems, and sealing of sleeves.
- B. Work to be insulated includes the following:
  - 1. All domestic cold water piping, valves, and fittings.
  - 2. All domestic hot & recirculating hot water piping, valves, and fittings.
  - 3. All sleeves.
- C. All insulation work shall be installed in a workmanlike manner by skilled workmen engaged in this type of work.
- D. Fire-Test-Response Characteristics: Provide products with flame-spread and smoke-developed indices of 25 and 50, respectively, according to ASTM E 84 by a testing agency acceptable to authorities having jurisdiction.

**1.3 SUBMITTALS**

- A. Shop drawings/product data as specified in Section 22 0500 shall include the following:
  - 1. Product Data: Identify thermal conductivity, thickness, and jackets (both factory installed and field applied, if any), for each type of product indicated.

**1.4 COORDINATION**

- A. Coordinate clearance requirements with duct Installer for insulation application.
- B. Coordinate clearance requirements with piping Installer for insulation application.
- C. Coordinate size and location of supports, hangers, and insulation shields.
  - 1. All hangers and insulation shields for piping shall be large enough to encompass insulation without penetrating vapor barrier.
  - 2. It shall not be acceptable for insulation to envelope hangers/saddles.
  - 3. It shall not be acceptable for insulation to terminate on either side of hangers not properly sized to encompass insulation.

**PART 2 - PRODUCTS**

**2.1 NEW DOMESTIC COLD, HOT, & RECIRCULATING WATER PIPING INSULATION**

- A. All piping in concealed and exposed areas shall be insulated with fiberglass pipe insulation with all service jacket. Jacket shall be factory-applied, and, where specified, with white foil scrim-kraft vapor barrier. Insulation shall be Johns-Manville Micro-Lok 850 APT, or accepted equal.
- B. For pipe sizes 1" and less – insulation thickness shall be ½". For pipe sizes of 1-1/4"-2" – insulation thickness shall be 1". For pipe sizes of 2-1/2" and larger – insulation thickness shall be 1-1/2".
- C. Fittings, valves, flanges, etc. shall be insulated with fiberglass blanket, Johns-Manville Microlite or pre-cut mitered sections for elbows, J-M Micro-Lok (1lb/cu. ft. density).
- D. Encase pipe fitting insulation with one piece pre-molded PVC fitting covers having flame spread index of 25 or less, and smoke developed index of 50 or less, as tested by ASTM E84 (NFPA 255) method.
- E. Provide sheet metal insulation shields at all hanger locations.

- F. Hangers for piping shall be large enough to encompass insulation. It shall not be acceptable for insulation to envelope hangers/saddles, or for insulation to stop on either side of hangers.**

### **PART 3 - EXECUTION**

#### **3.1 GENERAL APPLICATION**

- A. All insulation shall be applied on clean, dry surfaces. All joints shall be snugly butted against the adjoining piece and all joints, seams, voids, flat spots, etc., shall be filled with insulation cement. Do not use cut pieces or scraps abutting each other.
- B. Where double layers are installed, the first layer shall be fastened with binding wire. All joints shall be staggered between the two layers.
- C. Insulation on all cold surfaces must be applied in a continuous, unbroken vapor seal. Hangers, supports, anchors, etc., that are secured directly to cold surfaces must be adequately insulated and vapor sealed to prevent condensation.
- D. All surface finishes shall be extended to protect all surfaces, ends, and raw edges of insulation.
- E. All insulation materials shall be installed in strict accordance with manufacturer's instructions, using recommended adhesives, mastics and coatings applied at specific coverage per gallon and temperature conditions.
- F. Extend insulation without interruption through walls, floors and similar penetrations, except where otherwise indicated.
- G. Maintain integrity of vapor-barrier jackets on insulation, and protect to prevent puncture or other damage.
- H. Do not apply insulation to equipment, breechings, or stacks while hot.
- I. Do not insulate boiler manholes, handholes, cleanouts, ASME stamp, and manufacturer's nameplate. Provide neatly beveled edge at interruptions of insulation.
- J. Provide removable insulation sections to cover parts of equipment, which must be opened periodically for maintenance; include metal vessel covers, fasteners, flanges, frames and accessories.
- K. Repair damaged sections of existing mechanical insulation, both previously damaged or damaged during this construction period. Use insulation of same thickness as existing insulation, install new jacket lapping and sealed over existing.
- L. Insulation installer shall advise Contractor of required protection for insulation work during remainder of construction period, to avoid damage and deterioration.

#### **3.2 MINERAL-FIBER PIPE INSULATION APPLICATION**

- A. Fittings, valves, and flange insulation shall be wrapped firmly under compression (minimum 2:1) to a thickness equal to the adjoining insulation, secured with No. 20 gauge galvanized annealed steel wire, and finished with a smoothing coat of mastic, Johns-Manville No. 375 Insulating and Finishing Cement or equal.
- B. Cold Fittings, Valves, Flanges, etc., shall be additionally sealed with a layer of resin coated glass mesh, such as Johns-Manville Duramesh 207 glass cloth, embedded between two 1/16" thick coats of vapor barrier coating, Benjamin Foster 30-35 or equal. Lap the sealed glass cloth at least 2" on itself and the adjoining insulation.
- C. Premolded Insulation Valve and Fitting Covers shall be installed by tack fastening, banding, or taping as required by manufacturer.
- D. Expansion Joints: For expansion joints, a tube of pipe insulation shall be fabricated that will allow the expansion joint to move within the tube. The insulating tube shall be fastened at one end of the pipe or equipment and the other end shall be free to slide over the adjacent insulated piping. Provide an aluminum jacket over the insulated pipe to provide a smooth surface on which the insulated tube may slide.

- E. Insulation Under Hangers: Pipe hangers shall encompass the insulation and shall have sheet metal saddles furnished by the Mechanical Contractor.
- F. Inserts shall be installed at all hanger locations. Inserts between the pipe and pipe hangers shall consist of 13lb/cubic foot hydrous calcium silicate pipe insulation, or wood blocking, of thickness equal to the adjoining insulation and shall be provided with vapor barriers where required. Insulation inserts shall not be less than the following lengths:
  - 1. 1/2" to 1-1/2" pipe size 10" long
  - 2. 3" to 6" pipe size 12" long
  - 3. 8" and larger pipe size 16" long
- G. On all piping the full thickness of insulation and jacket shall run continuously under the sheet metal pipe saddle and through the pipe hanger (pipe hanger shall be large enough to permit full insulation thickness.)

### **3.3 SEALING OF SLEEVES**

- A. All sleeves for pipes, ductwork, etc., furnished under Division 22 of specifications, penetrating floors, fire and/or smoke walls and full height partitions, including chase walls, shall be sealed in accordance with the following:
  - 1. All insulated services shall have the specified insulation terminated on either side of sleeve. Services which require a vapor barrier jacket shall have segment through sleeve insulated with calcium silicate having a minimum thickness same as specified for service. Vapor barrier jacket shall be uninterrupted. Entire void space between inside of sleeve and outside of duct, pipe, and/or calcium silicate insulation shall be packed with fiber insulation, conforming to HHI-521E Type 3 or HHI-558B Form A and having an ASTM fire class E-84 with fiber melt point in excess of 2000 degrees F., to a point 1/8 inch from ends of pipe sleeve. After void is packed with fiber insulation, services which are specified to be insulated shall have a section of insulation installed on each side of sleeve, insulation to be fitted tight to sleeve insulation. Balance of space in sleeve to be filled with nonhardening silicone conforming to TTS-00230 and of type which will allow 50 percent movement in one direction.
  - 2. Contractor is herein given the option to provide Pipe Shield, Inc., fire rated wall and floor sleeves for insulated and noninsulated piping in lieu of sealing sleeves as outlined above. Shields shall be installed in strict accordance with manufacturer's recommendations.

**END OF SECTION 22 0700**



**SECTION 22 4000  
PLUMBING**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. This section specifies a system or part of a system being commissioned as defined in 01 9113 General Commissioning Requirements. Testing of these systems, as well as Operations & Maintenance (O&M) Manuals and Training of the Owner's personnel, is required in cooperation with the Owner, General Contractor, and the Commissioning Professional. Project Closeout is dependent on successful completion of all commissioning procedures, documentation, and issue closure. Refer to 01 9113 General Commissioning Requirements for detailed commissioning requirements.

**1.2 SUMMARY**

- A. The work in this specification and the accompanying drawings consists of performing all labor and furnishing of all material and equipment necessary to install complete systems listed below, including minor items obviously necessary for complete and operating systems.
  - 1. Plumbing Fixtures
  - 2. Soil, Waste, Sanitary Drainage, and Vent Piping
  - 3. Sump Pump System
  - 4. Natural Gas Piping Systems
  - 5. Compressed Air Systems
  - 6. Domestic Water Systems
- B. The plumbing work shall be installed in strict accordance with all applicable local, state, national plumbing regulations, and authority having jurisdiction.
- C. Also included is the work involved to remove & relocate existing associated equipment, remodeling of existing systems, including connections between new and existing systems.

**1.3 SUBMITTALS**

- A. Shop drawings as specified in Section 22 0500 shall include the following:
  - 1. Domestic Water/Fire Sprinkler Service Stub Out Piping
  - 2. Domestic Water System Piping, Valves, and Fittings
  - 3. Utility Provided Domestic Water Meterfit, and Dual Check Backflow Preventer
  - 4. Domestic Water Meters with BAS Output
  - 5. Sanitary Waste & Vent System Piping and Fittings
  - 6. Sump Pump System
  - 7. Natural Gas System Piping, Valves, Fittings
  - 8. Natural Gas Pressure Reducing Valves
  - 9. Air Compressor and Refrigerated Air Dryer
  - 10. Compressed Air Piping, Valves, Fittings, & Pneumatic Vacuum Valves
  - 11. Plumbing Fixtures
  - 12. Floor Drains
  - 13. Floor Sinks
  - 14. Interior & Exterior Cleanouts
  - 15. Shock Absorbers & Mfgr's Recommended Locations to be Installed
  - 16. High Efficiency Natural Gas Domestic Water Heater
  - 17. Domestic Hot Water Recirculation Pump
  - 18. Domestic Water System Expansion Tank
  - 19. Digital Water Tempering System
  - 20. Domestic Hot Water Recirculation Manual Balancing Valves and Strainers
  - 21. Drain Valves with Chained Caps

- B. Refer to Section 01 9113 General Commissioning Requirements for commission-related submittals and submittal review processes.

## **PART 2 - PRODUCTS**

### **2.1 GENERAL**

- A. Before proceeding with this part of the work, the Contractor shall carefully survey the existing conditions, and, if necessary, modify the service installation, in order to avoid unforeseen obstructions such as in the floor ductwork, etc. This Contractor shall include all costs for this work, including saw cutting & patching, permits, etc., in his bid.

### **2.2 FIRE PROTECTION WATER SERVICE STUB OUT**

- A. Provide new water service stub out as indicated on the plans. Provide minimum 7'-0" of cover over water line outside of building. Make all arrangements with Water Department and comply with all requirements.
- B. Furnish and install sleeves, thrust blocks and/or tie-rods in accordance with the local water department standards and regulations.
- C. Before proceeding with this part of the work, the Contractor shall carefully survey the existing conditions, and, if necessary, modify the service installation, in order to avoid unforeseen obstructions, such as telephone cables, cisterns, electrical conduits, large tree roots, existing water and sewer lines, flag pole bases, etc. This Contractor shall include all costs for this work, including street and sidewalk repair, permits, etc., in his bid.

### **2.3 DOMESTIC WATER SERVICE STUB OUT**

- A. Provide new water service stub out as indicated on the plans. Provide minimum 7'-0" of cover over water line outside of building. Install city approved water meters (provided by Site Utility Contractor) thru service development charge) as shown on the plans and in accordance with the manufacturer's recommendations. Make all arrangements with Water Department and comply with all requirements.
  - 1. **Coordinate BAS interface of utility provided water meter with Water Department and Temperature Controls Contractor.**
- B. Furnish and install sleeves, thrust blocks and/or tie-rods in accordance with the local water department standards and regulations.
- C. Install dual check back flow prevention assembly(s) suitable for continuous pressure application. Include shutoff valves on inlet and outlet, strainer on inlet, and test cocks with two positive seating check valves. Manufacturer and model shall be as specified on plans or approved equal.
- D. Before proceeding with this part of the work, the Contractor shall carefully survey the existing conditions, and, if necessary, modify the service installation, in order to avoid unforeseen obstructions, such as telephone cables, cisterns, electrical conduits, large tree roots, existing water and sewer lines, flag pole bases, etc. This Contractor shall include all costs for this work, including street and sidewalk repair, permits, etc., in his bid.

### **2.4 WATER METERS WITH BAS OUTPUT**

- A. Utility Provided Domestic Water Meter #1 – 2", Provided by Water Utility, coordinate required interface with Water Department and Temperature Controls Contractor
- B. Utility Provided Domestic Water Meter #2 –2", Provided by Water Utility, coordinate required interface with Water Department and Temperature Controls Contractor
- C. Lawn Irrigation Domestic Water Meter #3 – 1-1/2", Basis of design shall be Seametrics Model MJNR-150-1G
- D. Domestic Hot Water Meter #4 – 1", Basis of design shall be Seametrics Model MJNR-100-1G
- E. Fixture Domestic Cold Water Meter #5 – 2", Basis of design shall be Seametrics Model MJNR-200-1G

- F. Building Hydronic Heating Water Makeup Meter #6 – 3/4", Basis of design shall be Seametrics Model MJNR-075-1G
- G. Building Hydronic Chilled Water Makeup Meter #7 – 3/4", Basis of design shall be Seametrics Model MJNR-075-1G
- H. Graham Hall Domestic Cold Water Meter #1G – 2", Basis of design shall be Seametrics Model MJNR-200-1G
- I. All water meters shall provide the proper interface with the DDC Controls Contractor in Section 23 0900 either via pulse, BACnet MS/TP or 4-20 ma, coordinate with DDC Control Contractor.

## **2.5 SANITARY SEWER SERVICE**

- A. Provide new sewer service as indicated on the plans. Provide minimum 5'-6" cover over sewer line outside of building. Provide main clean out where sewer leaves building as indicated on the plans. Before building footings are formed, this contractor shall start excavating for sewer services and shall confirm that depth of existing sewer is such that building sewer services will drain into it by gravity. If existing sewer is not deep enough, the contractor shall notify the Engineer at once.
- B. Before proceeding with this part of the work, the Contractor shall carefully survey the existing conditions, and, if necessary, modify the service installation, in order to avoid unforeseen obstructions, such as telephone cables, cisterns, electrical conduits, large tree roots, existing water and sewer lines, flag pole bases, etc. This Contractor shall include all costs for this work, including street and sidewalk repair, permits, etc., in his bid.

## **2.6 SUMP PUMP & BASIN SYSTEM**

- A. General - The plumbing contractor shall provide and install where shown on the drawings a complete and operable sump pump system including but not limited to a properly sized sump basin, cover and high water alarm.
- B. Pump - Provide and install sump pump as scheduled or equal.
- C. Isolation/Check valves – Provide as scheduled.
- D. Controls - Provide a control of pump as scheduled. Include alarm with optional BAS interface with dry contacts.
- E. Sump Basin - Provide a fiberglass basin as scheduled or equal.
- F. Sump Cover - Provide a steel cover for the sump as specified or equal.
- G. Testing - When the installation is complete, the contractor shall add water to the sump to demonstrate to the owner or his representative that the pump system operates at a sufficient flow rate.
- H. Provide & install accessories as scheduled on the plans.

## **2.7 NATURAL GAS SYSTEM PRESSURE REDUCING VALVES**

- A. See section 22 0510 Basic Plumbing Materials and Methods for Piping Specifications.
- B. Furnish and install gas pressure reducing valves where shown on plans per manufacturer's recommendations. Type and size shall be as shown on plans. Confirm equipment pressure requirements prior to ordering.
- C. Natural gas pressure reducing valves shall have venting per manufacturer's recommendations.
- D. Provide isolation valves as shown on plans.

## **2.8 COMPRESSED AIR SYSTEM COMPONENTS**

- A. Air Compressor
  - 1. One (1) Ingersoll Rand Premium Package Model 2545 – Two Stage Reciprocating Air Compressor with 208/3/60 7.5HP 80 Gal. Vertical Tank. Simplex Reciprocating Air Compressor, rated at 26.6 acfm at 175 psig. The tank mount unit is built on an 80 gallon

tank and powered by a 7.5 hp, 208/3/60, ODP, standard efficiency motor with the compressor operating at 825 rpm.

2. *Optional Equipment:*
  - a. Air Cooled Aftercooler -----Included
  - b. Vibration isolators: spring -----Included
  - c. Low oil level switch -----Included
  - d. Extended 2 year warranty kit-----Included
    - 1) Kit includes two replacement air filters and replacement oil filters.
  - e. Control Panel Type - Simplex Magnetic Motor Starter-----Included
  - f. One spare belt for compressor.
  - g. Automatic electric tank drain valve with automatic timer.

B. Air Dryer

1. One (1) Ingersoll Rand Air Dryer D54IN, non-cycling, air-cooled, 115/1/60, refrigerated air dryer.

C. Filters

1. One (1) Ingersoll Rand general Purpose G Series F71IG Filter, 3/4" NPT, general purpose, compressed air filter with one (1) replacement element..
2. One (1) Ingersoll Rand General Purpose H Series F71IH Filter, 3/4" NPT, high efficiency, oil removal, compressed air filter with one (1) replacement element.

D. Flex Connector

1. One flex connector.

E. Air Regulator

1. One relieving regulator, 0-125 psi adjustable.

F. Prior to final inspection, factory authorized start-up of the Air Compressor System will be required. Air Compressor Manufacturer shall provide the services of a factory trained representative who shall supervise all final preparation for start-up, inspect the complete installation, make necessary final adjustments, and instruct the Owner's personnel in the proper operation and maintenance of the equipment. Factory authorized start-up documentation to be submitted to the engineer prior to final inspection.

G. Medical Simulation Air Connections

1. Compressed air vacuum generating fittings – contractor to provide & install all pneumatic vacuum fittings required for Owner's vacuum termination in head wall. Install all required pneumatic tubing between pneumatic vacuum fittings and head wall terminations.
  - a. Basis of design fitting to be SMC model ZH07B, box type vacuum ejector with integral silencer.
2. Connect to all head wall, compressed air, simulated oxygen (compressed air), and vacuum terminations not provided by this contractor. See sheets A430 and A501.

**2.9 PLUMBING FIXTURES**

- A. Furnish and install plumbing fixtures where shown on the Drawings. Type, size, and performance shall be as tabulated in the schedule and on the drawings.
- B. Where indicated on the drawings to be a future fixture, this contractor shall provide all waste, vent, and water supplies as indicated on the drawings and according to local code.
- C. Exposed flush, waste, and supply pipes at the fixtures shall be chromium plated brass pipe, iron pipe size. Fittings for brass pipe shall be cast brass, chromium plated.
- D. Install chromium plated wall or floor plates (escutcheons) with set-screw where piping passes through walls or floors.
- E. All handicap laboratories supply pipe and drain pipe will be fitted with removable safety covers that comply with handicap code requirements.
- F. All fixtures fitted to the walls or floors shall be ground and true and be sealed with a non-hardening white silicone caulk bead.

- G. All plumbing fixtures shall be supported per manufacturer's recommendations.

#### **2.10 FLOOR DRAINS**

- A. Furnish and install floor drains where shown on the Drawings. Type, size, and performance shall be as tabulated in the schedule and on the drawings. Connect outlet of drain to "P" trap. Venting installation requirements of floor drains whether or not shown on plans shall be according to code and approved by the code official.
- B. Furnish and install any floor drains required by the authority having jurisdiction to meet the Uniform Plumbing Code 2009 704.3.

#### **2.11 FLOOR SINKS**

- A. Furnish and Install floor sinks where shown on the Drawings. Type, size, and performance shall be as tabulated in the schedule and on the drawings. Connect outlet of drain to "P" trap. Venting installation requirements of floor sinks whether or not shown on plans shall be according to code and approved by the code official.

#### **2.12 CLEANOUTS (INTERIOR & EXTERIOR)**

- A. Furnish and install clean outs where shown on the Drawings. Type, size, and performance shall be as tabulated in the schedule and on the drawings. Install proper traffic rating and floor pattern shape for intended use.
- B. Cleanouts shall be provided at the base of all vertical stacks with the cleanout plug located approximately 12" above the floor and extended to wall access cover. Cleanouts in floors on grade shall be located as shown on plans and at changes in direction of pipe run and shall consist of Y fittings and eighth bends. Cleanouts must be provided in accordance with the local code and as shown on the drawings.
- C. Floor cleanouts – frame and cover threaded for 2" vertical adjustment, threads protected with shield to be removed when concrete is set. Covers-nickel bronze round frame and cover, deep flange tractor type. Extra heavy type in heavy traffic areas, and with carpet cleanout marker for carpeted floors.
- D. Wall Cleanouts – access covers shall be stainless steel.
- E. Provide exterior ground cleanouts up to grade from sewer mains where service exits the building, as shown on drawing, and using service weight cast iron soil pipe up to grade (regardless of the type of material for the line). If not in concrete, pour an 18"x18"x6" concrete pad around cleanout and install flush with surrounding surface. Cleanout to be Zurn Z-1474-VP Heavy Duty Cleanout with dura-coated cast iron top and vandal proof screws or equal by Zurn, Blake, Josam, or Smith.

#### **2.13 ROOF JACKET**

- A. Roof extension from soil, waste, and vent pipes shall be extended at least 18 inches above the roof, and must be encased in frostproof jackets, each having an air space at least 1" between the outside surface of the pipe and a cap over the top of the pipe so that it will be unnecessary otherwise to plug the inside of the vent pipes at the top when the test is made. These plugs must be of a type readily seen until removed. Remove them at once after the piping system has been tested and approved.

#### **2.14 NATURAL GAS DOMESTIC HOT WATER HEATERS**

- A. Natural gas water heater(s) shall be A. O. Smith Cyclone Mxi or pre approved equal, with performance as scheduled. Water heater(s) shall:
  1. Modulating gas burner that automatically adjusts the input based on demand.
  2. Have powered anodes that are non-sacrificial and maintenance free.
  3. Have seamless glass-lined steel tank construction, with glass lining applied to all water-side surfaces after the tank has been assembled and welded;
  4. Meets the thermal efficiency and/or standby loss requirements of the U. S. Department of Energy and current edition of ASHRAE/IES 90.1

5. Have foam insulation and a CSA Certified and ASME rated T&P relief valve. Have a down-fired power burner designed for precise mixing of air and gas for optimum efficiency, requiring no special calibration on start-up
  6. Be approved for 0" clearance to combustibles.
  7. Be UL listed.
- B. The control shall be an integrated solid-state temperature and ignition control device with integral diagnostics, graphic user interface, fault history display, and shall have digital temperature readout. All models are design certified by Underwriters Laboratories (UL), Inc., according to ANSI Z21.10.3 - CSA 4.3 standards governing storage type water heaters; Meet the thermal efficiency and standby loss requirements of the U. S. Department of Energy and current edition ASHRAE/IES 90.1. Complies with SCAQMD Rule 1146.2 and other air quality management districts with similar requirements for low NOx emissions.
- C. Provide & install accessories as scheduled on the plans.

#### **2.15 DOMESTIC HOT WATER RECIRC PUMP**

- A. The contractor shall furnish and install inline pump as illustrated on the plans and in accordance with the following specifications:
1. The pump shall be of the horizontal, permanently lubricated type, specifically designed and guaranteed for quiet operation.
  2. The pump shall have a steel shaft supported by permanently lubricated, sealed precision ball bearings. The pumps are to be equipped with a water-tight seal to prevent leakage. Mechanical seal faces to be carbon on silicon carbide. The motor shall be non-overloading at any point on the pump performance curve.
  3. The motor shall be of the drip-proof, sealed precision ball-bearing, quiet-operating construction. The EC motor shall be equipped with thermal overload protection.
  4. Pump to be suitable for 225°F (107°C) operating temperature at 150 psig (10 bar) working pressure.
  5. Variable speed EC motor
  6. 0-10V input BAS control capability for enable/disable and speed control.

#### **2.16 DOMESTIC WATER SYSTEM EXPANSION TANK**

- A. Furnish and install a pre-pressured expansion tank as scheduled on the drawings or prior approved equal.

#### **2.17 DIGITAL WATER TEMPERING SYSTEM**

- A. Temperature control system shall be controlled digitally via integrated circuit board technology designed to deliver blended water economically at accurate temperature selected by user as safe and appropriate for sanitary use in facility's recirculated hot water system. The mixing valve shall be a Lawler Neptune EMX with model as noted on plans.
- B. Construction shall be lead free design and in compliance with lead free laws. Digital water temperature control and monitoring system shall feature interface capable of displaying critical system data in standard or metric measurements. Unit shall be user-configurable on location and shall not require factory pre-programming prior to shipment. Temperature adjustment shall be made locally by user at the control module and shall not require a laptop computer or special software to initiate. BAS to monitor and override.
- C. System shall control water temperature to +/- 2°F in accordance with ASSE 1017 and during periods of low and zero demand, and maintain a consistent system "idling" temperature to mitigate "temperature creep" without the use of a manual throttling device/balancing valve. The actuator shall be located external to mixing chamber where water from valve cannot affect performance as a result of faulty o-rings or seals.
- D. System shall digitally monitor and display the following without the use of a separate module, laptop and special software that must be downloaded:
1. Mixed outlet temperature and mixed outlet set point in oF/oC

- E. Control module shall integrate with building automation systems through BACnet and/or Modbus protocols without the use of a separate module, and feature local and remote temperature alarms.
- F. In the event of a power failure, system will fail to “last position” in event of power failure. In the event of the loss of cold water, the system will close the hot water inlet. Actuator shall also feature a manual override which can be used to set mixed outlet temperature in the event of a power loss.
- G. System shall be listed/approved to ASSE 1017, cUPC, NSF and CSA 24/UL873. System shall come with a standard 5-year limited warranty.
- H. Provide & install unions as shown on piping detail to facilitate simple unit removal for maintenance.

## **2.18 DOMESTIC HOT WATER RECIRCULATION MANUAL BALANCING VALVES AND STRAINERS**

- A. Calibrated Balance Valve
  1. Valve body shall be constructed out of lead free brass
  2. Valve shall include a ball valve constructed in 304 Stainless Steel.
  3. Valve shall be AB1953 and CSA certified and compliant with Vermont 152S, Maryland House Bill HB372, Senate Bill S.3874, and NSF/ANSI-372.
  4. Valve body shall include two pressure/temperature ports.
  5. Valve body shall include an optional drain valve port.
  6. Valve shall utilize a calibrated nameplate with a memory stop.
  7. Valve shall utilize a reduced port design that provides velocity head recovery.
  8. Valve temperature range shall be from -4°F (-20°C) to 250°F (121°C).
  9. Valve shall have either NPTF thread or SWTF end connections.
  10. Valves with NPT end connections shall be rated for 400 PSIG working pressure.
  11. Valves with SWTF end connections shall be rated for a maximum of 300 PSIG working pressure.
- B. Provide strainer valve body constructed out of lead free brass, see detail.
- C. Install in accordance with manufacturer’s instructions.

## **2.19 SHOCK ABSORBERS**

- A. Piping shall be installed with proper safeguards to prevent water hammer. This will be done by installing a sufficient number of shock absorbers. Shock absorbers shall be Watts or equal.
- B. Contractor to indicate installed locations on as-built drawings.

## **2.20 MISCELLANEOUS CONNECTIONS**

- A. Make all domestic water, waste, vent, gas, air, etc., connections to all equipment in this building whether or not such equipment is furnished under this section or under other sections of the specification. This includes furnishing piping, traps (if required) and shut-off valves on branches to and from each piece of equipment from mains or branch mains.
- B. Make all plumbing connections to existing piping and to all equipment shown on the plans as requiring same. If specific piping details are not shown, the equipment shall be roughed in for and connected in accordance with the manufacturer’s recommendations. It will be this contractor’s responsibility to obtain shop drawings from whomever furnishes the equipment.

## **2.21 TESTING/CLEANING**

- A. The mechanical contractor is responsible for the testing & cleaning of each respective system in accordance with applicable state and local codes. Tests shall be repeated until each system is proven acceptable.

## **2.22 DEMONSTRATION AND TRAINING**

- A. Training of the Owner’s operation and maintenance personnel is required in cooperation with the Owner, General Contractor, and the Commissioning Professional. Provide competent, factory-authorized personnel to provide instruction to operation and maintenance personnel concerning the location, operation, troubleshooting, routine servicing and maintenance of the

installed systems. The instruction shall be scheduled in coordination with the Owner and the Commissioning Professional after submission and approval of formal training agendas. Refer to Sections 01 9113 General Commissioning Requirements.

**2.23 FUNCTIONAL PERFORMANCE TESTING**

- A. System functional performance testing is part of the Commissioning Process as detailed in Section 01 9113 General Commissioning Requirements. Functional performance testing shall be performed by the contractor and witnessed and documented by the Commissioning Professional. Installation checklists shall be successfully completed by the contractor and submitted to the Commissioning Professional prior to functional performance testing.

**END OF SECTION 22 4000**



**SECTION 23 0500  
GENERAL HVAC REQUIREMENTS**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. The mechanical contractor shall perform all work and furnish all materials as indicated in the mechanical plans and specifications as necessary for the successful completion of this project.
- B. This section specifies a system or part of a system being commissioned as defined in 01 9113 General Commissioning Requirements. Testing of these systems, as well as Operations & Maintenance (O&M) Manuals and Training of the Owner's personnel, is required in cooperation with the Owner, General Contractor, and the Commissioning Professional. Project Closeout is dependent on successful completion of all commissioning procedures, documentation, and issue closure. Refer to 01 9113 General Commissioning Requirements for detailed commissioning requirements.

**1.3 PERMITS AND SERVICES**

- A. The mechanical contractor shall obtain all permits and arrange all inspections, give notices and pay all fees as required by the Authority Having Jurisdiction.
- B. This contractor shall coordinate any necessary site utilities including water, natural gas, and sewer work with local utility, owner, and other contractors to minimize disruption and downtime. ANY AND ALL CHARGES ASSESSED BY THE UTILITY OR CITY TO ACCOMMODATE THE REQUIREMENTS OF THIS PROJECT ARE THE SOLE RESPONSIBILITY OF THE MECHANICAL CONTRACTOR. VERIFY ALL CHARGES AND COORDINATE ALL EQUIPMENT NECESSARY WITH THE UTILITY BEFORE SUBMITTING BID.

**1.4 DRAWINGS AND MEASUREMENTS**

- A. Verify all dimensions and conditions with Architectural and Structural drawings. The small scale of the drawings prohibits the indication of all offsets, fittings and accessories necessary and shall be furnished by this Contractor and required for complete and proper operation.
- B. "Existing Conditions" shown on drawings are based on existing plans and limited field investigation. The field survey was conducted to verify, as much as possible, the accuracy of the locations shown. The Contractor shall verify the accuracy of the "Existing Conditions" as shown on the drawings. As the demolition work progresses perform modifications and additions as necessary to correct for these hidden conditions and allow for the completion of the new work.
- C. The general arrangement of the mechanical systems shall be as shown on the drawings. Field changes shall have the written acceptance of the Engineer.
- D. Consult the drawings and specifications of all other trades. Layout work and coordinate with other trades, before installing any equipment, to avoid interfering with these trades or conflicting with applicable codes.
- E. The mechanical contractor shall bear full responsibility for coordinating his work with other trades to avoid conflicts in space requirements, clearances, etc. Problems arising due to lack of coordination will be the responsibility of the mechanical contractor to resolve. Extra work and/or equipment as a result of not coordinating work shall be the responsibility of the installing contractor and at no cost to the Owner.

**1.5 INSPECTION OF SITE AND DOCUMENTS**

- A. Before submitting a proposal on the work contemplated, the bidder shall thoroughly familiarize himself with the contract documents, the site, and all existing conditions and limitations that may affect the performance of his work. Any conflict noted shall be brought to the attention of

the Engineer before bidding. If there is not sufficient time prior to bidding, the Contractor shall bid the larger quantity or better quality of work.

- B. No extra compensation will be allowed, because of misunderstanding the amount of work involved or the bidder's lack of knowledge, for obvious conflicts which could have been discovered or reasonably anticipated prior to bidding.

#### **1.6 REGULATIONS AND CODES**

- A. All work, materials, and equipment in this contract shall comply with all applicable local, city, state and federal ordinances, regulations, and codes.

#### **1.7 INSTRUCTIONS & TRAINING**

- A. Each trade shall provide training to the owner's representative with engineer's representative present.
- B. Training of the Owner's operation and maintenance personnel is required in cooperation with the Owner, General Contractor, and the Commissioning Professional. Provide competent, factory-authorized personnel to provide instruction to operation and maintenance personnel concerning the location, operation, troubleshooting, routine servicing and maintenance of the installed systems. The instruction shall be scheduled in coordination with the Owner and the Commissioning Professional after submission and approval of formal training agendas. Refer to Sections 01 9113 General Commissioning Requirements.

#### **1.8 OPERATING AND MAINTENANCE MANUALS (3 Hard Copies & 1 Electronic Submittal via Submittal Exchange)**

- A. PRIOR TO FINAL INSPECTION, The mechanical contractor shall furnish (3) hard copies (including 1 USB drive containing electronic copy) and (1) electronic submittal via Submittal Exchange of the O&M Manuals to the Engineer, containing all pertinent data to the mechanical systems. Information shall be indexed and labeled per system and shall include catalog cuts, installation manuals, maintenance manuals, manufacturer's names, replacement parts list. Include balancing reports as specified. Include written instructions and warranty info as specified.
- B. The first section shall be indexed/labeled "WRITTEN INSTRUCTIONS & TRAINING" noting written instructions with company service contact info and shall include a list of filters for each unit. Also include document with owners signature attesting to date and satisfaction of training.
- C. The second section shall be indexed/labeled "WARRANTY INFO" and shall include a statement of guarantee on the contractors company letter head and shall include warranty statements of all equipment provided/installed under his contract with specific dates. This will note any longer/special warranties.

#### **1.9 AS-CONSTRUCTED DRAWINGS (Red Lined on Plans & USB Drive containing scanned PDF)**

- A. During construction, each trade shall keep track of the major changes in the rerouting of piping and equipment, and shall note these in red on one set of drawings. This set of drawings shall be submitted with the Operation and Maintenance Manuals along with a USB drive containing a single PDF file with these same red line plans in electronic form. Most printing shops will be able to scan your trade's large plan sheets into electronic form. Contact the engineer's office if there are any questions.

#### **1.10 WORKMANSHIP**

- A. Qualified individuals that are properly licensed to perform the work involved shall perform all mechanical work.

#### **1.11 CUTTING AND PATCHING**

- A. This Contractor shall be responsible for all cutting and patching of holes required for passage of piping, equipment, and ducts. This also applies to the removal or installation of new equipment.
- B. All cutting of existing construction required to install or join new work, except where otherwise indicated on the plans, shall be the responsibility of this Contractor and coordinated with the General Contractor. Before making any cuts, verify exact locations and sizes with the General

Contractor to confirm that no structural members will be cut. Contractor shall make every effort to minimize extent of cutting existing construction.

- C. The mechanical contractor shall be responsible for patching any openings left in floors, walls, and ceilings that were caused by his/her actions. Patching shall match existing surface in color, texture and quality so that patch is indistinguishable from original surface.

#### 1.12 PAINTING

- A. Any equipment which becomes rusted or damaged during construction shall be repaired, cleaned, and repainted by this Contractor. Painting shall always be applied in two coats, one primer and one finish.

#### 1.13 EQUIPMENT AND PIPE SUPPORTS

- A. Provide all structural supporting frames, steel stands, concrete bases, and hangers as required for mechanical equipment. All floor equipment shall be set on 4" high concrete bases furnished by this Contractor, unless otherwise noted.
- B. Paint all unprotected metal, except galvanized and copper, with metal protective paint.
- C. **Hangers for piping shall be large enough to encompass insulation. It shall not be acceptable for insulation to envelope hangers/saddles, or for insulation to stop on either side of hangers.**
- D. Provide saddles at all hangers or supports of insulated piping. Saddles for 4" and larger piping shall be fabricated of 14 gauge galvanized iron, and for smaller piping shall be fabricated of 16 gauge galvanized iron. Saddles shall be one-half the circumference of the pipe insulation and 4" shorter than the insulation inserts.
- E. Under no condition shall any pipe or duct structure be used to support another.

#### 1.14 ACCESS TO EQUIPMENT

- A. Access shall be provided to all motors, valves, dampers, controls, specialties, etc., for maintenance purposes. All access doors, access panels, removable sections, etc., required for access shall be provided. The location of the access openings relative to the mechanical equipment shall be coordinated to assure proper access to the equipment.
- B. Access openings are required for manual, motorized, fire, and smoke dampers and other devices requiring access and shall be provided in the ductwork, plenums, housings, tanks, etc., under this portion of the contract.

#### 1.15 EXCAVATING AND BACKFILLING

- A. When work to be completed by this contractor requires trenching, digging, etc. this contractor shall be responsible for properly protecting open trenches in accordance with required safety procedures. Backfill shall be placed in horizontal layers, not exceeding 9 inches in thickness. Moisten and hand or machine compact to 95% of standard proctor density. Bring fill to elevations indicated. If backfill fails the proctor density test in accordance with ASTM D-2049 and conducted by an independent testing laboratory retained by the owner, Contractor shall recompact and retest until satisfactory density is reached. This contractor shall restore the surface (whether grass, asphalt, concrete, etc.) to its original condition. Grass shall be seeded to match surrounding turf.
- B. When work is in public street, paving repairs shall be equal to and comply with municipal agency requirements. If repairs are done by municipal agency, make necessary arrangement with such agency to make the repairs. Contractor shall include cost for permits, inspection fees, work, etc. in Mechanical Bid.

#### 1.16 TESTING AND ADJUSTING

- A. At the completion of work, all parts of the installation under Division 23 shall be cleaned, lubricated, tested, and adjusted for proper operation.
- B. All piping and ductwork shall be tested and cleaned as required, by all local, state and federal codes. Tests shall be performed in the presence of the authority having jurisdiction. Written

notification of test, date, and results shall be furnished to the Engineer before concealing or covering the installation.

- C. All controls shall be tested and adjusted for proper operation. Adjustments shall be made when all systems are operating which may affect the control system.
- D. An Independent Testing & Balancing Agent shall test and balance all mechanical systems as specified in Section 23 0593.

### 1.17 GUARANTEE

- A. Warranty: The mechanical contractor shall warrant his work against failure and workmanship for a period of at least one year from the date of substantial completion, for all new work. Any work that is defective within that one-year period shall be replaced by the Contractor without charge. If longer/special warranties are noted elsewhere in the specifications, those warranties shall apply.

### 1.18 EQUIPMENT IDENTIFICATION

- A. Major mechanical equipment, rooftop units, energy recovery ventilators, electric duct heaters, heat pumps, exhaust fans, etc. shall be provided with identification as designated on the plans. Labels shall be black laminate three-layer plastic with engraved 1/2 inch white letters, adhered, screwed, or riveted to the equipment. Manufactured by Brady, Champion America/Seton.
- B. Piping shall be identified as to contents and flow direction with plastic, color coded, snap-on or adhesive labels. Manufactured by Brady, Champion America/Seton.
  - 1. Labeling shall be located:
    - a. Adjacent to each valve.
    - b. At each side of and at each obstruction.
    - c. At each branch.
    - d. At each cap for future.
    - e. At each takeoff.
    - f. At each side of penetration of structure or enclosure.
    - g. At each equipment connection.
    - h. At all access doors.
    - i. A maximum of every 40 feet on straight runs of piping including rises and drops.
    - j. Minimum one label per room/space.
- C. Valve tags shall be brass with stamped letters, tag size 1-1/2" minimum in diameter.
  - 1. Provide typed valve lists in each O&M binder. Valve lists shall include the valve number, location, and purpose of each valve, and any other necessary information such as the required opening or closing of another valve when one valve is to be opened or closed.
- D. Color coded indicators shall be installed on the ceiling grid or access door to hard lid areas to indicate all valves and other ceiling mounted equipment requiring service (example – VAV's). Each trade shall be responsible for equipment provided under their respectable trade.
  - 1. Each ceiling label shall be color coded laminated engraved plastic, 1/16" thick, 2.5" wide by 0.75" tall, with white lettering centered on each label. Label to be adhered to the acoustic ceiling tile grid. Seton Style AV0175 or similar.

### 1.19 MECHANICAL SUBMITTAL

- A. All equipment shall be as listed on the equipment schedules or approved equal.
- B. Prior Approval: Manufacturers whose product is not specified or specifically listed on the plans or in the specifications are allowed to submit information on a product that they would like to be considered as an equal to those specified or listed. By submitting this information for consideration, the product representative is indicating that the product being presented for consideration equals or exceeds the specified product in quality, performance and operating parameters. Proof of equality rests with the party making the request. The procedure for this submittal is listed below.

- C. Submit literature on product that is to be considered for prior approval. This literature shall include catalog cuts with all pertinent technical specifications, dimensions and pictures of the product.
- D. Final approval of all equipment shall be contingent on shop drawing acceptance, compliance with the specifications and performance criteria as required. General approval to bid a product does not relieve the supplier or contractor of meeting specific specification requirements.
- E. The Mechanical Contractor shall pay, provide, install and be responsible for any extra materials required due to his use of alternate accepted equipment which has installation requirements different than the specified equipment. This includes paying other trades for any extra work they are involved in due to this substitution of equipment.
- F. Literature shall be submitted so that the engineer receives it no later than 7 days prior to bid date.
- G. All approvals will be in the form of an addendum issued to all plan holders.
- H. List of Acceptable Substitutions:
  - 1. Equipment Identification, Pipe Labeling, Valve Tags, Ceiling Grid Labeling: Seton, Brady Corporation, Marking Services Incorporated
  - 2. VAV Air Handling Unit with DX Cooling & Hot Water Reheat Coil: Daikin (must provide technical submittal during prior approval process, min 7 days prior to bid)
  - 3. DX Air Cooled Condensing Unit: Daikin (must provide technical submittal during prior approval process, min 7 days prior to bid)
  - 4. VAV Air Handling Units with Chilled Water Cooling & Hot Water Heating Coils: Daikin (must provide technical submittal during prior approval process, min 7 days prior to bid)
  - 5. Shutoff VAV Terminal Units: Carrier, Price, Krueger, Nailor, Trane, Tuttle & Bailey, Titus, JCI, Greenheck
  - 6. Inline Exhaust Fans: PennBarry, Greenheck, Loren Cook, ACME, ILG Air Specialties Express/Carnes, Aerovent, Panasonic, Twin City Fan & Blower
  - 7. Dryer Booster Fans: Tjernlund
  - 8. Ductless Split System Air Sourced Heat Pump: Daikin, Panasonic, LG, Mitsubishi, Fujitsu, Carrier, Samsung
  - 9. Stationary Louvers: ACME, Ruskin, Pottorff, Arrow United Industries, Greenheck, Air Balance, Nailor, NCA, Safe-Air Dowco
  - 10. Registers, Grilles, & Diffusers: Metalaire, Price, Tuttle & Bailey, Krueger, Nailor, Hart & Cooley, Anemostat, Nailor, J & J Register, Air Specialties Express/Carnes, Titus
  - 11. Smoke Dampers: Ruskin, Safe Air, Air Balance, Nailor, Cesco, Advance Air, Air Control Products, International Air, Greenheck, Pottoff, Lloyd, NCA, United Enertech
  - 12. Add Alternate Near Condensing Natural Gas Boiler: Thermal Solutions EVS (must provide technical submittal during prior approval process, min 7 days prior to bid)
  - 13. Add Alternate Air Cooled Chiller: Daikin (must provide technical submittal during prior approval process, min 7 days prior to bid)
  - 14. Hydronic Pumps: Armstrong, Taco, B&G, Allis-Chalmers, General Signal Pump Group, Thrush, Patterson, Grundfos, Pentair
  - 15. Hydronic Expansion Tanks: Bell & Gossett, Taco, Wessels, Watts, Armstrong, Thrush, Grundfos, Amtrol, American Wheatley, Elbi, Pentair
  - 16. Hydronic Air Separators: Bell & Gossett, Taco, Wessels, Watts, Armstrong, Thrush, Grundfos, Pentair
  - 17. Bypass Filter Feeders: Vector Industries, Neptune, Wessels
  - 18. Propylene Glycol (all systems, new building & Graham Hall): Dow Chemical Dowfrost HD, no substitutions.
  - 19. Hot Water Cabinet Unit Heaters: Sigma, Sterling, Airtherm, Vulcan, Rittling, Modine, Airtherm, IEC
  - 20. Hot Water Hanging Unit Heaters: Sigma, Sterling, Airtherm, Vulcan, Rittling, Modine, Airtherm, IEC
  - 21. Panel Radiation: Runtal

22. Pressure-compensating Flow Control and Strainer Valves: Nexus, Pro Hydraulics, Griswold, Autoflow, B&G, Flow Design, IMI Flow Design
  23. Manual Calibrated Flow Balancing Valves - Nexus, Pro Hydraulics, Griswold, Autoflow, B&G, Flow Design, IMI Flow Design
  24. DDC Temperature Controls (BACnet) – New Building Only: Invensys by Johnson Controls Inc. or Siemens by G&R Controls, no others shall be accepted.
  25. DDC Temperature Controls (BACnet) – Graham Hall Only: Invensys by Johnson Controls Inc. no others shall be accepted.
  26. DDC Temperature Controls (BACnet) – Student Center Only: Siemens by G&R Controls, no others shall be accepted.
- I. Refer to Section 01 9113 General commissioning Requirement for commissioning-related submittals and submittal review processes.

#### **1.20 SHOP DRAWINGS**

- A. Before ordering any item, Contractor shall review, stamp with his approval and submit shop drawings of equipment as to be furnished under this contract.
  1. Electronic submittals are REQUIRED. Electronic submittals can be one combined .pdf. for each of the following mechanical trades: Fire Sprinkler Drawings, Fire Sprinkler Calcs, Fire Sprinkler Materials, Temperature Controls, HVAC, Plumbing, and Hydraulics.
- B. Where the contractor is submitting shop drawings that differ from the plans and specifications, the contractor must notify the engineer in writing each variance from the plans and specifications and the Mechanical Contractor shall pay, provide, install and be responsible for any extra materials required due to his use of alternate accepted equipment which has installation requirements different than the specified equipment. This includes paying other trades for any extra work they are involved in due to this substitution of equipment.
- C. Product Data shall include, but are not limited to, the following: Manufacturer's product specifications, Manufacturer's installation instructions, standard color charts, catalog cuts, roughing-in diagrams and templates, and standard wiring diagrams.

#### **1.21 TEMPORARY HEAT**

- A. Temporary heating of the building during construction will be provided as specified in the General Conditions and Supplemental General Conditions. Under no circumstance shall the proposed HVAC equipment be brought into service as temporary heating prior to project completion without written permission from the mechanical engineer & owner.

#### **1.22 EXECUTION**

- A. Remove equipment as indicated. Demolition work shall be coordinated with the Owner. Should questions arise regarding the removal of equipment, confer with the owner before such equipment is demolished.
- B. Materials removed by demolition shall remain the property of the Owner unless specifically noted. Material the Owner does not wish to retain shall be removed and properly disposed of by the Contractor.
- C. The existing building will be in use during this construction. Schedule and carry out the work in such a manner as to cause the Owner a minimum of inconvenience due to service interruptions. Temporary services shall be installed if one area or phase of construction disrupts service to another area of the building or if equipment has to be relocated to allow construction to progress. Service interruptions shall be confined to the smallest area possible at any one time and interruptions shall be scheduled with the Owners site representative. After service has been restored following an interruption, inspect areas affected by the interruption and be responsible for returning automatically controlled equipment to the same operating condition that existed prior to the interruption.
- D. Install equipment and materials to provide required access for servicing and maintenance. Coordinate the final location of concealed equipment and devices requiring access with final location of required access panels and doors. Allow ample space for removal of all parts that require replacement or servicing.

- E. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.
- F. Coordinate mechanical equipment and materials installation with other building components. Verify all dimensions by field measurements. Arrange for chases, slots, and openings in other building components to allow for mechanical installations.
- G. Final locations of equipment may differ slightly from those shown on these plans. Coordinate exact location of equipment with equipment supplier, structural members, furniture layout and other trades before rough in and adjust accordingly. Pricing shall allow for a minimum of 10 ft. of difference in the actual location of items as compared to the location shown on the drawings.
- H. All penetrations for piping, ductwork, etc. which penetrate floors, fire and/or smoke walls, roofs, full height partitions and similar structures shall be sealed by the mechanical contractor with a UL system specifically approved for the application. This system must maintain the required fire rating.
- I. All mechanical systems shall be tested and cleaned as required by Authority Having Jurisdiction.
- J. The mechanical contractor shall have the full responsibility of ensuring that his/her work is performed in a safe manner and shall bear all liability associated with his/her job site safety.
- K. Upon completion of the work, the Contractor shall notify the A/E and make arrangements for a final inspection. Contractor shall provide A/E with copy of all required balance reports prior to the final inspection.
- L. After the final inspection is made, the Contractor will receive a list of items requiring adjustment, correction, replacement, or completion.
- M. The Contractor shall comply completely with all listed requirements within (40) days of receipt of list. Should the Contractor fail to perform within this time limit, the A/E and/or Owner reserves the right to have the work completed by others and the cost deducted from the contract price.

**END OF SECTION 23 0500**

**SECTION 23 0510**  
**BASIC HVAC MATERIALS AND METHODS**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. This section includes the following basic mechanical materials and methods to complement other Division 23 Sections.
  - 1. Piping materials and installation instructions common to most piping systems.
  - 2. Dielectric fittings.
  - 3. Mechanical sleeve seals.
  - 4. Sleeves.
  - 5. Escutcheons.
  - 6. Grout.
  - 7. Concrete bases.
  - 8. Mechanical Demolition.
  - 9. Installation requirements common to equipment specification sections.

**1.3 DEFINITIONS**

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

**1.4 QUALITY ASSURANCE**

- A. All piping shall be specified in this section. Material and installation shall also be subject to state, local codes and ordinances of the area encompassing this project.
- B. Delete first paragraph below if no welding. AWS states that welding qualifications remain in effect indefinitely unless welding personnel have not welded for more than six months or there is a specific reason to question their ability.
- C. Welder's Qualifications: All welder shall be qualified in accordance with ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
- D. Potable-water piping and components shall comply with NSF 14 and NSF 61 Annex G. Plastic piping components shall be marked with "NSF-pw."
- E. Electrical Characteristics for Mechanical Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.



## **PART 2 - PRODUCTS**

### **2.1 PIPE, TUBE, AND FITTINGS**

- A. Provide piping and factory fabricated fittings as indicated for each service and pipe size. Fitting sizes and types shall match piping or equipment connections. Where not indicated, comply with governing regulations or manufacturer's recommendations.

### **2.2 SLEEVES**

- A. The following materials are for wall, floor, slab, and roof penetrations:
  - 1. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
  - 2. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.
  - 3. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
  - 4. Molded PE: Reusable, PE, tapered-cup shaped, and smooth-outer surface with nailing flange for attaching to wooden forms.

### **2.3 ESCUTCHEONS**

- A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
- B. One-Piece, Cast-Brass Type: With set screw.
  - 1. Finish: Polished chrome-plated.
- C. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.
  - 1. Finish: Polished chrome-plated.

### **2.4 GROUT**

- A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
  - 1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
  - 2. Design Mix: 5000-psi, 28-day compressive strength.
  - 3. Packaging: Premixed and factory packaged.

### **2.5 CONCRETE BASES**

- A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.
  - 1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.
  - 2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.
  - 3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
  - 4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  - 5. Install anchor bolts to elevations required for proper attachment to supported equipment.
  - 6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

## **PART 3 - EXECUTION**

### **3.1 MECHANICAL DEMOLITION**

- A. Refer to Division 1 Sections "Cutting and Patching" and "Selective Demolition" for general demolition requirements and procedures.
- B. Disconnect, demolish, and remove mechanical systems, equipment, and components indicated to be removed.
  - 1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.

2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
  3. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
  4. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material.
  5. Equipment to Be Removed: Disconnect and cap services and remove equipment.
  6. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
  7. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
- C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

### 3.2 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. Install piping according to the following requirements and Division 22 Sections specifying piping systems.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- D. Do not run piping through electrical or electronic equipment spaces and enclosures unless unavoidable. Install drip pan under piping that must be run through electrical spaces, if approved by local authority.
- E. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- G. Install piping to permit valve servicing.
- H. Install piping to allow maximum possible headroom unless specific mounting heights or slopes are indicated.
- I. Install piping at indicated slopes, or level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- J. Install piping free of sags and bends.
- K. Install fittings for changes in direction and branch connections.
- L. Install piping to allow application of insulation.
- M. Select system components with pressure rating equal to or greater than system operating pressure.
- N. Install escutcheons for penetrations of walls, ceilings, and floors.
- O. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.
- P. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
  1. Install steel pipe for sleeves smaller than 6 inches in diameter.
  2. Install cast-iron "wall pipes" for sleeves 6 inches and larger in diameter.

3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- Q. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
  1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- R. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials conforming to the 25/50 flame spread and smoke developed rating.
- S. Verify final equipment locations for roughing-in.
- T. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

### **3.3 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS**

- A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.
- B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- C. Install mechanical equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
- D. Install equipment to allow right of way for piping installed at required slope.

**END OF SECTION 23 0510**

**SECTION 23 0593  
TESTING, ADJUSTING, AND BALANCING (AIR & WATER)**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. This section specifies a system or part of a system being commissioned as defined in 01 9113 General Commissioning Requirements. Testing of these systems, as well as Operations & Maintenance (O&M) Manuals and Training of the Owner's personnel, is required in cooperation with the Owner, General Contractor, and the Commissioning Professional. Project Closeout is dependent on successful completion of all commissioning procedures, documentation, and issue closure. Refer to 01 9113 General Commissioning Requirements for detailed commissioning requirements.

**1.2 SUMMARY**

- A. This Section includes testing, adjusting, and balancing HVAC systems to produce design objectives, including the following:
  - 1. Balancing AIRFLOW and WATER flow within distribution systems, including submains, branches, and terminals, to indicated quantities according to specified tolerances.
    - a. **Includes balancing of domestic hot water recirculation pump and balancing valve system.**
  - 2. Adjusting total HVAC systems to provide indicated quantities.
  - 3. Verifying that automatic control devices are functioning properly.
  - 4. Reporting results of activities and procedures specified in this Section.
- B. **Also include all balancing of existing equipment and systems where indicated on the plans.**

**1.3 DEFINITIONS**

- A. AABC: Associated Air Balance Council.
- B. AMCA: Air Movement and Control Association.
- C. NEBB: National Environmental Balancing Bureau.
- D. SMACNA: Sheet Metal and Air Conditioning Contractors' National Association.

**1.4 SUBMITTALS**

- A. Certified Testing, Adjusting, and Balancing Reports: Prepared on approved forms certified by the testing, adjusting, and balancing Agent.
- B. Refer to Section 01 9113 General commissioning Requirement for commissioning-related submittals and submittal review processes.

**1.5 QUALITY ASSURANCE**

- A. Agent Qualifications: Engage a testing, adjusting, and balancing agent certified by AABC or NEBB or Engineer's approved equal.
- B. Certification of Testing, Adjusting, and Balancing Reports: Certify testing, adjusting, and balancing field data reports. This certification includes the following:
  - 1. Review field data reports to validate accuracy of data and to prepare certified testing, adjusting, and balancing reports.
  - 2. Certify that testing, adjusting, and balancing team complied with approved testing, adjusting, and balancing plan and procedures specified and referenced in this Specification.
- C. Testing, Adjusting, and Balancing Reports: Use standard forms approved by the Engineer.
- D. Instrumentation Type, Quantity, and Accuracy: As described in NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems," Section II, "Required Instrumentation for NEBB Certification."
- E. Instrumentation Calibration: Calibrate instruments at least every six months or more frequently if required by the instrument manufacturer.

**1.6 PROJECT CONDITIONS**

- A. Partial Owner Occupancy: The Owner may occupy completed areas of the building before Substantial Completion. Cooperate with the Owner during testing, adjusting, and balancing operations to minimize conflicts with the Owner's operations.

### 1.7 COORDINATION

- A. Coordinate efforts of factory-authorized service representatives for systems and equipment, HVAC controls installers, and other mechanics to operate HVAC systems and equipment to support and assist testing, adjusting, and balancing activities.
- B. Provide 7 day's advance notice for each test including scheduled test dates and times.
- C. Perform testing, adjusting, and balancing after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

### PART 2 - PRODUCTS (Not Applicable)

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine approved submittal data of HVAC systems and equipment.
- B. Examine system and equipment installations to verify that they are complete and that testing, cleaning, adjusting, and commissioning specified in individual Specification Sections have been performed.
- C. Examine system and equipment test reports.
- D. Examine HVAC system and equipment installations to verify that indicated balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are properly installed, and their locations are accessible and appropriate for effective balancing and for efficient system and equipment operation.
- E. Examine systems for functional deficiencies that cannot be corrected by adjusting and balancing.
- F. Examine air-handling equipment to ensure clean filters have been installed, bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.
- G. Examine strainers for clean screens and proper perforations.
- H. Examine hydronic equipment for correct piping connections and for clean and straight fins.
- I. Examine equipment for installation and for properly operating safety interlocks and controls.
- J. Examine automatic temperature system components to verify the following:
  - 1. Dampers, valves, and other controlled devices operate by the intended controller.
  - 2. Verify dampers and valves are in the position indicated by the controller.
  - 3. Integrity of valves and dampers for free and full operation and for tightness of fully closed and fully open positions. This includes dampers in multizone units, mixing boxes, and variable-air-volume terminals.
  - 4. Automatic modulating and shutoff valves, including two-way valves and three-way mixing and diverting valves, are properly connected.
  - 5. Sensors are located to sense only intended conditions.
  - 6. Sequence of operation for control modes is according to the Contract Documents.
  - 7. Controller set points are set at design values. Observe and record system reactions to changes in conditions. Record default set points if different from design values.
  - 8. Interlocked systems are operating.
- K. Report to the Engineer deficiencies discovered before and during performance of testing, adjusting, and balancing procedures.

#### 3.2 TESTING AND BALANCING PROCEDURES

- A. Perform testing and balancing procedures on each system according to procedures contained in AABC national standards.
- B. Perform testing and balancing procedures on each system according to procedures contained in NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems."
- C. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and balancing, close probe holes and patch insulation with new materials identical to those removed. Restore vapor barrier and finish according to the insulation Specifications for this Project.
- D. Mark equipment settings with paint or other suitable, permanent identification material, including damper-control positions, valve indicators, fan-speed-control levers, and similar controls and devices, to show final settings.

### **3.3 TOLERANCES**

- A. Set HVAC system airflow and water flow rates within the following tolerances:
  - 1. Supply, Return, and Exhaust Fans: Plus 10 to minus 10 percent.
  - 2. Air Outlets and Inlets: Plus 10 to minus 10 percent.
  - 3. Hydronic & Domestic Water Flow Rate: Plus 10 to minus 10 percent.

### **3.4 REPORTS**

- A. Status Reports: As Work progresses, prepare reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.
- B. Final Report: Typewritten, or computer printout in letter-quality font, on standard bond paper, bound in three-ring, loose-leaf binder, and tabulated and divided into sections by tested and balanced systems.
  - 1. Include a certification sheet in front of binder signed and sealed by the certified testing and balancing agent.
  - 2. Include a list of instruments used for procedures, along with proof of calibration.
  - 3. Final Report Contents: In addition to certified field report data, include the following:
    - a. Pump curves.
    - b. Fan curves.
    - c. Manufacturers' test data.
    - d. Field quality-control test reports prepared by system and equipment installers.
    - e. Other information relative to equipment performance, but do not include approved Shop Drawings and Product Data.
  - 4. General Report Data: In addition to form titles and entries, include the following data in the final report, as applicable:
    - a. Title page.
    - b. Name and address of testing, adjusting, and balancing Agent.
    - c. Project name.
    - d. Project location.
    - e. Architect's name and address.
    - f. Engineer's name and address.
    - g. Contractor's name and address.
    - h. Report date.
    - i. Signature of testing, adjusting, and balancing Agent who certifies the report.

### **3.5 ADDITIONAL TESTS**

- A. Within 90 days of completing testing, adjusting, and balancing, perform additional testing and balancing to verify that balanced conditions are being maintained throughout and to correct unusual conditions.
- B. Seasonal Periods: If initial testing, adjusting, and balancing procedures were not performed during near-peak summer and winter conditions, perform additional inspections, testing, and adjusting during near-peak summer and winter conditions.

**END OF SECTION 23 0593**

**SECTION 23 0700  
HVAC SYSTEMS INSULATION**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. The work in this section of the specification and the accompanying drawings consists of performing all labor, equipment, accessories, and materials and in performing all operations necessary for the installation of all insulation for the duct systems and sealing of sleeves.
- B. Work to be insulated includes the following:
  - 1. All supply air, return air, transfer air, outside air, relief air, and exhaust air ducts.
  - 2. All circulating above ground hot water air separators, expansion tanks, pump bodies, and other heating water equipment as required.
  - 3. All circulating above ground hot water piping, valves, and fittings.
  - 4. All circulating above ground chilled water air separators, expansion tanks, pump bodies, and other chilled water equipment as required.
  - 5. All circulating above ground chilled water piping, valves, and fittings.
  - 6. All pumped condensate piping and condensate drain piping (less condensate drains directly from air handlers to floor sinks).
  - 7. All sleeves.
  - 8. Note – underground chilled water piping to be pre-manufactured, see 23 2113.
- C. All insulation work shall be installed in a workmanlike manner by skilled workmen engaged in this type of work.
- D. Fire-Test-Response Characteristics: Provide products with flame-spread and smoke-developed indices of 25 and 50, respectively, according to ASTM E 84 by a testing agency acceptable to authorities having jurisdiction.

**1.3 SUBMITTALS**

- A. Shop drawings/product data as specified in Section 23 0500 shall include the following:
  - 1. Product Data: Identify thermal conductivity, thickness, and jackets (both factory installed, and field applied, if any), for each type of product indicated.

**1.4 COORDINATION**

- A. Coordinate clearance requirements with duct Installer for insulation application.
- B. Coordinate clearance requirements with piping Installer for insulation application.
- C. Coordinate size and location of supports, hangers, and insulation shields.
  - 1. All hangers and insulation shields for piping shall be large enough to encompass insulation without penetrating vapor barrier.
  - 2. It shall not be acceptable for insulation to envelope hangers/saddles.
  - 3. It shall not be acceptable for insulation to terminate on either side of hangers not properly sized to encompass insulation.

**PART 2 - PRODUCTS**

**2.1 DUCTWORK INSULATION**

- A. RIGID BOARD DUCT INSULATION
  - 1. Rigid Board shall be fiberglass, CertainTeed type IB with FSK reinforced foil scrim-kraft jacket or accepted equal. Board density shall be 3 lb/cubic foot with thermal conductivity of .23 at 75 degrees F mean temperature. ASTM C 612, Class 1.
- B. FLEXIBLE DUCT INSULATION
  - 1. Flexible insulation shall be fiberglass, CertainTeed standard duct wrap with FSK reinforced foil scrim-kraft jacket or accepted equal. Flexible insulation density shall be 1-

1/2 lb/cubic foot with thermal conductivity of .24 at 75 degrees F mean temperature. ASTM C 553, Type I, Class B-4.

C. DUCTWORK INSULATION ACCESSORIES

1. Provide staples, bands, wires, tape, anchors, comer angles and similar accessories as recommended by insulation manufacturer for applications indicated.

D. DUCTWORK INSULATION COMPOUNDS

1. Provide cements, adhesives, coatings, sealers, protective finishes and similar compounds as recommended by insulation manufacturer for applications indicated.

E. INSULATION THICKNESS FOR DUCTWORK: All ducts are to be insulated unless otherwise noted. Insulation thickness and type shall be as follows:

1. AHU/VAV System Supply Air:
  - a. Rectangular Supply duct insulation before the VAV shall be exterior and 1-1/2" thick. In addition to wrapping, for the first 15' from units provide 1/2" interior liner for acoustical purposes.
  - b. Round Supply duct insulation before the VAV shall be exterior and 1-1/2" thick.
  - c. Rectangular Supply duct insulation after the VAV shall be interior and 1/2" thick.
  - d. Round Supply duct insulation after the VAV shall be exterior and 1-1/2" thick.
2. Rectangular Return Duct Insulation shall be interior and 1/2" thick.
3. Transfer Duct Insulation shall be interior and 1/2" thick.
4. Transfer Sleeves Insulation shall be interior and 1/2" thick.
5. Outside Air Duct Insulation shall be exterior and 2" thick.
6. Exhaust Air Duct Insulation shall be exterior and 1-1/2" thick within 15' of power roof ventilator or other exterior termination unless otherwise noted.
  - a. Dryer exhaust ductwork to be exterior insulated 1-1/2" full length of duct between the dryer exhaust booster fan and the exterior termination. Ductwork between the dryer and booster fan may be uninsulated.
  - b. All in line exhaust fan ductwork between the exhaust fan and the louver shall be insulated. Exhaust ductwork upstream of exhaust fan may be uninsulated.
7. Concealed ducts may be insulated with rigid or flexible fiberglass insulation.
8. Exposed ducts shall be insulated with rigid fiberglass insulation, including ducts exposed in mechanical rooms and storage rooms. See HVAC and architectural ceiling plans.
  - a. Protective Coating: Portions of insulated duct, 84 inches or less above the floor, shall be additionally protected by the application of a layer of 20 x 20 mesh Johns-Manville "Duramesh" coated with Benjamin Foster mastic #30-36.

**2.2 HEATING WATER AIR SEPARATOR, BYPASS FILTER FEEDER, PUMP BODIES, & OTHER HEATING WATER EQUIPMENT INSULATION**

- A. All surfaces (including the air separator, bypass filter feeder, and pump bodies) shall be insulated with 3 lb. density fiberglass board Johns-Manville #814-450 °F at a thickness of 3".
- B. Insulation shall be cut or mitered where necessary to fit the contour of the equipment. All voids shall be packed with light density glass fiber insulation. Insulation sections shall be banded in place with 3/4 inch x 0.015 inch thick galvanized steel bands at 18 inch o.c. for all large equipment. Insulation shall be covered with one inch galvanized hexagonal wire mesh. Apply 1/2 inch of insulating cement such as OC-110 or equal in 2 layers over the wire mesh.

**2.3 CIRCULATING ABOVE GROUND HEATING PIPING INSULATION**

**A. See plans for PVC jacketing locations.**

- B. All piping in concealed and exposed areas shall be insulated with fiberglass pipe insulation with all service jacket. Jacket shall be factory-applied, and, where specified, with white foil scrim-kraft vapor barrier. Insulation shall be Johns-Manville Micro-Lok 850 HP, or accepted equal.
- C. For pipe sizes to individual terminal units 1" and less – insulation thickness shall be 1/2". For pipe sizes of 1-1/4" thru 2" – insulation thickness shall be 1". For pipe sizes of 2-1/2" and larger – insulation thickness shall be 1-1/2".
- D. Fittings, valves, flanges, etc. shall be insulated with fiberglass blanket, Johns-Manville Microlite or pre-cut mitered sections for elbows, J-M Micro-Lok (1lb/cu. ft. density).



- E. Encase pipe fitting insulation with one piece pre-molded Zeston 2000 PVC fitting covers having flame spread index of 25 or less, and smoke developed index of 50 or less, as tested by ASTM E84 (NFPA 255) method.
- F. Provide sheet metal insulation shields at all hanger locations.
- G. **Hangers for piping shall be large enough to encompass insulation. It shall not be acceptable for insulation to envelope hangers/saddles, or for insulation to stop on either side of hangers.**

#### 2.4 CIRCULATING ABOVE GROUND CHILLED WATER PIPING INSULATION

- A. All piping in concealed and exposed areas shall be insulated with fiberglass pipe insulation with all service jacket. Jacket shall be factory-applied, and, where specified, with white foil scrim-kraft vapor barrier. Insulation shall be Johns-Manville Micro-Lok 850 APT, or accepted equal.
- B. For pipe sizes to individual terminal units 1" and less – insulation thickness shall be 1". For pipe sizes of 1-1/4" thru 2" – insulation thickness shall be 1". For pipe sizes of 2-1/2" and larger – insulation thickness shall be 1-1/2".
- C. Fittings, valves, flanges, etc. shall be insulated with fiberglass blanket, Johns-Manville Microlite or pre-cut mitered sections for elbows, J-M Micro-Lok (1lb/cu. ft. density).
- D. Encase pipe fitting insulation with one piece pre-molded PVC fitting covers having flame spread index of 25 or less, and smoke developed index of 50 or less, as tested by ASTM E84 (NFPA 255) method.
- E. Provide sheet metal insulation shields at all hanger locations.
- F. **Hangers for piping shall be large enough to encompass insulation. It shall not be acceptable for insulation to envelope hangers/saddles, or for insulation to stop on either side of hangers.**
- G. All exterior chilled water piping shall have UV resistant 0.020" PVC jacket with 1-1/2" extruded polystyrene Styrofoam insulation thru exterior penetration, or until connection to preinsulated piping. Fiberglass insulation shall not be acceptable on exterior piping. Seal all seams/connections weather tight.

#### 2.5 CHILLED WATER AIR SEPARATOR, EXPANSION TANK, BYPASS FILTER FEEDER, PUMP BODIES, & OTHER CHILLED WATER EQUIPMENT INSULATION

- A. All surfaces shall be insulated with 3 lb. density fiberglass board Johns-Manville #814-450 °F at a thickness of 3".
- B. Insulation shall be cut or mitered where necessary to fit the contour of the equipment. All voids shall be packed with light density glass fiber insulation. Insulation sections shall be banded in place with 3/4 inch x 0.015 inch thick galvanized steel bands at 18 inch o.c. for all large equipment. Insulation shall be covered with one inch galvanized hexagonal wire mesh. Apply 1/2 inch of insulating cement such as OC-110 or equal in 2 layers over the wire mesh.

#### 2.6 COOLING CONDENSATE PIPING

- A. All piping in concealed and exposed areas shall be insulated with flexible elastomeric thermal insulation consisting of closed-cell, sponge- or expanded rubber materials. Comply with ASTM C 534, Type I for tubular materials, Type II for sheet materials. Maximum thermal conductivity of 0.28 at 75 degrees.
  - 1. Provide adhesives as recommended by insulation material manufacturer.
  - 2. Provide ultraviolet-protective coating as recommended by insulation material manufacturer.
- B. Insulation thickness shall be 1/2" and shall include a vapor retarder.
- C. Fittings, valves, flanges, etc. shall be insulated with prefabricated thermal insulating fitting covers complying with ASTM C 450 for dimensions used in performing insulation to cover valves, elbows, tee, and flanges.
- D. Install per manufacturer's recommendations.

### **PART 3 - EXECUTION**

#### **3.1 GENERAL APPLICATION**

- A. All insulation shall be applied on clean, dry surfaces. All joints shall be snugly butted against the adjoining piece and all joints, seams, voids, flat spots, etc., shall be filled with insulation cement. Do not use cut pieces or scraps abutting each other.
- B. Where double layers are installed, the first layer shall be fastened with binding wire. All joints shall be staggered between the two layers.
- C. Insulation on all cold surfaces must be applied in a continuous, unbroken vapor seal. Hangers, supports, anchors, etc., that are secured directly to cold surfaces must be adequately insulated and vapor sealed to prevent condensation.
- D. All surface finishes shall be extended to protect all surfaces, ends, and raw edges of insulation.
- E. All insulation materials shall be installed in strict accordance with manufacturer's instructions, using recommended adhesives, mastics and coatings applied at specific coverage per gallon and temperature conditions.
- F. Extend insulation without interruption through walls, floors and similar penetrations, except where otherwise indicated.
- G. Maintain integrity of vapor-barrier jackets on insulation, and protect to prevent puncture or other damage.
- H. Do not apply insulation to equipment, breechings, or stacks while hot.
- I. Do not insulate boiler manholes, handholes, cleanouts, ASME stamp, and manufacturer's nameplate. Provide neatly beveled edge at interruptions of insulation.
- J. Provide removable insulation sections to cover parts of equipment, which must be opened periodically for maintenance; include metal vessel covers, fasteners, flanges, frames and accessories.
- K. Repair damaged sections of existing mechanical insulation, both previously damaged or damaged during this construction period. Use insulation of same thickness as existing insulation, install new jacket lapping and sealed over existing.
- L. Insulation installer shall advise Contractor of required protection for insulation work during remainder of construction period, to avoid damage and deterioration.

#### **3.2 FLEXIBLE ELASTOMERIC PIPE INSULATION APPLICATION**

- A. Apply insulation to straight pipes and tubes as follows:
  - 1. Follow manufacturer's written instructions for applying insulation.
  - 2. Seal longitudinal seams and end joints with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the pipe surface.
- B. Apply insulation to fittings and elbows as follows:
  - 1. Apply mitered sections of pipe insulation.
- C. Secure insulation materials and seal seams with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the pipe surface.
- D. Insulation Under Hangers: Pipe hangers shall encompass the insulation and shall have sheet metal saddles furnished by the Mechanical Contractor.
- E. Inserts shall be installed at all hanger locations. Inserts between the pipe and pipe hangers shall consist of 13lb/cubic foot hydrous calcium silicate pipe insulation, or wood blocking, of thickness equal to the adjoining insulation and shall be provided with vapor barriers where required. Insulation inserts shall not be less than the following lengths:
  - 1. 1/2" to 1-1/2" pipe size 10" long
  - 2. 3" to 6" pipe size 12" long
  - 3. 8" and larger pipe size 16" long
- F. On all piping the full thickness of insulation and jacket shall run continuously under the sheet metal pipe saddle and through the pipe hanger (pipe hanger shall be large enough to permit full insulation thickness.)

### 3.3 DUCT APPLICATION

- A. Rigid Insulation shall be secured to duct or sheet metal work by impaling over pin anchors space no more than 12" centers and secured with washers and clips. Pins shall be spot welded to the duct surface by a welding procedure which will not distort the sheet metal or burn through or mar interior finish of the duct plenums of casings but which develop full strength of the pin. Pin sizes and diameters shall be as recommended by manufacturer for type and thickness of insulation specified. Insulation on the underside of all horizontal or sloping ducts shall be additionally secured with 3M Insulation Adhesive 35.
- B. Insulation shall be applied with all joints tightly butted and all points of impalement shall be pointed up and sealed with approved mastic before positioning clips. Where vapor barrier is specified, all joints, breaks, punctures and voids shall be filled with vapor barrier coating compound and covered with vapor seal material identical to the surrounding material.
- C. All joints, duct attachments, and junctions (including those caused by ducts entering walls, projections such as hanger, etc.) shall be pointed and sealed with approved mastic and taped. Where no further finish is required over the vapor barrier, taping shall be carefully done to obtain a neat finished appearance.
- D. Flexible Insulation shall be adhered to duct with fire-retardant adhesive in sufficient quantities to prevent sagging. Ducts with a width over 30" shall be further secured on the underside with mechanical fasteners on 12" maximum centers. Insulation shall be butted with facing overlapping all joints at least 2" and sealed with fire-retardant vapor barrier adhesive. Seal all breaks and punctures with vapor barrier tape and same type of fire retardant adhesive.

### 3.4 MINERAL-FIBER PIPE INSULATION APPLICATION:

- A. Fittings, valves, and flange insulation shall be wrapped firmly under compression (minimum 2:1) to a thickness equal to the adjoining insulation, secured with No. 20 gauge galvanized annealed steel wire, and finished with a smoothing coat of mastic, Johns-Manville No. 375 Insulating and Finishing Cement or equal.
- B. Cold Fittings, Valves, Flanges, etc., shall be additionally sealed with a layer of resin coated glass mesh, such as Johns-Manville Duramesh 207 glass cloth, embedded between two 1/16" thick coats of vapor barrier coating, Benjamin Foster 30-35 or equal. Lap the sealed glass cloth at least 2" on itself and the adjoining insulation.
- C. Premolded Insulation Valve and Fitting Covers shall be installed by tack fastening, banding, or taping as required by manufacturer.
- D. Expansion Joints: For expansion joints, a tube of pipe insulation shall be fabricated that will allow the expansion joint to move within the tube. The insulating tube shall be fastened at one end of the pipe or equipment and the other end shall be free to slide over the adjacent insulated piping. Provide an aluminum jacket over the insulated pipe to provide a smooth surface on which the insulated tube may slide.
- E. Insulation Under Hangers: Pipe hangers shall encompass the insulation and shall have sheet metal saddles furnished by the Mechanical Contractor.
- F. Inserts shall be installed at all hanger locations. Inserts between the pipe and pipe hangers shall consist of 13lb/cubic foot hydrous calcium silicate pipe insulation, or wood blocking, of thickness equal to the adjoining insulation and shall be provided with vapor barriers where required. Insulation inserts shall not be less than the following lengths:
  - 1. 1/2" to 1-1/2" pipe size 10" long
  - 2. 3" to 6" pipe size 12" long
  - 3. 8" and larger pipe size 16" long
- G. On all piping the full thickness of insulation and jacket shall run continuously under the sheet metal pipe saddle and through the pipe hanger (pipe hanger shall be large enough to permit full insulation thickness.)

### 3.5 SEALING OF SLEEVES

- A. All sleeves for pipes, ductwork, etc., furnished under Division 23 of specifications, penetrating floors, fire and/or smoke walls and full height partitions, including chase walls, shall be sealed in accordance with the following:
1. All insulated services shall have the specified insulation terminated on either side of sleeve. Services which require a vapor barrier jacket shall have segment through sleeve insulated with calcium silicate having a minimum thickness same as specified for service. Vapor barrier jacket shall be uninterrupted. Entire void space between inside of sleeve and outside of duct, pipe, and/or calcium silicate insulation shall be packed with fiber insulation, conforming to HHI-521E Type 3 or HHI-558B Form A and having an ASTM fire class E-84 with fiber melt point in excess of 2000 degrees F., to a point 1/8 inch from ends of pipe sleeve. After void is packed with fiber insulation, services which are specified to be insulated shall have a section of insulation installed on each side of sleeve, insulation to be fitted tight to sleeve insulation. Balance of space in sleeve to be filled with nonhardening silicone conforming to TTS-00230 and of type which will allow 50 percent movement in one direction.
  2. Contractor is herein given the option to provide Pipe Shield, Inc., fire rated wall and floor sleeves for insulated and noninsulated piping in lieu of sealing sleeves as outlined above. Shields shall be installed in strict accordance with manufacturer's recommendations.

**END OF SECTION 23 0700**

**SECTION 23 0900  
CONTROLS & CONTROL SEQUENCES**

**THIS TEMPERATURE CONTROL WORK TO BE THE RESPONSIBILITY OF THE HVAC CONTRACTOR.**

**NEW BUILDING –SHALL BE BY JCI or SIEMENS BY G&R CONTROLS.**

**GRAHAM HALL & GRAHAM ADDITION – SHALL BE AN EXTENSION OF THE EXISTING DDC SYSTEM, & BE BY JOHNSON CONTROLS INC. CONTACT GREG HINTGEN AT 605-362-5315**

**STUDENT CENTER – SHALL BE AN EXTENSION OF THE EXISTING DDC SYSTEM, & BE SIEMENS BY G&R CONTROLS; CONTACT PAUL DOOHEN AT 605-336-3788**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. This section specifies a system or part of a system being commissioned as defined in 01 9113 General Commissioning Requirements. Testing of these systems, as well as Operations & Maintenance (O&M) Manuals and Training of the Owner's personnel, is required in cooperation with the Owner, General Contractor, and the Commissioning Professional. Project Closeout is dependent on successful completion of all commissioning procedures, documentation, and issue closure. Refer to 01 9113 General Commissioning Requirements for detailed commissioning requirements.

**1.2 SUMMARY**

- A. THIS TEMPERATURE CONTROL WORK WILL BE THE RESPONSIBILITY OF THE HVAC CONTRACTOR.
- B. ALL TEMPERATURE CONTROLS INSTALLED BY THIS CONTRACTOR SHALL BE FIELD INSTALLED. If there are any discrepancies, contact the engineer's office at least 7 days prior to bidding.
- C. **GRAHAM HALL & STUDENT CENTER:** THESE SYSTEMS SHALL BE EXTENSIONS OF THE EXISTING DDC CONTROLS. THE NEW DDC SYSTEMS MUST BE FULLY INTEGRATED INTO THE EXISTING DDC SYSTEMS FOR COMPLETE OPERATOR ACCESS AND CONTROL THROUGH THE EXISTING COLOR GRAPHIC WORKSTATIONS. CUSTOM GRAPHICAL DISPLAYS FOR THE PROPOSED FLOOR PLAN & ALL PROPOSED EQUIPMENT SHALL BE GENERATED AT THE EXISTING WORKSTATIONS.
- D. Exact thermostats or space sensors &/OR PROTECTIVE COVERS to be located in the space shall be SUBMITTED TO & APPROVED BY SICHMELLER ENGINEERING & OWNER. Coordinate sensor only vs adjustable thermostats with digital display with Engineer prior to submitting shop drawings.
- E. This Section includes controls & control sequences for HVAC systems, subsystems, and equipment.
- F. The work in this section of the specification and the accompanying drawings consists of performing all labor and furnishing of all material and equipment necessary to install a complete Automatic Temperature Control System for the heating, ventilating, and air conditioning systems as indicated on drawings and specified herein, including minor items obviously necessary for complete and operating systems. Automatic Temperature Control System shall provide the "Sequence of Operation" as described in this section.

- G. The control system shall consist of all room sensors, floor sensors, thermostats, valves, damper operators and other accessories to fulfill the intent of the specifications. The temperature control system shall be installed by trained mechanics regularly employed by the manufacturer of the temperature control system.
- H. Each microprocessor based digital controller will be able to maintain its programmed memory in a non-volatile state during power failures without the use of batteries. All components and related temperature control components such as sensors, control valves, actuators, thermostats, control panels, etc. shall be manufactured by the same vendor.
- I. These requirements are to be demonstrated to the Owner, A/E team, and Commissioning Authority prior to the acceptance of shop drawings.

### **1.3 QUALITY ASSURANCE**

- A. Agent Qualifications: An Independent Engineer Approved Temperature Control Contractor shall provide and install all temperature controls and control sequences as specified in this section.

### **1.4 PROJECT CONDITIONS**

- A. Partial Owner Occupancy: The Owner may occupy completed areas of the building before Substantial Completion. Cooperate with the trades and HVAC contractor to minimize conflicts with the Owner's operations.

### **1.5 BALANCING OF SYSTEMS**

- A. The Temperature Controls Contractor shall cooperate and work with the mechanical contractors to properly balance out all mechanical systems to obtain a satisfactory working system.

### **1.6 ADJUSTMENT AND CALIBRATION OF SYSTEMS**

- A. After the system is completely installed, the Temperature Controls Contractor with the presence of the mechanical engineer shall verify the various temperature control cycles as herein specified to the satisfaction of the engineer. The Temperature Controls Contractor shall submit direct to the engineer, a tabulation of all outdoor air, mixed air, discharge air, and all room temperatures for each unit. All thermostats and their thermometers shall be calibrated after installation.

### **1.7 SUBMITTALS**

- A. Shop drawings as specified in Section 230500 shall include the following:
  - 1. All control devices, valves, dampers and auxiliary devices to be used.
  - 2. Written descriptions and diagrams to describe the operational sequences.
  - 3. Room thermostat schedule.
  - 4. Air Flow Measuring Stations
  - 5. Variable Frequency Drives as follows:
    - a. Refer to HVAC Motor Schedule and Mechanical Schedules on Plans for VFD's provided by T.C.C.. If there are any discrepancies or questions, contact the engineer's office prior to bidding.
- B. Refer to Section 01 9113 General Commissioning Requirements for commissioning-related submittals and submittal review processes.

### **1.8 CONTROLLERS & WEB-ACCESSED SYSTEM WITH CUSTOM COLOR GRAPHICS**

- A. Provide BACnet Controllers that are BACnet Testing Laboratory Listed. Network communication protocol used throughout entire DDC system shall be native BACnet Communication certified by the BTL open to Owner and available to other companies for use in making future modifications to DDC system.
- B. Unless otherwise specified, all equipment described below shall be controlled and monitored via a Web-accessed system. The Web-accessed system shall allow for any owner's designated personnel to change schedules and setpoints through a PC user on the Local Area Network or remotely via the Internet. This system shall provide complete custom color graphics

and password protection. This system shall allow for remote monitoring, control, and troubleshooting via the Internet.

- C. Custom Graphics of Floor Plan: Display the following data:
  - 1. Equipment Designation/Label.
  - 2. Outside-Air Temperature Indication.
  - 3. Cooling or Heating/Economizer System Mode Indication.
  - 4. Zone temperature indication and setpoints.
  - 5. Alarms (as recommended by T.C.C.).

## **PART 2 - CONTROL SEQUENCES**

### **2.1 LIGHTING CONTROL**

- A. All exterior lighting on the new building to be controlled by BAS.
  - 1. Exterior lighting controller provided by EC, located in Mechanical/Electrical 147. T.C.C. to interface with controller through BACnet as required, coordinate with EC on interface. Exterior lighting schedule to match existing campus schedule (adj) with existing campus wide photocell override.
- B. Graphic Operator's Workstation shall display the following:
  - 1. Equipment Designation/Label.
  - 2. Building Occupied/Unoccupied Status
  - 1. Exterior Lights On/Off.
  - 2. Exterior Lights Status

### **2.2 ENERGY METERING & MONITORING & TRENDING**

- A. Building Domestic Cold & Lawn Irrigation Water Meter Monitoring
  - 1. Displaying the following for the day, month, year:
    - a. Flow in GPM from Utility Meter #1
    - b. Flow in GPM from Utility Meter #2
    - c. Flow in GPM from Domestic Cold Water Meter #5 (Provided by P.C.)
- B. Lawn Irrigation Water Meter #3 (Provided by P.C.) Monitoring
  - 1. Displaying the following for the day, month, year:
    - a. Flow in GPM from Water Meter #3
- C. Domestic Hot Water Meter #4 (Provided by P.C.) Monitoring
  - 1. Displaying the following for the day, month, year:
    - a. Flow in GPM from Water Meter #4
- D. Heating Water Hydronic Make-Up Water Meter #6 (Provided by P.C.) Monitoring
  - 1. Displaying the following for the day, month, year:
    - a. Flow in GPM from Water Meter #6
- E. Chilled Water Hydronic Make-Up Water Meter #7 (Provided by P.C.) Monitoring
  - 1. Displaying the following for the day, month, year:
    - a. Flow in GPM from Water Meter #7
- F. Utility Natural Gas Metering
  - 1. Displaying the following for the day, month, year:
    - a. Flow in Therms from Utility Meter (Provided by NWE)
- G. Electrical
  - 1. Interface to the building electrical meter or main distribution panel for monitoring phase currents, phase-to-neutral voltages, power factor, KW-hr totalization and kW demand. All information shall be capable of being logged and trended. Provide all necessary cabling, programming, and installation. Information shall be displayed on the graphical user interface. The electrical meter or main distribution panel is specified to have metering with BACnet communication capability, see electrical specifications.
  - 2. Refer to electrical sheets for breakers to monitor phase currents, phase-to-neutral voltages, power factor, KW-hr totalization and kW demand.

### 2.3 GRAHAM HALL ENERGY MONITORING

- A. Graham Hall Domestic Cold Water Meter Monitoring (**by G&R Controls installed in Student Center**)
  - 1. Displaying the following for the day, month, year:
    - a. Flow in GPM from Domestic Cold Water Meter #1G (Provided by P.C.)
- B. Graham Hall Building Heating Water BTU Meter (**by G&R Controls installed in Student Center**)
  - 1. Displaying the following for the day, month, year:
    - a. Flow in GPM from the flow meter in the heating mains.
    - b. Temperature difference in (°F) between the supply and return in the heating mains.
    - c. Hydronic Heat Energy consumed in BTU by Graham Hall.
- C. Electric (**By Johnson Controls installed in Graham Hall**)
  - 1. Interface to the building electrical meter or main distribution panel for monitoring phase currents, phase-to-neutral voltages, power factor, KW-hr totalization and kW demand. All information shall be capable of being logged and trended. Provide all necessary cabling, programming, and installation. Information shall be displayed on the graphical user interface. The electrical meter or main distribution panel is specified to have metering with BACnet communication capability, see electrical specifications.
  - 2. Refer to electrical sheets for breakers to monitor phase currents, phase-to-neutral voltages, power factor, KW-hr totalization and kW demand.

### 2.4 ELEVATOR SUMP PUMP

- A. Pump shall operate with float switch provided & installed by PC. T.C.C. to monitor the high level alarm.
- B. Operator's workstation shall display the following:
  - 1. High Water Alarm Status.
  - 2. High Water Alarm History.

### 2.5 DOMESTIC HOT WATER SYSTEMS

- A. The domestic hot water recirculation pump CP-1G in Graham Hall will be controlled by a local timer/aquastat provided & installed by the PC. T.C.C. to only monitor hot water supply piping out of the water heater WH-1G.
- B. The domestic hot water recirculation pump CP-7 will be controlled by an aquastat by the T.C.C.. When the water temperature in the recirc piping prior to the pump is less than 115°F (adj.), cycle the recirc pumps as necessary to meet the demand.
  - 1. OCCUPIED MODE
    - a. The controller monitors the domestic hot water recirc temperature sensor, and enables the recirc pump on a call to maintain the recirc temperature at 115°F (adj.).
  - 2. UNOCCUPIED
    - a. The domestic hot water recirc pumps shall be off.
- C. Operator's workstation shall display the following:
  - 1. WH-1 Domestic Hot Water Storage Temp Actual
  - 2. WH-1 Digital TMV Setpoint
  - 3. WH-1 Domestic Hot Water Temp to fixtures after thermostatic mixing valve Actual
  - 4. WH-1G Domestic Hot Water Temp to fixtures after thermostatic mixing valve Actual
  - 5. Domestic Hot Water Recirc Temp to CP-7 Actual
  - 6. CP-7 Start/Stop
  - 7. CP-7 Speed
  - 8. CP-7 Status
  - 9. CP-7 Pump Run Time (hours) On Totalizations Page
    - a. Day
    - b. Month
    - c. Year



10. Alarm if water temp after mixing valve is 10°F (adj.) or more above or below 120°F (adj.).

## 2.6 AIR HANDLING UNIT & CONDENSING UNIT CONTROL – VAV APPLICATION (AHU-1G & CU-1G)

- A. Occupied and Unoccupied cycles of operation shall be determined by the DDC controller serving this unit. During occupied operation, the AHU supply fan and return fan will run continuously with the outside air damper open to its minimum open position (adjustable). A discharge air temperature sensor will maintain the discharge air temperature at its setting (reset based on outdoor air temperature) by modulating the normally closed outdoor air damper in sequence with the modulating 3-way hot water coil valve and DX cooling. Upon a call for cooling the outside air damper will be modulated open beyond its minimum setting and the normally open return air damper will be modulated closed. If economizer cannot satisfy the cooling requirements, the DX cooling will be modulated. The normally open return air damper shall operate inversely to the outside air damper. The normally closed relief air damper and outside air damper will be balanced to maintain a slight positive pressure in the space relative to outdoors (0.05" w.c., adj., 5 minute average reading, BAS to monitor only). A mixed air low limit sensor will prevent the mixed air temperature from dropping below 45°F (adj.) by modulating the outside air damper maintain mixed air low limit of 45°F (adj.). An outdoor air sensor will over-ride the outdoor air damper back to minimum position whenever the outdoor air temperature is above 60F (adj.). The 3-way hot water coil valve will be modulated open as necessary to maintain the discharge air temperature at its setting. An automatic reset, safety low limit freeze protection thermostat set at 35°F(adj) on the leaving side of the heating coil will stop the fans and close the outdoor air dampers if a freeze condition is sensed. Note: 3-way valve to have normal/fail position such that water flows through coil. Fail to last position shall not be acceptable.
- B. Reset schedule – control AHU discharge air temperature in straight-line relationship for the following outside air temperature conditions:
1. 80 deg f (adj.) discharge air when outside temperature is less than 20 deg f.
  2. 52 deg f (adj.) discharge air when outside temperature is greater than 90 deg f.
- C. Minimum Outside Air Ventilation – Return air duct mounted Carbon Dioxide (CO2) Control: When in the occupied mode, the controller shall measure the zone CO2 levels and override normal damper operation to maintain a CO2 setpoint of 800 ppm (adj.). When zone CO2 levels are at 800 ppm or below, the outside air damper shall be closed, and be overridden open to maintain the slight positive building pressure. The outside air damper shall modulate open on rising CO2 concentrations to the scheduled minimum outside air level for 1000 ppm (adj.) or above.
- D. Dehumidification (both occupied and unoccupied operation)
1. TC to install duct mounted enthalpy/humidity sensors in the following locations:
    - a. Return air duct before the return air fan.
    - b. Supply air discharge of air handler.
  2. When the return air enthalpy levels are at or below 21 btu/lb (adj.) (10-minute average), the air handler and condensing unit shall operate under normal conditions to maintain the required discharge air temperatures.
  3. When the return air is above 22 btu/lb (adj.) (10-minute average), the condensing unit will be modulated in cooling mode as necessary to lower the discharge air enthalpy level to 21 btu/lb (adj), and the hot water reheat in the air handler with be modulated as necessary to maintain the required discharge air temperatures required by the standard operating sequences.
  4. Dehumidification to be disabled when outside air temperatures are at or below 25 degrees F.
- E. The existing static pressure sensor in the supply air duct will maintain its set point (1.0" w.c., adj.) by modulating the speed of the VFD on the unit's supply fans. A duct static pressure controller in the return fan discharge plenum will control the speed of the return/relief fan via its' Variable Speed Drive (0.01" adj.). A duct static pressure high limit will stop the unit fans if its setting is exceeded (2.5" w.c., adj.).

- F. During Unoccupied operation the AHU supply fan and the return fan will be off and the outdoor air dampers will be closed. If any space temperature in zones served by this unit fall below 60F during the unoccupied cycle, the air handling unit will be started with the outdoor air dampers closed and the hot water coil valve will be controlled to supply 90F (adj.) air to the spaces until the zone requiring heating is satisfied. This same cycle will take place during cold weather on morning warm up except that the unit will operate in the heating mode with the outside air dampers closed until the return air temperature reaches 68F (adj.). If any space temperature in zones served by this unit rise above 85F(adj) during the unoccupied cycle, the air handling unit will be started with the outdoor air dampers closed and the cooling coil and condensing unit will be controlled to supply 60F (adj.) air to the spaces until the zone requiring cooling is satisfied.
- G. Safeties: The following device(s) will close the outdoor air damper, modulate the hot water valve to fully open position, and send an alarm to the workstation and printer when activated:
  - 1. Coil low limit.
- H. Smoke detectors (provided & installed by E.C.), signals alarm, stops AHU-1G fans, and closes smoke dampers when products of combustion are detected in airstream.
- I. Operator's Workstation shall display the following:
  - 1. Equipment Designation.
  - 2. System on-off indication.
  - 3. System occupied/unoccupied mode.
  - 4. System fans on-off command.
  - 5. Supply fan on-off indication.
  - 6. Return fan on-off indication.
  - 7. Building Pressure Sensor indication & location.
  - 8. Relief Damper Position.
  - 9. Relief air CFM indication (AFMS).
  - 10. Relief air CFM setpoint.
  - 11. Outside-air Damper Position.
  - 12. Outside-air CFM indication (AFMS).
  - 13. Outside-air CFM setpoint.
  - 14. Outside-air temperature indication.
  - 15. Outside-air relative humidity indication.
  - 16. Return air temperature indication.
  - 17. Return air relative humidity indication.
  - 18. Return air CO2 level indication.
  - 19. Return air CO2 level setpoint.
  - 20. Mixed-air temperature indication.
  - 21. Mixed-air relative humidity indication.
  - 22. Mixed-air damper position.
  - 23. Economizer Mixed Air Temperature Setpoint.
  - 24. Economizer Status.
  - 25. Supply Fan Status.
  - 26. Supply Fan VFD Speed.
  - 27. Supply Fan VFD Fault.
  - 28. Supply Fan On-Off Command.
  - 29. Supply Fan High Static Shutdown.
  - 30. Supply Air Discharge Air-Temperature Indication.
  - 31. Supply Air Discharge Air-Temperature Set-Point.
  - 32. Supply Air Discharge Relative Humidity Indication.
  - 33. Supply Air Discharge Relative Humidity Set-Point.
  - 34. Supply Air Duct Static Pressure Indication.
  - 35. Supply Air Duct Static Pressure Set-Point.
  - 36. Return Fan Status.
  - 37. Return Fan VFD Speed.
  - 38. Return Fan VFD Fault.
  - 39. Return Fan On-Off Command.

40. Return Fan High Static Shutdown.
41. 3-way modulating Heating Water Heat Enable/Disable.
42. 3-way modulating heating water valve position as percent open (through coil).
43. Heating Hot Water Temperature Available.
44. Coil Freeze Limit
45. Filter Differential Pressure
46. DX Condensing Unit command.
47. DX Condensing Unit on-off indication.
48. DX Condensing Unit Each Compressor Modulation %.
49. DX Condensing Unit Each Compressor Enable
50. DX Condensing Unit Each Compressor Stage run-time hours.
51. Mixed Air Low Limit Alarm
52. Discharge Air Low Limit Alarm
53. Coil Freeze Limit Alarm
54. High Return Air CO2 alarm (greater than 1200 ppm)

**2.7 AIR HANDLING UNIT WITH CHILLED WATER COILS, HOT WATER REHEAT COILS, & RETURN/RELIEF FAN CONTROL – VAV APPLICATION (AHU-100, AHU-200, AHU-300)**

- A. Occupied and Unoccupied cycles of operation shall be determined by the DDC controller serving this unit. During occupied operation, the AHU supply fan cube array and return/relief fan cube array will run continuously with the outside air damper open to its minimum open position (adjustable). A discharge air temperature sensor will maintain the discharge air temperature at its setting (55°F with reset based on building demand determined by VAV's for their respective AHU) by modulating the normally closed outdoor air damper in sequence with the modulating 3-way hot water coil valve and modulating 3-way chilled water cooling coil valve. Upon a call for cooling, the outside air dampers and relief air dampers will be modulated open beyond their minimum setting, and the normally open return air damper will be modulated closed. If economizer cannot satisfy the cooling requirements, the chilled water cooling will be modulated. The normally open return air damper shall operate inversely to the outside air damper. The normally closed relief air damper will be modulated based off of outside air damper position. An Air Flow Measuring Station (AFMS) will measure the outside air entering air handler. An Air Flow Measuring Station (AFMS) will measure the relief air exiting the building. The outdoor air damper position, relief air damper position, and return air damper position will be modulated to maintain a slight positive pressure in the space relative to outdoors (0.05" w.c., adj., BAS to monitor). Building pressure sensor will monitor only and will be used for a reference point. A mixed air low limit sensor will prevent the mixed air temperature from dropping below 45F (adj.) when in economizer mode. An outdoor air sensor will over-ride the outdoor air damper back to minimum position whenever the outdoor air temperature is above 60F (adj.). The 3-way modulating hot water coil valve and the 3-way modulating chilled water cooling coil valve will be modulated open as necessary to maintain the discharge air temperature at its setting, An automatic reset, safety low limit freeze protection thermostat set at 35°F(adj) on the leaving side of the heating coil will stop the fans and close the outdoor air dampers if a freeze condition is sensed. Note: Hot water 3-way valve to have normal/fail position such that water flows through coils, chilled water 3-way valve to have normal/fail position such that water bypasses coils. Fail to last position shall not be acceptable.
- B. Minimum Outside Air Ventilation – Return air duct mounted Carbon Dioxide (CO2) Control: When in the occupied mode, the controller shall measure the zone CO2 levels and override normal damper operation to maintain a CO2 setpoint of 800 ppm (adj.). When zone CO2 levels are at 800 ppm or below, the outside air damper shall be modulated closed to match the general building exhaust. The outside air damper shall modulate open on rising CO2 concentrations to the scheduled minimum outside air level setpoint for 1000 ppm (adj.) or above.
- C. A static pressure sensor in the supply air duct 2/3 way to furthest VAV box will maintain its set point (1.0" wc., adj.) by modulating the speed of the VFD on the unit's supply fans. A duct static pressure controller in the return fan discharge plenum will control the speed of the re

turn/relief fan via its Variable Speed Drive (0.01" adj.). A duct static pressure high limit will stop the unit fans if its setting is exceeded (2.5" wc, adj.).

- D. Dehumidification (both occupied and unoccupied operation)
  - 1. TC to install duct mounted enthalpy/humidity sensors in the following locations:
    - a. Return air duct before the return air fan.
    - b. Supply air discharge of air handler.
  - 2. When the return air enthalpy levels are at or below 21 btu/lb (adj.) (10-minute average), the air handler and chiller shall operate under normal conditions to maintain the required discharge air temperatures.
  - 3. When the return air is above 22 btu/lb (adj.) (10-minute average), the chiller will be modulated in cooling mode as necessary to lower the discharge air enthalpy level to 21 btu/lb (adj), and the hot water reheat in the air handler (and/or VAV's if necessary) will be modulated as necessary to maintain the required discharge air temperatures required by the standard operating sequences.
    - a. Dehumidification sequence shall also be enabled if space sensor in Commons/Study Space 100 exceeds relative humidity setpoint in occupied and unoccupied modes (reheat on associated VAV to be modulated as required in lieu of air handler reheat coil in occupied mode).
  - 4. Dehumidification to be disabled when outside air temperatures are at or below 25 degrees F.
- E. During Unoccupied operation the AHU supply fan and the return fan will be off and the outdoor air dampers will be closed. If any space temperature in zones served by this unit fall below 60F during the unoccupied cycle, the air handling unit will be started with the outdoor air dampers closed and the hot water coil valve will be controlled to supply 90F (adj.) air to the spaces until the zone requiring heating is satisfied. This same cycle will take place during cold weather on morning warm up except that the unit will operate in the heating mode with the outside air dampers closed until the return air temperature reaches 68F (adj.). If any space temperature in zones served by this unit rise above 85F(adj) during the unoccupied cycle, the air handling unit will be started with the outdoor air dampers closed and the chilled water coil valve will be controlled to supply 60F (adj.) air to the spaces until the zone requiring cooling is satisfied.
- F. Safeties: The following device(s) will close the outdoor air damper, modulate the hot water valve to fully open position, and send an alarm to the workstation and printer when activated: Coil low limit.
- G. A smoke detector (provided & installed by E.C.), located in the supply air and return air connections of the AHU (AHU-100, AHU-200, AHU-300), signals alarm, stops the AHU fans, and closes smoke dampers when products of combustion are detected in airstream.
- H. Operator's Workstation shall display the following:
  - 1. Equipment Designation.
  - 2. System on-off indication.
  - 3. System occupied/unoccupied mode.
  - 4. System fans on-off command.
  - 5. Supply fan on-off indication.
  - 6. Building Pressure Sensor indication & location.
  - 7. Relief Damper Position.
  - 8. Relief air CFM indication (AFMS).
  - 9. Relief air CFM setpoint.
  - 10. Outside-air Damper Position.
  - 11. Outside-air CFM indication (AFMS).
  - 12. Outside-air CFM setpoint.
  - 13. Outside-air temperature indication.
  - 14. Outside-air relative humidity indication.
  - 15. Return air temperature indication.
  - 16. Return air relative humidity indication.
  - 17. Return air relative humidity setpoint.

18. Return air CO2 level indication.
19. Return air CO2 level setpoint.
20. Return/Relief Fan Status.
21. Return/Relief Fan VFD Speed.
22. Return/Relief Fan VFD Fault.
23. Return/Relief Fan On-Off Command.
24. Mixed-air temperature indication.
25. Mixed-air relative humidity indication.
26. Mixed-air damper position.
27. Economizer Mixed Air Temperature Setpoint.
28. Economizer Status.
29. Supply Fan Status.
30. Supply Fan VFD Speed.
31. Supply Fan VFD Fault.
32. Supply Fan On-Off Command.
33. Supply Fan High Static Shutdown.
34. Supply Air Discharge Air-Temperature Indication.
35. Supply Air Discharge Air-Temperature Set-Point.
36. Supply Air Discharge Relative Humidity Indication.
37. Supply Air Duct Static Pressure Indication.
38. Supply Air Duct Static Pressure Set-Point.
39. Primary Heating Water Pump on-off indication.
40. Back-up Heating Water Pump on-off indication.
41. Primary Chilled Hot Water Pump on-off indication.
42. Back-up Chilled Water Pump on-off indication.
43. 3-way modulating Heating Water Heat Enable/Disable.
44. 3-way modulating heating water valve position as percent open (through coil).
45. Heating Hot Water Temperature Available.
46. Primary Chilled Water Pump on-off indication.
47. Back-up Chilled Water Pump on-off indication.
48. 3-way modulating Chilled Water Heat Enable/Disable.
49. 3-way modulating Chilled water valve position as percent open (through coil).
50. Chilled Water Temperature Available.
51. Mixed Air Low Limit Alarm
52. Discharge Air Low Limit Alarm
53. Coil Freeze Limit Alarm
54. High Return Air CO2 alarm (greater than 1200 ppm)

## **2.8 SHUTOFF VARIABLE AIR VOLUME (VAV's) TERMINAL UNIT CONTROL**

### **A. VAV UNITS WITH HYDRONIC CONTROLS**

1. The VAVs will be controlled by the space temperature sensor to vary the primary air flow to the space to provide cooling or heating whenever the air handling unit is operational. On a call for cooling in the space, the primary damper will be modulated open beyond the minimum position to meet the cooling demand. On a call for heating in the space the primary air damper will be modulated to the heating position (adj.) as scheduled and the HW 2-way modulating normally open control valve will modulate open as necessary (0-100%) to provide heat to the space. 2-way valve normal (fail) to open position.
  - a. In heating mode, the primary air damper will be modulated beyond the heating position to maintain a discharge air temperature no higher than 20°F above the space setpoint.
2. All VAV Units shall operate in either the occupied or unoccupied mode and the space sensor with adjustable setpoint shall have an over-ride button on the face to return the terminal unit to its occupied mode of operation if the terminal unit is in "Unoccupied" mode.

### **B. Operator's Workstation shall display the following:**

1. Equipment Designation/Label.

2. Room/area served.
3. Room occupied/unoccupied.
4. Room temperature.
5. Room temperature set point, occupied.
6. Room temperature set point, unoccupied.
7. Actual Air Temperature Delivered to the VAV.
8. Mode indication, heating/cooling/satisfied.
9. Entering Hot Water Temperature
10. 2-way Modulating hot water valve position as percent open.
11. Air-damper position as percent open
12. Supply airflow rate, target.
13. Supply airflow rate, actual.
14. VAV Discharge Air Temperature.
15. Room Temp Alarm ( $\pm 5^{\circ}\text{F}$  from setpoint, adj.)

## **2.9 AIR COOLED DUCTLESS SPLIT SYSTEMS**

- A. VC to provide and install hardwired remote t-stat.
- B. TC to monitor space temperature and alarm when exceeding 72 F (adj).

## **2.10 AIR COOLED CHILLER AND CHILLED WATER PUMPS (CH-1, CP-5&6)**

### **A. CHILLER PLANT ENABLE/DISABLE:**

1. The chiller plant shall be enabled and disabled either manually by an operator command or automatically through the BAS. In automatic mode, the BAS shall enable the chiller plant whenever the outdoor air dry-bulb temperature exceeds the chiller plant enable setpoint of  $55^{\circ}\text{F}$ (adj.) and disable the chiller plant when the outdoor air dry-bulb temperature is equal to or less than the chiller plant enable setpoint of  $55^{\circ}\text{F}$ (adj.) minus a differential of  $4^{\circ}\text{F}$ (adj.). When the chiller plant is disabled, this shall be considered building Heating/Economizer Mode, and all devices shall be commanded off. All chilled water cooling coil valves shall close.

### **B. CHILLER CONTROL:**

1. The chiller shall be controlled via factory installed controls to maintain a chilled water supply temperature and shall be equipped with a BACnet interface for T.C.C. to tie into. The chilled water supply temperature setpoint will be supplied by the BAS. The chilled water system consists of one, four stage chiller on two circuits for increased modulation.

### **C. CHILLED WATER LOOP PUMPS CONTROL:**

1. The BAS shall start the chilled water pumps whenever a chilled water valve on a piece of equipment opens when the system is not in heating/economizer mode. The BAS shall modulate the variable frequency drive for the primary pump to maintain the desired system differential pressure according to a differential pressure sensor located as directed by the Engineer.
2. The backup pump is enabled if the primary pump fails to prove operation or when the system differential pressure set point is not maintained with the primary pump for a minimum of 5 minutes (adj.) and an alarm shall be initiated at the BAS. If both primary and backup pumps are operating below 50% or minimum speed (whichever is higher), the stand-by pump shall be disabled.
3. Each of the two chilled water pumps shall have a current switch or differential pressure switch to prove pump operation. If flow is not proven after the BAS has commanded the primary pump to start, an alarm shall be initiated at the BAS and the backup pump shall be started and its variable frequency drive shall be modulated by the BAS to maintain the desired system differential pressure. The BAS Contractor shall provide the necessary programming to primary/backup and alternate the pumps on a weekly basis.

### **D. CHILLED WATER LOOP PRESSURE CONTROL:**

1. The chilled water loop pump speed shall be controlled to maintain the specified Building-Loop differential pressure setpoint as recommended by the balancing contractor. Building-Loop differential-pressure error shall be taken into account, when adding pumps.

To ensure stable system flow, the rate at which chilled water pump speed may change shall be limited to 10% per minute (adj.). The minimum speed of the pumps shall be adjustable and set as required to meet chiller minimum flow, or value recommended by the pump and/or variable frequency drive manufacturer (if higher).

E. INITIAL CHILLER START-UP:

1. The following sequence applies to the specific case when the chiller is started.
  - a. Command primary pump to start.
  - b. Prove pump running status. After a 60 second (adj.) Stabilization delay, command chiller to start.

F. CHILLER PLANT SHUTDOWN:

1. When the BAS disables the chilled water system, the chiller shall receive a disable command, and the chilled water pump shall continue to run for an additional 2 minutes (adj.). After the 2 min. period expires, the chilled water pumps shall be shut down.

G. Graphic Operator's Workstation shall display the following:

1. Outside-Air Temperature Indication.
2. Building Cooling or Heating/Economizer System Mode Indication.
3. Auto or Manual Override indication.
4. Chiller Flow Switch indication.
5. Chiller off-cooling indication.
6. Each Compressor on-off indication.
7. Each Compressor run-time hours.
8. Chilled Water Supply from Chiller Temperature.
9. Chilled Water Return to Chiller Temperature.
10. Chilled Water Flow Meter.
11. Chilled Water System Pressure.
12. Differential Pressure Set-point.
13. Differential Pressure Actual.
14. Chilled Water Loop Circulating Pump CP-5 on-off indication.
15. Chilled Water Loop Circulating Pump CP-5 VFD speed indication.
16. Chilled Water Loop Circulating Pump CP-6 on-off indication.
17. Chilled Water Loop Circulating Pump CP-6 VFD speed indication.
18. CP-5 VFD Fault.
19. CP-6 VFD Fault.
20. AHU-100 Chilled Water Valve Position
21. AHU-200 Chilled Water Valve Position
22. AHU-300 Chilled Water Valve Position
23. Chiller Alarm
24. CP-5 Pump Failure
25. CP-6 Pump Failure
26. Chilled Water No System Pressure Alarm

**2.11 NEAR CONDENSING HOT WATER BOILERS & BOILER CIRCULATORS (B-1/CP-1, B-2/CP-2)**

1. The BAS system shall integrate with the boiler control systems as required.
2. BAS contractor shall provide the necessary programming & communication control wiring to primary/backup and alternate the primary boiler. BAS shall enable and modulate individual boilers to maintain secondary loop supply temperature at setpoint. Boiler/equipment shall accept enable and modulation signal from BAS.
  - a. Factory boiler controller staging or cascading shall not be acceptable.
  - b. Rotate primary/backup boilers on a weekly basis.
3. Reset schedule - control heating water loop supply temperature in straight-line relationship for the following outside air temperature conditions:
  - a. 160 deg f (adj.) heating water when outside temperature is less than 20 deg f.
  - b. 140 deg f (adj.) heating water when outside temperature is greater than 65 deg f.

- c. Do not allow the return (entering) water temp to the boilers to be lower than minimum recommended by Boiler Manufacturer (135F adj verify with exact boiler installed).
  - 1) In order to prevent low inlet water temperature, T.C.C. to provide & PC to install a modulating three-way mixing valve on boiler manifold inlet (see piping diagram). If the boiler inlet water temperature is below 135° F (adjustable) or when boiler differential temperature is above 40° F (adjustable), the valve shall slowly modulate closed causing boiler outlet water to mix with the inlet water. When the inlet water temperature and differential temperature return to an acceptable range, the boiler inlet mixing valve shall slowly modulate open.
4. The BAS shall keep each boiler enabled for a minimum of 10 minutes (adj) once enabled before shutting down to prevent excessive short cycling.
5. An emergency boiler shut-down push button (provided & installed by E.C.), stops boilers when the emergency pushbutton is pressed.
6. Boiler circulator enabled by boiler relay, wired by T.C.C., combination starter/disconnect by EC.
7. Boiler circulators shall have a current switch to prove pump operation.
8. Graphic Operator's Workstation shall display the following (each water temp point represents a temperature sensor well to be installed in the heating system piping, coordinate with PC to install wells within 12" of thermometer wells by PC):
  - a. Outside-Air Temperature Indication.
  - b. Each Boiler enable/disable.
  - c. Each Boiler burner modulation.
  - d. Each Boiler Circulator Status.
  - e. Boiler return water temperature.
  - f. Boiler return water 3-way valve position.
  - g. MFR's Minimum return water temperature.
  - h. Each Boiler supply water temperature.
  - i. Each Boiler Runtime.
  - j. Each Boiler Starts.
  - k. B-1 Alarm
  - l. B-2 Alarm
  - m. CP-1 Failure Alarm
  - n. CP-2 Failure Alarm
  - o. Low Boiler return water temperature (Return after mixing valve less than 135°F for more than 15 min. when boiler is enabled.)

#### **2.12 HEATING WATER LOOP PUMPS (CP-3 & CP-4) CONTROL:**

- A. The primary hot water heating pump shall be started by the BAS whenever a heating water valve opens. The BAS shall modulate the variable frequency drive for the primary pump to maintain the desired system differential pressure according to a differential pressure sensor located as directed by the Engineer. Final differential pressure setpoint shall be coordinated with Balancing Contractor.
- B. Each of the two hot water heating pumps shall have a current switch or differential pressure switch to prove pump operation.
- C. Primary pump shall be enabled, and its variable frequency drive shall be modulated by the BAS to maintain the desired system differential pressure. The minimum speed of the pumps shall be 20% (adj.), or value recommended by the pump and/or variable frequency drive manufacturer. The BAS Contractor shall provide the necessary programming to alternate the pumps. Rotate primary/backup pumps on a weekly basis.
- D. The backup pump is enabled if the primary pump fails to prove operation or when the system differential pressure set point is not maintained with the primary pump for a minimum of 5 minutes (adj.). If both primary and backup pumps are operating at or below 40% speed, and dif



ferential pressure setpoint is exceeded by 2 psi for a minimum of 5 minutes (adj.), the stand-by pump shall be disabled.

- E. Graphic Operator's Workstation shall display the following (each water temp point represents a temperature sensor well to be installed in the heating system piping, coordinate with PC to install wells within 12" of thermometer wells by PC):
  - 1. Equipment Designation.
  - 2. Auto or Manual Override indication.
  - 3. Differential Pressure Set-point.
  - 4. Differential Pressure Actual.
  - 5. Heating Water System Pressure.
  - 6. Heating Water Flow Meter
  - 7. CP-3 on-off indication.
  - 8. CP-3 VFD speed indication.
  - 9. CP-4 on-off indication.
  - 10. CP-4 VFD speed indication.
  - 11. CP-3 VFD Fault.
  - 12. CP-4 VFD Fault.
  - 13. Heating Water Supply to Building Temperature after CP-3&4.
  - 14. Heating Water Return Temp from building before boilers.
  - 15. Outside-Air Temperature Indication.
  - 16. Boiler Enable Status
  - 17. CP-3 Pump Failure
  - 18. CP-4 Pump Failure

### **2.13 CABINET UNIT HEATER CONTROL**

- A. Cabinet unit heaters to have 3-way 2-position temperature control valve with normal/fail position to flow through coil. Normal/fail to last position shall not be acceptable.
- B. The unit heaters will be controlled by the space temperature sensor. On a call for heat, the first stage of heat shall be water flow through the coil at 100% flow with the fan disabled. If the room temperature drops more than 1 degree below setpoint after first stage heating, the fan will be enabled, with the hot water valve open to meet the heating demand. Once, setpoint is satisfied, the fan shall be disabled, and the hot water valve will close. The BAS will prevent the fan from operating unless minimum 100 degree F. (adj.) hot water is available from the hot water plant.
- C. OPERATOR WORKSTATION
  - 1. Display the following data:
    - a. Equipment Designation.
    - b. Room/area served.
    - c. Room occupied/unoccupied.
    - d. Room temperature.
    - e. Room temperature set point.
    - f. Hot water valve position as open/closed to coil.
    - g. Fan Enable
    - h. Low Room Temp Alarm (less than 50°F for more than 5 minutes)

### **2.14 HANGING UNIT HEATER CONTROL**

- A. Hanging unit heaters to have 2-way 2-position temperature control valve with normal/fail position to flow through coil. Normal/fail to last position shall not be acceptable.
- B. The unit heaters will be controlled by the space temperature sensor. On a call for heat, the first stage of heat shall be water flow through the coil at 100% flow with the fan disabled. If the room temperature drops more than 1 degree below setpoint after first stage heating, the fan will be enabled, with the hot water valve open to meet the heating demand. Once, setpoint is satisfied, the fan shall be disabled, and the hot water valve will close. The BAS will prevent the fan from operating unless minimum 100 degree F. (adj.) hot water is available from the hot water plant.
- C. OPERATOR WORKSTATION
  - 1. Display the following data:

- a. Equipment Designation.
- b. Room/area served.
- c. Room occupied/unoccupied.
- d. Room temperature.
- e. Room temperature set point.
- f. Hot water valve position as percent open to coil.
- g. Fan Enable
- h. Low Room Temp Alarm (less than 50°F for more than 5 minutes)

#### 2.15 HYDRONIC RADIATION CONTROL

- A. Where radiation is being used as supplemental heat, radiation shall be modulating first stage of heat for that zone with VAV reheat as the second stage.
- B. The radiation will be controlled by the space temperature sensor. On a call for heat, the 2-way modulating normally open hot water valve will open as necessary to meet the heating demand. Valve normal (fail) position to flow through coil, fail to last position shall not be acceptable. The space served by the radiation is controlled in occupied and unoccupied modes as follows:
  1. OCCUPIED MODE
    - a. The controller monitors the room temperature sensor and modulates the 2-way heating valve open/closed to maintain the space temperature at occupied set point.
  2. UNOCCUPIED
    - a. The controller monitors the room temperature sensor and modulates the 2-way heating valve open/closed to maintain the space temperature at unoccupied set point.
  3. Operator Workstation: Display the following data:
    - a. Equipment Designation
    - b. Room/area served.
    - c. Room occupied/unoccupied.
    - d. Room temperature.
    - e. Room temperature set point, occupied.
    - f. Room temperature set point, unoccupied.
    - g. 2-way modulating hot water valve position.
    - h. Room Temp Alarm ( $\pm 5^\circ\text{F}$  from setpoint, adj.)

#### 2.16 EXHAUST FAN CONTROL (EF-X)

- A. EF-1 – Level 1 & Level 2 General Exhaust – shall operate during occupied hours as determined by the BAS System.
  1. D.D.C. controls shall prevent fan operation during Unoccupied Operation and interlock schedule with AHU schedules. (as determined by the BAS).
  2. EF-1 Failure Alarm
- B. EF-2 – Dryer Booster for Penthouse – shall operate as controlled by the integral pressure switch to the unit.
- C. EF-3 – Dryer Booster for Laundry 214 – shall operate as controlled by the integral pressure switch to the unit.

#### 2.17 DEMONSTRATION AND TRAINING

- A. Training of the Owner's operation and maintenance personnel is required in cooperation with the Owner, General Contractor, and the Commissioning Professional. Provide competent, factory-authorized personnel to provide instruction to operation and maintenance personnel concerning the location, operation, troubleshooting, routine servicing and maintenance of the installed systems. The instruction shall be scheduled in coordination with the Owner and the Commissioning Professional after submission and approval of formal training agendas. Refer to Sections 01 9113 General Commissioning Requirements.

## 2.18 WARRANTY

- A. The entire control system shall be warranted for a period of 1 year from the date of beneficial use of the system.

## PART 3 - PRODUCTS

### 3.1 VARIABLE FREQUENCY DRIVES

#### A. WARRANTY

- 1. The warranty shall be 24 months from the date of start-up, not to exceed 30 months from the date of shipment.
- 2. The warranty shall include all parts.

#### B. GENERAL

- 1. VFD shall be current rated at 8 kHz carrier frequency for VFD's 1-75 HP and 4 kHz for VFD's 100-400 HP. All HP ratings shall meet or exceed Table 430-150 of the National Electric Code. Three Phase Motor Full Load Currents, HP, Maximum Current, and Rated Voltage shall appear on the drive nameplate.
- 2. VFD shall not generate damaging voltage pulses at the motor terminals when applied within 500 feet of each other. Both Drive and Motor shall comply with NEMA MG1 section 30.40.4.2 which specifies these limits at a maximum peak voltage of 1600 Volts and a minimum rise time of .1 microseconds.

#### C. CODES/STANDARDS

- 1. VFD and options shall be c UL-508 listed.
- 2. NEMA 12 enclosed VFD shall be UL-1995 approved for mounting in conditioned air ducts and plenums.
- 3. The drive and options shall comply with the applicable requirement of the latest standards of ANSI, NEMA, National Electric Code NEC, NEPU-70, IEEE 519-1992, FCC Part 15 Subpart J, CE 96.

#### D. QUALITY ASSURANCE

- 1. Every VFD shall be functionally tested under motor load. During this load test the VFD shall be monitored for correct phase current, Phase voltages, and motor speed. Correct Current Limit operation shall be verified by simulating a motor overload.
- 2. Verification of proper factory presets by scrolling through all parameters shall be performed to ensure proper microprocessor settings. The computer port should also verify that the proper factory settings are loaded correctly in the drive.
- 3. All options shall be functionally tested. Proper heater coil installation in motor overload, if supplied, shall be verified.

#### E. SERVICE

- 1. Factory authorized representative start-up shall be included for each VFD provided.
- 2. Service engineers shall be employed by the manufacturer or be certified by the manufacturer and provide start-up service including physical inspection of drive and connected wiring and final adjustments to meet specified performance requirements.

#### F. DRIVE FUNCTIONS

- 1. An electronic overload circuit designed to protect an AC motor operated by the VFD output from extended overload operation on an inverse time basis. This Electronic overload shall be UL® and NEC recognized as adequate motor protection. No additional hardware such as motor overload relays or motor thermostats shall be required.
- 2. An LED display mounted on the door of the cabinet that digitally indicates:
  - a. Frequency output
  - b. Voltage output
  - c. Current output
  - d. Motor RPM
  - e. Input kW
  - f. Elapsed Time
  - g. Time Stamped Fault Indication
  - h. DC Bus Volts

3. The VFD shall have the capability of riding through power dips up to 10 seconds without a controller trip depending on load and operating condition. In this extended ride through, the drive shall use the energy generated by the rotating fan as a power source for all electronic circuits.
4. RS232 Port and Windows based software for Configuration, Control, and Monitoring.
5. An isolated 0-20mA, 4-20mA or 0-4, 0-8, 0-10 volt analog speed input follower.
6. An isolated 0-10 V or 4-20 mA output signal proportional to speed or load.

G. PROTECTIVE CIRCUITS AND FEATURES

1. Motor current exceeds 200% of drive continuous current rating.
2. Output phase-to-phase short circuit condition.
3. Total ground fault under any operating condition.
4. High input line voltage.
5. Low input line voltage.
6. Loss of input or output phase.
7. External fault. (This protective circuit shall permit wiring of remote N.C. safety contact to shut down the drive). User supplied end switches, thermal switches, fire-stats, freeze-stats inputs will be connected to this VFD supplied circuit.
8. Metal oxide varistors for surge suppression shall be provided at the VFD input terminals.

H. GENERAL OPTIONS AND MODIFICATIONS

1. Input line fuses shall provide protection for the input rectification circuit using Class J fuses with interrupting rating of 200,000 AIC. The series interrupting rating of the VFD and fuses shall be a minimum of 30,000 AIC and shall be stated in the VFD Instruction Manual as required by UL
2. Disconnect provided & installed by EC.
3. A three phase 3% impedance Input Line Reactor shall be provided to minimize drive harmonics on the AC line and protect the drive from damaging electrical system transients.

I. INSTALLATION

1. Installation shall be the responsibility of the mechanical contractor. The contractor shall install the AFD's in accordance to the manufacturer's recommendation as outlined in the instruction manual.
2. The electrical contractor shall complete power wiring. The contractor shall install the AFD's in accordance to the manufacturer's recommendation as outlined in the instruction manual.

J. TRAINING

1. The contractor shall provide a training session for owner's representatives
2. The training shall be conducted by the manufacturer's authorized representative and shall include:
3. Instructions on the proper operation of the equipment
4. Instructions on the proper maintenance of the equipment

**3.2 AIR FLOW MEASURING STATIONS ON ALL OUTSIDE AIR AND RELIEF AIR DUCTWORK**

A. TC to provide & install air flow measuring stations on all air handling unit outside air and relief air connections.

B. JCI to provide & install air flow measuring stations on Graham AHU-1G outside air and relief air connections.

C. SUBMITTALS

1. Submit under the provisions of Section 013000
2. Provide the following:
3. Equipment schedule.
4. Product overview and technical specification.
5. Placement guide.
6. Sensor density table.
7. Probe installation guide.

8. Wiring guide.
  9. Startup guide.
- D. Independent Test Reports: Provide a copy of each of the following test reports:
1. NIST Report of Airflow Calibration
  2. CHEMIR Test Report on Sensor Exposure to Salts and Acids.
  3. UL Certificate Report
  4. CE Certification form (European shipments)
  5. FCC Part 15 compliance report.
  6. BTL Certification Report.
- E. Quality Assurance
1. Manufacturer Qualifications: Company specializing in manufacturing thermal dispersion airflow measurement devices with minimum ten years documented experience.
- F. DELIVERY, STORAGE AND HANDLING
1. Store products in manufacturer's unopened packaging until ready for installation.
  2. Store products in an environment that is protected from rain, snow and/or condensing moisture.
  3. Handle with care during installation.
  4. Protect sensors from construction debris and remove all debris that may enter the air distribution system prior to system startup.
- G. SYSTEM STARTUP AND VERIFICATION
- H. Startup and verify products in accordance with manufacturers procedures in the operations and maintenance manual.
- I. MANUFACTURERS
1. Approved Manufacturer: EBTRON, Inc.
  2. Requests for substitutions that meet the specification requirements will be considered in accordance with the provisions of Section 23 0500.
- J. GENERAL REQUIREMENTS AND EXCLUSIONS
1. Provide one thermal airflow measuring device (AMD) for each location indicated on plans, schedules and/or control diagrams. Fan inlet measurement devices shall not be substituted for duct or plenum measurement devices indicated on the plans.
  2. Each AMD shall use the principle of thermal dispersion to determine the actual or mass airflow rate of the airstream. Differential pressure-based devices, including pitot tubes, pitot arrays, piezo-rings and devices measuring the pressure drop across a louver, damper or obstruction are not acceptable.
  3. Each AMD shall be provided with one or more sensor probes having one or more sensor nodes per probe.
  4. Each sensor node shall consist of two hermetically sealed bead-in-glass thermistors. The airflow of each sensor node shall be determined using one self-heated and ambient temperature sensing thermistor. Devices using indirectly heated thermistors to determine the airflow rate are not acceptable. Devices using chip thermistors of any type or packaging are not acceptable. Devices using platinum wire RTDs or similar "hot wire" devices are not acceptable.
  5. Thermistors shall be potted in an engineering thermoplastic assembly using water-proof, marine epoxy and shall not be damaged by moisture, direct contact with water or exposure to atmospheric acids. Provide a copy of an independent laboratory report to verify compliance with this requirement.
  6. All internal wiring in the probe tube shall be chemical and abrasion resistant Kynar® coated copper.
  7. All connections to internal wires in the probe tube shall be solder joints or welds. Connectors of any type in the probe tube are not acceptable.
  8. Each thermistor shall be independently calibrated to NIST traceable temperature standards to establish the resistance-temperature characteristics for the determination of

- airflow and temperature. Devices using interchangeable, curve-matched, thermistors are not acceptable.
9. Each sensor node shall be independently processed by the transmitter prior to averaging and output.
  10. The specified sensor accuracy shall include the combined uncertainty of the sensor nodes and transmitter. Devices whose overall accuracy is based on individual accuracy specifications of the sensor probes and transmitter shall demonstrate compliance with the specified sensor accuracy over the entire operating range.
  11. Installed accuracy shall include the uncertainty of the AMD and the additional uncertainty that results from the placement of the AMD in the airstream. The specified installed accuracy is based on the AMD being installed in accordance with manufacturers published placement and installation guidelines.
  12. Transmitters shall be microprocessor-based and operate automatically after brownouts and/or transient power interruptions.
  13. All printed circuit boards shall be have gold plated interconnects, edge fingers, and test points.
  14. Remote transmitters shall have an LCD and four-button user interface.
  15. Remote transmitters shall be mounted in a location protected from moisture, rain and snow with an ambient temperature between -20 and 120 °F [-28.9 to 48.9 °C] and a humidity range between 5 and 95% RH (non-condensing). Provide a weatherproof enclosure and mount away from direct sunlight when outdoor mounting is required.
  16. Probes with remote transmitters shall be “plug and play”, not require matching to the transmitter, and be provided with a UL listed, FEP jacketed, plenum rated cable and connector plug. Devices using PVC jacketed cables to connect sensor probes to the transmitter are not acceptable.
  17. All components of each AMD shall be RoHS2 compliant.
  18. Each AMD shall be UL/cUL listed as a final assembly.
  19. Each AMD shall be FCC-Part 15 compliant. Compliance shall be demonstrated by an independent test laboratory.
  20. European shipments shall be CE marked. Compliance shall be demonstrated by an independent test laboratory.
  21. Devices with a BACnet network connection shall be BTL tested and listed.
- K. DUCT AND PLENUM AMD WITH TEMPERATURE MEASUREMENT AND REMOTE TRANSMITTER
1. Basis of Design: EBTRON model GTx116e-P+.
  2. Each AMD shall be suitable for installation in ducts and plenums; including air handling equipment cabinets and outdoor air intakes to determine the airflow rate, velocity-weighted temperature and humidity of the airstream. Humidity and enthalpy shall be calculated using the velocity weighted temperature, humidity and on-board pressure sensor.
  3. Provide one to four gold anodized 6063 aluminum [optional: polished 316 stainless steel] probes and one remote transmitter.
  4. Probes shall have integral 304 stainless steel mounting brackets for insertion, internal or standoff mounting.
  5. Probe connector plug and receptacle pins shall be gold plated.
  6. Each sensor node shall be individually wind-tunnel calibrated at 16 points to NIST traceable airflow standards and have an accuracy of  $\pm 2\%$  of reading over the entire operating range. Provide a copy of the NIST calibration report for the reference standard used to calibrate the production tunnels used to calibrate individual sensor nodes. Reference standards calibrated to third-party NIST traceable labs are not acceptable. Devices claiming AMCA certification are not acceptable.
  7. Provide up to 16 sensing nodes per measurement location as required for the opening size and published sensor density tables to achieve an installed airflow accuracy of  $\pm 3\%$  of reading ( $\pm 5\%$  of reading on close coupled outdoor air intakes) between 0 and 5,000 fpm [0 to 25.4 m/s] over a temperature range of -20 to 160 °F [-28.9 to 71.1 °C] and a humidity range between 0 and 100% RH (non-condensing).

8. Provide the velocity weighted temperature of the airstream with an accuracy of  $\pm 0.15$  °F [0.08 °C].
9. This product may be used for temperature measurement when the required measurement location for temperature is satisfied by the measurement location of the AMD.
10. Provide low and high airflow alarms with a user defined setpoint and tolerance.
11. The airflow rate, temperature, humidity, enthalpy or dewpoint, airflow alarm and system status alarm shall be visible on the transmitters display.
12. Provide the following output transmitter model:
  - a. GTC116e: Three isolated, field selectable (4-20mA, 0-5/0-10 VDC) analog output signals and one isolated RS-485, field selectable (BACnet MS/TP or Modbus RTU) network connection.
13. Transmitters with analog output signals shall provide:
  - a. One linear output signal for airflow.
  - b. One linear output signal for velocity-weighted temperature or one binary signal for the airflow alarm or system status alarm.
14. Transmitters with network capability shall provide the airflow, velocity-weighted temperature, velocity-weighted-humidity, velocity-weighted-enthalpy, dewpoint, airflow alarm status, individual sensor node airflow and temperature data and device fault status.
15. Transmitters shall be provided with a 16-character by two-line, backlit, alpha-numeric LCD.
16. Provide a Bluetooth, low-energy interface and free Android® or iOS® software that allows real-time airflow, temperature and humidity monitoring and airflow and temperature traverses. Software shall capture, save and/or e-mail airflow/temperature/humidity data, transmitter settings and diagnostics information.
17. Each AMD shall be powered by 24 VAC (22.8 to 26.4 VAC under load) and have a maximum power requirement of 22 V-A.

#### **PART 4 - EXECUTION**

##### **4.1 INSTALLATION**

- A. All devices in mechanical rooms shall be panel mounted whenever possible. Wiring to remote mounted devices in mechanical rooms and inaccessible spaces shall be run in conduit. Wiring in accessible ceilings may be run with plenum rated cable providing it is securely fastened to the structural members at 4' intervals. In general, all wiring in conjunction with the automatic temperature control system shall be furnished by the Temperature Control Contractor under this section of the specifications in accordance with Division 26 of the specifications.
- B. All automatic valves shall be furnished by the Temperature Control Contractor and installed under his supervision by the Heating Contractor. All automatic dampers, not furnished with the equipment, shall be furnished by the Temperature Control Contractor and installed under his supervision by the Sheet Metal Contractor.
- C. **Room thermostats and remote sensors shall be wall mounted type and shall be mounted to match installation height of adjacent switches/sensors by EC. Coordinate mounting location with EC to locate t-stats/sensors and wall switches. Thermostats and sensors shall not be mounted on outside walls.**
- D. Thermostats shall be installed in locations to minimize adverse effects from supply air diffusers and direct sunlight exposure.<sup>2</sup>

##### **4.2 PROJECT COMPLETION AND ACCEPTANCE**

- A. Upon completion of this project, it will be this Contractors responsibility to insure that the control system is functioning properly. The Contractor shall also insure that the control diagrams for the project are brought up to date and that they reflect the control system "as built". These control diagrams and screen shots of the various screens of the color graphics system shall be included in the Operation and Maintenance Manuals, which shall be turned over to the Owner following the acceptance of the above procedure by the A/E.

**4.3 ON-SITE ASSISTANCE**

- A. **ON-SITE Adjustments: Within one year of date of Substantial Completion, provide 4 hours EVERY MONTH to adjust and calibrate components and to assist Owner's personnel in making program changes and in adjusting sensors and controls to suit actual conditions and improve efficiency. Certain off-site adjustments may be acceptable if owner and engineer approved.**

**4.4 FUNCTIONAL PERFORMANCE TESTING**

- A. System functional performance testing is part of the Commissioning Process as detailed in Section 01 9113 General Commissioning Requirements. Functional performance testing shall be performed by the contractor and witnessed and documented by the Commissioning Professional. Installation checklists shall be successfully completed by the contractor and submitted to the Commissioning Professional prior to functional performance testing.

**END OF SECTION 23 0900**



**SECTION 23 2113  
HYDRONIC PIPING SYSTEMS**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. This section specifies a system or part of a system being commissioned as defined in 01 9113 General Commissioning Requirements. Testing of these systems, as well as Operations & Maintenance (O&M) Manuals and Training of the Owner's personnel, is required in cooperation with the Owner, General Contractor, and the Commissioning Professional. Project Closeout is dependent on successful completion of all commissioning procedures, documentation, and issue closure. Refer to 01 9113 General Commissioning Requirements for detailed commissioning requirements.

**1.2 SUMMARY**

- A. The work in this specification and the accompanying drawings consists of performing all labor and furnishing of all material and equipment necessary to install complete systems listed below, including minor items obviously necessary for complete and operating systems. Piping materials and equipment specified in this Section include the following:
  - 1. All new hot water hydronic piping systems
  - 2. All new chilled water hydronic piping systems
  - 3. Gravity Condensate Drain Piping
  - 4. Pipes, fittings, and specialties.
  - 5. Special-duty valves.
  - 6. Meters and gages.
  - 7. Hydronic specialties.
- B. See Division 23 Section "Basic HVAC Materials and Methods" for general piping installation requirements.
- C. Also included is the work involved to remove existing associated equipment, remodeling of existing systems, including connections between new and existing systems.
- D. Hydronics contractor to be responsible for all condensate drainage piping.

**1.3 SUBMITTALS**

- A. Shop Drawings: Shop drawings as specified in Section 230500 shall include the following:
  - 1. Hydronic Specialties
  - 2. Natural Gas Near-Condensing Boiler-Burner Units
  - 3. Boiler Combustion Air Materials
  - 4. In Line Circulator Pumps for Boilers
  - 5. Base Mounted End Suction Pumps Heating Loop
  - 6. Base Mounted End Suction Pumps Chilled Loop
  - 7. Bypass Filter Feeders & Spare Filters
  - 8. Heating Water Hydronic Pipe, Valves, and Fittings
  - 9. Chilled Water Hydronic Pipe, Valves, and Fittings
  - 10. Chilled Water Below Grade Pre-Insulated Piping System
  - 11. Heating Water Expansion Tank and Air Separator
  - 12. Chilled Water Expansion Tank and Air Separator
  - 13. Gravity Condensate Drain Piping
  - 14. Flow Control and Strainer Valves
  - 15. Hot Water Cabinet Unit Heaters
  - 16. Hot Water Hanging Unit Heaters
  - 17. Hot Water Finned Tube Radiation

18. Hot Water Radiant Panels (wall and pedestal mounted)
  19. Propylene Glycol – 30% Solution Lincoln Hall Heating System
  20. Propylene Glycol – 35% Solution Lincoln Hall Chilled System
  21. Propylene Glycol – 40% Solution Graham Hall Heating System
  22. Glycol Solution Analysis & Water-Treatment Program: Independent analysis of proposed and existing heating & chilled water solutions before and after work is complete (and proposed chilled water solution after work is complete) to confirm proper glycol % and treatment. If solution analysis is not satisfactory, make adjustments as recommended by glycol supplier.
  23. Spare Parts
- B. Product Data: For each type of special-duty valve indicated. Include flow and pressure drop curves based on manufacturer's testing for diverting fittings, calibrated balancing valves, and automatic flow-control valves.
  - C. Shop Drawings: Detail fabrication of pipe anchors, hangers, special pipe support assemblies, alignment guides, expansion joints and loops, and their attachment to the building structure.
  - D. Detail location of anchors, alignment guides, and expansion joints and loops.
  - E. Field quality-control test reports.
  - F. Operation and maintenance data.
  - G. Refer to Section 01 9113 General Commissioning Requirements for commissioning-related submittals and submittal review processes.

#### **1.4 MANUFACTURERS**

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work shall be as specified in Section 23 0510.

#### **1.5 QUALITY ASSURANCE**

- A. Welding: Qualify processes and operators according to the ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
- B. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation. Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp air separators and expansion tanks to comply with the ASME Boiler and Pressure Vessel Code, Section VIII, Division 1.
- C. Uponor PEX-a tube and fitting systems must be installed by a trained installer. Installer must be able to provide verification from the manufacturer that the training has been completed.

#### **1.6 COORDINATION**

- A. Coordinate pipe sleeve installations for foundation wall penetrations.
- B. Coordinate layout and installation of piping with equipment and with other installations.
- C. Coordinate pipe fitting pressure classes with products specified in related Sections.
- D. Coordinate with requirements for firestopping for fire and smoke wall and floor assemblies.

### **PART 2 - PRODUCTS**

#### **2.1 PIPES, TUBES, AND FITTINGS**

- A. Copper Tube and Fittings:
  1. Drawn-Temper Copper Tubing: ASTM B 88, Type L.
  2. Annealed-Temper Copper Tubing: ASTM B 88, Type K.
  3. Wrought-Copper Fittings: ASME B16.22.
  4. Wrought-Copper Unions: ASME B16.22.
  5. Solder Filler Metals: ASTM B 32, 95-5 tin antimony.
  6. At the contractor's option, Nibco Press System or Viega may be used on domestic or hydronic water in lieu of soldered copper fittings. Fittings shall be suitable for working pressures to 200 psig CWP and maximum operating temperatures to +230 degrees F. The fitting manufacturer's factory trained representative shall provide on-site training for

contractor's field personnel in the use of tools, marking and preparation of pipe, and installation of products. The representative shall periodically visit the job site and review contractor's installation and verify the correct procedures are being followed.

B. Steel Pipe and Fittings:

1. Steel Pipe, NPS 2 and Smaller: ASTM A 53, Type S (seamless), Grade A, Schedule 40, black steel, plain ends.
2. Steel Pipe, NPS 2-1/2 through NPS 12: ASTM A 53, Type E (electric-resistance welded), Grade A, Schedule 40, black steel, plain ends.
3. Steel Pipe Nipples: ASTM A 733, made of ASTM A 53, Schedule 40, black steel; seamless for NPS 2 and smaller and electric-resistance welded for NPS 2-1/2 and larger.
4. Cast-Iron Threaded Fittings: ASME B16.4; Classes 125 and 250.
5. Malleable-Iron Threaded Fittings: ASME B16.3, Classes 150 and 300.
6. Malleable-Iron Unions: ASME B16.39; Classes 150, 250, and 300.
7. Cast-Iron Pipe Flanges and Flanged Fittings: ASME B16.1, 125, and 250; raised ground face, and bolt holes spot faced.
8. Wrought-Steel Fittings: ASTM A 234 (ASTM A 234M), Standard Weight.
9. Wrought-Steel Flanges and Flanged Fittings: ASME B16.5, including bolts, nuts, and gaskets of the following material group, end connections, and facings:
  - a. Material Group: 1.1.
  - b. End Connections: Butt welding.
  - c. Facings: Raised face.
10. Grooved Mechanical-Joint Fittings: ASTM A 536, Grade 65-45-12 ductile iron; ASTM A 47, Grade 32510 malleable iron; ASTM A 53, Type F, E, or S, Grade B fabricated steel; or ASTM A 106, Grade B steel fittings with grooves or shoulders designed to accept grooved end couplings.
11. Grooved Mechanical-Joint Couplings: Ductile- or malleable-iron housing and synthetic rubber gasket of central cavity pressure-responsive design; with nuts, bolts, locking pin, locking toggle, or lugs to secure grooved pipe and fittings.
12. Spherical, Rubber, Flexible Connectors: Fiber-reinforced rubber body, steel flanges drilled to align with Classes 150 and 300 steel flanges; operating temperatures up to 220 deg. F and pressures up to 150 psig.
13. Gasket Material: Thickness, material, and type suitable for fluid to be handled; and design temperatures and pressures.

C. Polyethylene PEX Pipe and Fittings:

1. 2" and smaller Cross linked Polyethylene Uponor PEX a Pipe: ASTM 877, SDR 9 with oxygen diffusion penetration per DIN 4726. Fittings consisting of Engineered polymer ASTM F 1960 Cold expansion fitting with reinforcing ring. Two piece compression fitting ASTM 877 with cold expansion fitting with reinforcing ring.
2. Groove Fittings for PEX Tube: One-piece brass F1960 cold-expansion fitting and groove fitting CSAB242-05.

D. Below Ground Steel Pipe and Fittings:

1. All underground water lines shall be XTRU-THERM PREMIER ENGINEERED SERIES as manufactured by PERMA-PIPE or prior approved equal. All straight sections, fittings, anchors, and other accessories shall be factory fabricated, insulated, and jacketed. The piping system layout shall be analyzed by the piping system manufacturer to determine the stresses and displacements of the service pipe. The piping system design and manufacturer shall be in strict conformance with ASME B31.1, latest edition. Installation of the piping system shall be in accordance with the manufacturer's instructions. Factory trained field technical assistance shall be provided for critical periods of installation, unloading, field joint instruction and testing.

2. The service pipe shall be standard weight ASTM A53 Gr. B. ERW carbon steel. All joints shall be butt-welded for 2-1/2" and larger, and socket or butt-welded for 2" and smaller. Where possible, straight sections shall be supplied in 40-foot random lengths with piping exposed at each end for field joint fabrication.
3. Elbows, tees, reducers, anchors, field joints, and end seals shall be designed and factory fabricated to prevent the ingress of moisture into the system.
4. The service pipe insulation shall be polyurethane foam with 2.0 lbs./ft<sup>2</sup> minimum density, 90% minimum closed cell content and initial thermal conductivity of 0.16 btu in./hr ft<sup>2</sup> F. The insulation shall completely fill the annular space between the service pipe and jacket and shall be bonded to both. Systems using open cell insulation or a non-bonded design shall not be allowed. The insulation shall be 1 inch minimum thickness.
5. The outer protective insulation jacket shall be seamless high-density polyethylene (HDPE) in accordance with ASTM D1248, type 3, Class C. PVC or tape materials are not allowed. The minimum thickness of the HDPE jacket shall be 0.125 inch.
6. Provide with aluminum diffusion barrier between HDPE outer jacket and polyurethane foam insulation.
7. Provide with optional anti-corrosion coating over carrier pipe.
8. All fittings shall be factory prefabricated and pre-insulated. Straight tangent lengths shall be added to all ends so that all field joints are at straight sections of pipe. Elbow jackets shall be molded HDPE. Tee jackets shall be extrusion welded or butt fusion welded HDPE. Gluing, taping, or hot air welding shall not be allowed.
9. The service pipe shall be hydrostatically tested to 150 psig or 1-1/2 times the design pressures or whichever is greater. Insulation shall then be poured in place into the field joint area. All field applied insulation shall be placed only in straight sections of pipe. Field insulation of fittings is not acceptable. The installer shall seal the field joint area with a heat shrinkable adhesive backed sleeve. Backfilling shall not begin until the heat shrink sleeve has cooled. All insulation and jacketing materials for the field joint shall be furnished by the manufacturer.
10. A 4-inch layer of sand or fine gravel shall be placed and tamped in the trench to provide a uniform bedding for the pipe. The entire trench width shall be evenly backfilled with a similar material as the bedding in 6 inch compacted layers to a minimum height of 6 inches above the top of the insulated pipe. The remaining trench shall be evenly and continuously backfilled and compacted in uniform layers with suitable excavated soil.

## 2.2 COOLING CONDENSATE DRAIN PIPING

- A. Above Grade: Drain piping shall be type "M" copper, ASTM B 88, with cast-copper solder-joint drainage fittings, ANSI B 16.23, or wrought-copper solder joint, ANSI B 16.29, non-corrosive past flux and 50/50 tin-lead solder ASTM B 32.
  1. Where permitted, schedule 40 PVC or ABS, solvent weld fittings.

## 2.3 VALVES

- A. General-Duty Valves, NPS 2 and Smaller: Bronze body, ball type, threaded ends, unless otherwise indicated. Valve pressure and temperature ratings not less than indicated and as required for system pressures and temperatures. Valve size shall be the same size as upstream pipe, unless otherwise indicated. Quarter-turn lever handle valve actuators. Extended valve stems on insulated valves.
- B. Safety Valves: Diaphragm-operated, bronze or brass body with brass and rubber, wetted, internal working parts; shall suit system pressure and heat capacity and shall comply with the ASME Boiler and Pressure Vessel Code, Section IV.
- C. Pump Discharge Valves: 175-psig maximum working pressure, 250 deg F maximum operating temperature, cast-iron or ductile iron body, replaceable bronze disc with EPDM seat insert, bronze seat, stainless steel stem and spring, and "Teflon" packing. Valves shall have NPT, grooved or flanged connections and straight or angle pattern. Features shall include non-slam check valve with spring-loaded weighted disc, pressure taps, and calibrated adjustment feature

to permit regulation of pump discharge flow, shutoff and valve design to permit repacking under full system pressure.

## 2.4 METERS AND GAGES

### A. Liquid-In-Glass Thermometers

1. Description: ASTM E 1.
2. Range: Temperature range of 40 to 240 deg F, with 2-degree scale divisions (minus 18 to plus 70 deg C, with 1-degree scale divisions). Accuracy shall be plus or minus 1 percent of range span or plus or minus one scale division to maximum of 1.5 percent of range span.
3. Case: Die cast and aluminum finished in baked-epoxy enamel, glass front, spring secured, 9 inches long.
4. Adjustable Joint: Finish to match case, 180-degree adjustment in vertical plane, 360-degree adjustment in horizontal plane, with locking device.
5. Tube: Red or blue reading, organic-liquid filled with magnifying lens.
6. Scale: Satin-faced nonreflective aluminum with permanently etched markings.
7. Stem: Copper-plated steel, aluminum, or brass for separable socket; of length to suit installation.

### B. Bimetal Dial Thermometers

1. ASME B40.3; direct-mounting, universal-angle dial type.
2. Case: Stainless steel with 5-inch diameter lens.
3. Adjustable Joint: Finish to match case, 180-degree adjustment in vertical plane, 360-degree adjustment in horizontal plane, with locking device.
4. Element: Bimetal coil.
5. Scale: Satin-faced nonreflective aluminum with permanently etched markings.
6. Stem: Stainless steel for separable socket, of length to suit installation.

### C. Thermometer Wells

1. Description: Fitting with protective well for installation in threaded pipe fitting to hold test thermometer.
2. Material: Brass, for use in copper piping.
3. Material: Stainless steel, for use in steel piping.
4. Extension-Neck Length: Nominal thickness of 2 inches, but not less than thickness of insulation. Omit extension neck for wells for piping not insulated.
5. Insertion Length: To extend 2 inches into pipe.
6. Cap: Threaded, with chain permanently fastened to socket.

### D. Pressure Gages

1. Description: ASME B40.1, phosphor-bronze bourdon-tube type with bottom connection; dry type, unless liquid-filled-case type is indicated.
2. Case: Drawn steel, brass, or aluminum with 4 ½" diameter, glass lens.
3. Connector: Brass, NPS ¼.
4. Scale: White-coated aluminum with permanently etched markings
5. Accuracy: Grade A, plus or minimum 1 percent of middle 50 percent of scale.
6. Range: Comply with the following:
  - a. Fluids under Pressure: Two times the operating pressure.

### E. Pressure Gage Fittings

1. Hydronic Indicator: Brass body with four inlets and valves by Flow Conditioning Corp. (314) 878-7898 or equal.
2. Valves: NPS ¼ brass or stainless-steel needle type
3. Syphons: NPS ¼ coil of brass tubing with threaded ends.

4. Snubbers: ASME B40.5, NPS ¼ brass bushing with corrosion-resistant porous-metal disc of material suitable for system fluid and working pressure.
- F. Test Plugs
1. Description: Nickel-plated, brass –body test plug in NPS ½ fitting.
  2. Body: Length as required to extend beyond insulation.
  3. Pressure Rating: 500 psig minimum.
  4. Core Inserts: Two self-sealing valves, suitable for inserting 1/8-inch OD probe from dial-type thermometer or pressure gage.
  5. Core Material for Air, Water, and Gas: 20 to 200 deg F (Minus 7 to plus 93 deg C), chlorosulfonated polyethylene synthetic rubber.
  6. Test-Plug Cap: Gasketed and threaded cap, with retention chain or strap.
  7. Test Kit: Pressure gage and adapted with probe, two bimetal dial thermometers, and carrying case.
- G. Pressure Gage and Thermometer Ranges: Approximately two times the system's operating conditions.

## 2.5 HYDRONIC SPECIALTIES

- A. Manual Air Vent: Bronze body and nonferrous internal parts; 150-psig working pressure; 225 deg F operating temperature; manually operated 1/2" full port ball valve with gooseneck down; with NPS 1/2 discharge connection and NPS 1/2 inlet connection, and chained cap hose connection.
- B. Automatic Air Vent: Designed to vent automatically with float principle; bronze body and nonferrous internal parts; 150-psig working pressure; 240 deg F operating temperature; with NPS 1/4 discharge connection and NPS 1/2 inlet connection.
- C. Heating & Chilled Water Bladder Style Expansion Tanks: Welded carbon steel, rated for 125-psig working pressure and 240 deg F maximum operating temperature. Provide taps for pressure gage and air-charging fitting, and drain fitting. Support vertical tanks with steel legs or base; support horizontal tanks with steel saddles. Fabricate and test tank with taps and supports, and label according to the ASME Boiler and Pressure Vessel Code, Section VIII, Division 1.
- D. High flow bypass filter feeders across the hot water pumps and chilled water pumps as indicated on the plans. Basis of design shall be Vector Industries FA-900AL with stainless steel basket & "Sock" filter bag (5 micron), or equal. Unit shall have adjustable leg set from factory; it shall not be acceptable for unit to be set on floor. Installation shall comply with manufacturer's installation requirements. Provide with one additional 5 micron filter bag per filter feeder for owner's use.
- E. Heating Water & Chilled Water Air Separator: Welded black steel; ASME constructed and labeled for 125-psig minimum working pressure and 375 deg F maximum operating temperature; perforated stainless-steel air collector tube designed to direct released air automatic air vent; tangential inlet and outlet connections; threaded connections for 2-inch NPS (DN50) and smaller; flanged connections for 2-1/2-inch NPS (DN40) and larger; threaded blow-down connection. Provide units in sizes for full-system flow capacity.
- F. Y-Pattern Strainers: 125-psig working pressure; cast-iron body (ASTM A 126, Class B), flanged ends for NPS 2-1/2 and larger, threaded connections for NPS 2 and smaller, bolted cover, perforated stainless-steel basket, and bottom drain connection.
- G. Lincoln Hall: Propylene Glycol: Industrially inhibited propylene glycol-based heat transfer fluid, Dowfrost HD with Inhibitor and Deionized Water (or prior approved equal), with the following features:
1. Industrially inhibited propylene glycol (phosphate-based).
  2. Dyed (bright yellow/green) to facilitate leak detection.

3. Easily analyzed for glycol concentration and inhibitor level.
  4. For systems containing more than 250 gallons of fluid, annual analysis must be provided free of charge by the fluid manufacturer.
  5. Fluid must pass ASTM D1384 (less than 0.5 mils penetration per year for all systems metals).
  6. Reserve alkalinity of the fluid must be at least 15 to provide long-term resistance to acidic pH.
- H. Graham Hall/Student Center: Propylene Glycol: Industrially inhibited propylene glycol-based heat transfer fluid, Dowfrost HD with Inhibitor and Deionized Water (to match existing Student Center solution, no substitutions), with the following features:
1. Industrially inhibited propylene glycol (phosphate-based).
  2. Dyed (bright yellow/green) to facilitate leak detection.
  3. Easily analyzed for glycol concentration and inhibitor level.
  4. For systems containing more than 250 gallons of fluid, annual analysis must be provided free of charge by the fluid manufacturer.
  5. Fluid must pass ASTM D1384 (less than 0.5 mils penetration per year for all systems metals).
  6. Reserve alkalinity of the fluid must be at least 15 to provide long-term resistance to acidic pH.

## **2.6 BOILER CIRCULATORS, HOT WATER & CHILLED WATER PUMPS**

- A. See section 23 2123 HVAC Hydronic Pumps.

## **2.7 BOILER COMBUSTION AIR MATERIALS & INSTALLATION**

- A. Furnish and install schedule 40 PVC combustion air for the boilers where shown on the Drawings and terminate in combustion air plenum, coordinated with VC. Type, size, and performance shall be as per manufacturer's recommendations.
- B. Provide & install accessories as scheduled on the plans.

## **2.8 NATURAL GAS FIRED NEAR CONDENSING BOILER BURNER UNITS**

### **A. SUBMITTALS**

1. In accordance with Contract Documents. Minimum product data to include:
  - a. Capacities, accessories and options included with boiler.
  - b. General layout, dimensions, size and location of all required field connections.
  - c. Electrical characteristics - provide wiring diagrams that are specific to this project.
  - d. Weight and mounting loads.
  - e. Manufacturer's installation and start-up instructions.
  - f. Equipment Operation and Maintenance Manuals and control device cut-sheets.

### **B. QUALITY ASSURANCE**

1. Use an adequate number of skilled workers, trained and experienced in the necessary crafts, and who are completely familiar with the specified requirements, pertinent contract documents, and methods needed for proper performance of the work described therein.
2. Provide the services of a manufacturer's factory-authorized representative to inspect and verify proper installation of this equipment, and to provide equipment start-up and operator training.

### **C. DELIVERY, STORAGE, AND HANDLING**

1. In accordance with Contract Documents.
2. Accept equipment and accessories in Factory shipping packaging. Inspect for damage. Keep boiler in a vertical position from time of delivery to final installation.

3. While stored, all equipment must be protected from external elements such as inclement weather, job site construction activity, etc. Protect equipment from damage by leaving packaging in place until installation.

D. WARRANTY

1. The boiler shall come with the warranties stated below. Warranty period shall be one (1) year from date of start-up or eighteen (18) months from date of shipment, whichever comes first.
  - a. Heat exchanger: 5-year limited warranty, and a 20-year warranty against thermal shock.
  - b. Burner: 10-year limited warranty.
  - c. All other parts: 1-year limited warranty.

E. MANUFACTURER

1. Thermal Solutions Boiler, Evolution Model EVS 1500. Refer to the Equipment Schedule in the Contract Documents for specific design and performance criteria.
2. It shall be the responsibility of the Contractor to insure that any substituted equipment is equivalent in fit, form and function to the specified equipment. The cost of any additional work caused by the substitution of equipment shall be borne by the Contractor.
3. Or engineer prior approved equal.

F. GENERAL REQUIREMENTS

1. Boiler
  - a. The boiler shall be a factory-packaged unit, complete with jacket, gas manifold, burner and controls mounted and wired, as specified in this Section. The boiler shall be factory assembled and fire tested. Boiler connections shall be limited to the water supply & return, relief valve and boiler drains, fuel input, electrical power, exhaust vent and air inlet (as specified/shown in contract documents).
  - b. The boiler shall be constructed in conformance to ASME Section IV and UL 795. The boiler shall bear the ASME "H" stamp and be National Board Listed for 160 psi working pressure and 250 deg F. The gas train and safety controls shall conform to requirements of UL 795 and ASME CSD-1.
  - c. The complete boiler shall be factory fire tested by the manufacturer and a copy of the fire-test report shall be supplied with the boiler.
  - d. The boiler heat exchanger shall be constructed in accordance with Section IV of the ASME code with straight copper tubes having extruded, integral fins. Fin spacing shall be at least seven (7) fins per inch. Each copper tube shall have a minimum wall thickness of .072". All tubes shall be rolled securely into the headers (top and bottom). There shall be no bolts, gaskets, "O-Rings", welding or brazing used in the header construction. Removable access plugs shall be included in the design of the heat exchanger to allow for access (cleaning and inspection) and replacement of each individual tube. The heat exchanger shall encompass the entire burner and be enclosed in stainless steel inner shells. Stainless steel "V" Baffles shall be used between each tube to provide uniform heat distribution of the flue gases across the entire heat exchanger. The heat exchanger shall be of sufficient size and design to ensure effective, non-limiting control of the water flow rate and velocity through each tube at all load levels.
  - e. **The heating surface of the heat exchanger shall be no less than 8.0 ft<sup>2</sup> per boiler horsepower. The boiler heat exchanger shall have no less than 0.80 inch of tube per 1000 btuh of input capacity. List the quantity and length of the individual tubes on the shop drawing submittal. Boiler manufacturers that do not meet the total tube length listed above with a standard boiler size**



**shall provide a larger size unit and shall derate the burner for the capacity listed in the schedule.**

- f. The boiler shall be contained in a minimum 16-gauge negative pressure steel jacket protected with a powder-coated finish. The boiler control panel shall be non-pressurized allowing boiler operation with any jacket panels removed. Hinge-less front and rear access panels shall be provided for easy access to the operating controls and to eliminate electrical code “swing radius” clearance issues.
- g. The operating sound level for the boiler shall not exceed 50 dBA.
- h. See plans for electrical input to the boiler. The manufacturer will mount the control transformer and fuses inside the boiler control panel. Single-point electrical hook-up for each boiler shall be provided. Separate power wiring and control wiring is not acceptable. A dedicated disconnect shall be provided for each boiler.

G. Combustion System

- a. The burner shall be a radiant non-corroding ceramic burner, with no moving parts. Double-meshed screen, fiber-metal mats, aluminized or stainless steel construction of the burner will not be accepted. The burner shall fire in a full 360-degree pattern providing uniform heat transfer across the entire heat exchanger. A viewing port shall be provided for visual observation of burner performance. Burner shall require no maintenance, inspection or service.
- b. Burner operation shall provide infinite Modulation with minimum 3:1 turn down utilizing a Variable Frequency Drive and air-fuel ratio control gas valve for dependable, repeatable modulation and precise combustion control. The boiler will be equipped with a non-sparking blower manufactured with a cast-aluminum housing. Dampers, linkages or a single-speed fan are not acceptable.
- c. An interrupted-type mixed fuel/air pilot system with electric spark-to-pilot ignition shall be used. The pilot system shall use a UV scanner to prove pilot prior to energizing the main gas valves. Hot surface ignition systems and flame rods are not acceptable.
- d. The entire ignition and firing control sequence shall be monitored by a UL approved commercial-type microprocessor based integrated flame safeguard burner control with first out fault annunciation and operating sequence and diagnostic indicator lights. The burner control shall incorporate both pre-purge and post-purge timing functions. In the event of ignition pilot and/or main flame failure a burner “lockout” will occur requiring a manual reset of the burner control. It shall also recognize the Proof of Closure switches on the gas valves (if DB&B w/POC).
- e. The combustion air blower shall be equipped with a replaceable combustion air filter, 99% efficient to one micron to protect the burner from contamination. A delta-P type pressure switch shall be provided to alert the boiler operator of a dirty filter condition. Air inlet dampers and vacuum relief dampers are not required for proper operation. A combustion airflow switch shall be provided.
- f. The gas train shall be UL/FM/CSD-1 compliant and capable of accepting up to 5 psi Natural Gas. Additional step down regulators will be permitted. The gas train shall consist of a pilot gas pressure regulator, high and low gas pressure switches (each with manual reset), automatic main and redundant gas valve - Motorized automatic main and redundant gas valve and a normally open vent valve in between (if DB&B) - Motorized automatic main and redundant gas valve w/ Proof of Closure contacts and a normally open vent valve in between (if DB&B w/POC), leak test valves downstream of each gas valve, a manual shut off valve upstream

of burner and downstream of last gas valve. The main gas valve shall perform the functions of safety shutoff, constant pressure regulation and air-fuel ratio control.

2. Operating Control

a. The boiler shall be equipped with an onboard microprocessor based Electronic Control Module (ECM) featuring a 2-line, 16-character LCD display and user-friendly menu selections. All safety, operating and ignition controls shall be integrated in the ECM. The ECM shall include a diagnostic menu that provides an alarm history of the last ten (10) alarm messages and a low boiler inlet water temperature alarm history. The ECM shall have a user-friendly menu that allows easy selection of desired operating temperature, upper and lower temperature set-point limits, burner on/off thresholds PID control loop characteristics and local or remote operating modes. The ECM shall have an outdoor temperature reset function to allow the boiler operating temperature to vary based on outdoor air temperature. The ECM shall be capable of accepting a 0-10 vdc remote signal for changing temperature set-points and/or remote modulation control. Operating variables such as boiler inlet & outlet water temp, remote system temp, outdoor air temp, firing rate set-point, modulating percent and mixing valve demand percent are accessible on the display. The display shall also automatically present boiler sequence messages, alarms, and hold and lockout messages. Design features of the ECM shall include multi-level password security, outdoor temperature reset and DHW prioritization. The ECM shall provide for control of a dedicated boiler pump, up to two system pumps and a mixing valve to insure proper inlet water temperature to the boiler. The ECM shall be capable of providing peer-to-peer communication and lead/lag sequencing control (with auto rotation) of up to eight (8) boilers using standard RJ11 phone cables. The ECM shall also be capable of communicating with a BAS/BMS using Johnson Controls Metasys N2 communication protocol.

3. Water Trim

a. Water trim devices including an ASME rated pressure relief valve set at scheduled psig, combination water pressure and temperature gage (furnish graduated pressure gauge scale from 1-1/2 to 3 times of pressure relief valve setting) and water flow switch to prevent burner operation during low water flow conditions shall be provided in the boiler outlet piping. An adjustable high limit temperature controller with manual reset to prevent water temperature from exceeding a safe system temperature and an Auxiliary Low Water Cutoff to provide redundant low water protection shall both be provided.

4. Vent & Intake Air Connections

a. The boiler shall be designed to accommodate sealed, direct, or conventional venting options. The flue duct shall be AL 29-4C, positive pressure type vent material, provided & installed by VC.

b. For sealed combustion, air intake piping shall be PVC that is sealed and pressure tight. Pipe must be at least the same size as the air inlet connection on the boiler.

H. PERFORMANCE

1. Boiler efficiency shall be as stated in the Equipment Schedule of the Contract Documents.
2. The burner shall emit no more than 9 ppm NO<sub>x</sub> and 50 ppm CO (corrected to 3% O<sub>2</sub>) at all firing rates.
3. Provide services of a manufacturer's authorized representative to perform combustion test including boiler firing rate, gas flow rate, heat input, burner manifold gas pressure,

percent carbon monoxide, percent oxygen, percent excess air, flue gas temperature at outlet, ambient temperature, net stack temperature, percent stack loss, percent combustion efficiency, and heat output. Perform test at minimum, mid-range, and high fire.

I. INSTALLATION

1. In accordance with Contract Documents and boiler manufacturer's printed instructions.
2. Flush and clean the boiler upon completion of installation in accordance with manufacturer's start-up instructions. The boiler must be isolated when any cleaning or testing of system piping is being performed.
3. Install skid plumb and level, to plus or minus 1/16 inch over base.
4. Maintain manufacturer's recommended clearances around and over equipment, and as required by local Code.
5. Arrange all electrical conduit, piping, exhaust vent, and air intake with clearances for burner removal and service of all equipment.
6. Connect exhaust vent to boiler vent connection.
7. If shown in Contract Drawings, connect full sized air inlet vent to flanged connector on boiler.
8. Connect fuel piping in accordance with NFPA 54. Pipe size to be the same, or greater, than the gas train inlet connection.
9. Use full size (minimum) pipe/tubing on all gas vent connections.
10. Connect water piping, full size, to supply and return connections.
11. Install all piping accessories per the details on the contract drawings.
12. Install discharge piping from relief valves (open termination for viewing) and all drains to nearest floor drain.
13. Provide necessary water treatment to satisfy manufacturer's specified water quality limits.

J. Provide & install accessories as scheduled on the plans.

**2.9 FLOW CONTROL AND STRAINER VALVES**

- A. Furnish and install pressure-compensating flow control valves in a union (or flanges)/flow-control-device/ball-valve configuration. One piece configuration for valves 3" and smaller.
- B. Valves are to be installed where indicated on plans and in hydronic piping systems, serving hydronic coils, and hydronic radiation. Flow control valves will be installed in the return line.
- C. All valves shall have access capability to allow field-exchange of internal components without removing valve body from pipeline.
  1. All valves shall be permanently marked to show direction of flow, flow rate, and pressure range.
  2. All flow control valve cartridges shall be of stainless steel construction. Brass/Bronze cartridge construction shall **not** be acceptable.
- D. Furnish and install an in-line strainer for each flow control valve furnished that is 2" and smaller. Strainer to be in a union/strainer/ball valve configuration.
- E. Furnish and install as part of each flow control valve and strainer valve a Pete's plug 1/4" MPT fitting to receive either a temperature or pressure probe. Fitting shall be solid brass.
  1. Chilled water flow control valve and strainer valves shall have extended Pete's plug ports to accommodate chilled water insulation.
- F. Flow control valve shall be Pro Hydronics, Autoflow FV Series, Griswold Controls, or approved equal.
- G. Strainer valves shall be Pro Hydronics, Autoflow SV Series, Griswold Controls, or approved equal.
- H. If any flow controls are found to be installed backwards when balancing is performed, entire autoflow valve shall be replaced by this contractor.

- I. Furnish and install manual calibrated balancing valves in a union (or flanges)/flow-control/ball valve configuration. Valves are to be installed where indicated on plans and details. All valves shall be permanently marked to show direction of flow, flow rate, and pressure range.
  - 1. Valve body shall be constructed out of cast iron and rated for 175 psig working pressure.
  - 2. Valve body shall include two pressure/temperature ports.
  - 3. Valve body shall include an optional drain valve port.
  - 4. Valve shall utilize a calibrated nameplate with a memory stop.
  - 5. Valve temperature range shall be from -4deg F to 250deg F.
  - 6. Chilled water balancing valves shall have extend P/T plug ports to accommodate chilled water insulation.
- J. Manual calibrated balancing valves shall be Bell & Gossett Circuit Setter model CB or equal.

#### **2.10 HOT WATER CABINET UNIT HEATERS**

- A. Furnish and install cabinet unit heater(s) where shown on the Drawings. Type, size, and performance shall be as tabulated in the schedule and on the drawings.
- B. Cabinet unit heater shall be factory-assembled of type as indicated on plans. The motors shall be 120 volt, single phase, multi-speed. Units shall be provided with lock type removable front access panel. Panel shall have factory baked enamel finish, color to be selected by Architect.
- C. Make all hot water heating connections. This includes piping, valves, strainers, air vents, thermometers, immersion bulbs, flow switches, unions, etc.
- D. Controls, sensors, and control valve will be provided under Temperature Control Section.
- E. Power wiring will be provided under Division 26.
- F. Provide/install all accessories as scheduled or needed for proper operation

#### **2.11 HOT WATER HANGING UNIT HEATERS**

- A. Furnish and install unit heater(s) where shown on the Drawings. Type, size, and performance shall be as tabulated in the schedule and on the drawings.
- B. Unit heater shall be factory-assembled of type as indicated on plans. The motors shall be voltage as scheduled.
- C. Make all hot water heating connections. This includes piping, valves, strainers, air vents, thermometers, immersion bulbs, flow switches, unions, etc.
- D. Controls, sensors, and control valve will be provided under Temperature Control Section
- E. Power wiring will be provided under Division 26.
- F. Provide/install all accessories as scheduled or needed for proper operation

#### **2.12 HOT WATER FINNED TUBE RADIATION (BARE ELEMENT)**

- A. The contractor shall furnish and install finned tube radiation as indicated and scheduled on the plans. Units shall be installed in a neat and workmanlike manner in accordance with the specifications and the manufacturer's recommendations. Type, size, and performance shall be as tabulated in the schedule and on the drawings.
- B. Radiation shall be complete with heating elements, hangers, supports, and accessories.
- C. Heating Elements
  - 1. Elements shall be constructed of copper tubes expanded and rolled into cast brass headers, aluminum fins, steel side plates and fin tube supports.
  - 2. Fins shall have integral fin collars which space the fins and provide a fin-to-tube surface firmly bonded to the tube by mechanical expansion of the tube to help assure durability, eliminate the noise from loose fins and assure performance at cataloged ratings.

3. All elements shall withstand 100 pounds air pressure factory tested under water.
  4. Elements shall be capacities and characteristics as scheduled on drawings. Lineal feet indicated shall be the actual finned length.
- D. Make all hot water heating connections. This includes piping, valves, strainers, air vents, thermometers, immersion bulbs, flow switches, unions, etc.
- E. Controls, sensors, and control valve will be provided under Temperature Control Section.
- F. Provide & install accessories as scheduled on the plans.

### **2.13 HOT WATER RADIANT PANELS (RAD-XW, RAD-XP, RAD-XD)**

- A. Provide steel panel radiator elements of lengths and in locations as indicated on the plans and with capacities, style, mounting and accessories as scheduled.
- B. The heating panel radiation shall be of one-piece all-welded construction, consisting of flattened water tubes welded to headers at each end. The radiator shall include an integral heavy gauge (0.09" min thickness) all-welded perforated top grille.
- C. (RAD-XW, RAD-XP) Single sided radiators to have steel corrugated fins welded to the rear side of the water tubes to increase the convective output of the unit. There shall be no less than 32 fins per foot. Fins shall start within 1" of the headers, and shall be spot welded three times per tube.
- D. (RAD-XD) Double sided radiators to have a pair of flattened water tubes welded to headers at each end. Welded to the inside of each panel shall be steel corrugated fins to increase the convective output of the radiator. Fins shall start at no less than 3" from the end of the radiator and shall have no less than 32 fins per foot.
- E. Connection sizes are 1/2" NPT for supply and return piping and 1/8" NPT for the vent connection.
- F. Internal baffling shall be factory provided where required for proper water flow.
- G. Radiant panels shall be available in lengths from 2' to 29'-6" in two inch even increments without the need for splicing.
- H. Panel radiators shall be constructed for a standard working pressure of 56 PSIG and test pressure of 74 PSIG.
- I. (RAD-XW) Panel radiation shall be capable of being mounted to typical stud wall construction without additional blocking or strapping. Appropriate factory wall mounting brackets shall be provided with the radiation.
- J. (RAD-XP, RAD-XD) Panel radiation shall be provided with factory floor-mounted pedestals/posts in lieu of wall brackets. Provide pedestals/posts of mounting height as scheduled.
- K. Panel radiation shall be cleaned and phosphatized for a gloss powder coat finish for a total paint thickness of 2-3 mils. The color shall be custom color selected by architect/owner.
- L. Radiation
- M. Accessories
1. Provide radiators with necessary factory ribbed pipe covers for all supply, return, and interconnection piping as shown on the plans. Covers shall match finish and color of the radiator.
  2. Provide factory flexible connectors per manufacturer's recommendations to provide expansion compensation for the radiators.
  3. Provide factory combination shutoff valve/union fitting of less than two inches width for the supply and return of each radiator to be field installed by contractor.

### **2.14 SPARE PARTS**

- A. Provide Each Bypass Filter Feeder with one additional 5 micron "sock" filter bag for owner's use.
- B. Provide Cabinet Unit Heaters with one additional set of disposable filters.

## **PART 3 - EXECUTION**

### **3.1 PIPING APPLICATIONS**

- A. Coordinate applications below with materials specified in this Section. Pipe sizes at which joining methods change are between NPS 2 and NPS 2-1/2 (DN 50 and DN 65). Adjust this change point to suit personal preference. Soldered joints for pipes larger than NPS 2 (DN 50) may not meet system pressures.
- B. Hydronic Piping Systems: Type L drawn-temper copper tubing with soldered joints.
- C. Hydronic Piping Systems: Schedule 40 steel pipe with threaded joints and fittings for 2 inch and smaller, and with welded joints and fittings for 2-1/2 inch and larger.
- D. Hydronic Piping Systems: Schedule 40 steel pipe with mechanical couplings.
- E. Hydronic Piping Systems: Type L drawn-temper copper tubing with mechanical couplings.
- F. Hydronic Piping Systems: Uponor SDR 9 PEX-A tubing with Uponor one-piece cold expansion F1960 fittings. Crimp ring fittings shall not be acceptable. Uponor fittings must be used with Uponor pipe and must meet all requirements to achieve full warranty coverage.

### **3.2 VALVE APPLICATIONS**

- A. Unless otherwise indicated, use the following general-duty valve types for applications indicated:
  - 1. Shutoff Duty: Ball, and butterfly valves.
  - 2. Throttling Duty: Ball, and butterfly valves.
- B. Install shutoff duty valves at each branch connection to supply mains, at supply connection to each piece of equipment, and elsewhere as indicated.
- C. Install throttling duty valves at each branch connection to return mains, at return connections to each piece of equipment, and elsewhere as indicated.
- D. Install calibrated plug or automatic flow control valves on the outlet of each heating or cooling element and elsewhere as indicated to facilitate system balancing.
- E. Install drain valves at low points in mains, risers, branch lines, and elsewhere as required for system drainage.
- F. Install check valves at each pump discharge and elsewhere as required to control flow direction.
- G. Install safety relief valves on hot-water generators and elsewhere as required by the ASME Boiler and Pressure Vessel Code. Install safety-valve discharge piping, without valves, to floor. Comply with the ASME Boiler and Pressure Vessel Code, Section VIII, Division 1, for installation requirements.

### **3.3 METER AND GAGE INSTALLATION**

- A. Calibrate and install meters, gages, and accessories according to manufacturer's written instructions for applications where used.
- B. Thermometer Installation
  - 1. Install thermometers and adjust vertical and tilted positions.
  - 2. Install in the following locations:
    - a. As shown on piping details of plans.
  - 3. Install remote-reading dial thermometers in control panels with tubing connecting panel and thermometer bulb supported to prevent kinks. Use minimum tubing length.
  - 4. Install thermometer wells in vertical position in piping tees where test thermometers are indicated.
    - a. Install with stem extending a minimum of 2 inches into fluid.
    - b. Fill wells with oil or graphite and secure caps.
- C. Pressure Gage Installation
  - 1. Install pressure gages in piping tees with pressure-gage valve located on pipe at most readable position.

2. Install dry-type pressure gages in the following locations:
    - a. As shown on piping details of plans.
  3. Install liquid-filled-type pressure gages at suction and discharge of each pump.
- D. Install pressure-gage needle valve and snubber in piping to pressure gages.

### **3.4 HYDRONIC PIPING INSTALLATIONS**

- A. Install piping according to Section 23 0510 "Basic Mechanical Materials and Methods."
- B. Locate groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.
- C. Install drains, consisting of a tee fitting, NPS 3/4 ball valve, and short NPS 3/4 threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.
- D. Install piping at a uniform grade of 0.2 percent upward in direction of flow. Install condensate piping at a uniform grade of 1/4 inch per foot downward in direction of flow.
- E. Reduce pipe sizes using eccentric reducer fitting installed with level side up.
- F. Install branch connections to mains using tee fittings in main pipe, with the takeoff coming out the top or side of the main pipe. For up-feed risers, install the takeoff coming out the top of the main pipe.
- G. Install unions in pipes 2-inch NPS (DN50) and smaller, adjacent to each valve, at final connections of each piece of equipment, and elsewhere as indicated. Unions are not required at flanged connections.
- H. Install flanges on valves, apparatus, and equipment having 2-1/2-inch NPS (DN65) and larger connections.
- I. Install flexible connectors at inlet and discharge connections to pumps (except in-line pumps) and other vibration-producing equipment.
- J. Install strainers on supply side of each control valve, pressure-reducing valve, solenoid valve, in-line pump, and elsewhere as indicated. Install NPS 3/4 nipple and ball valve in blowdown connection of strainers NPS 2 and larger.
- K. Anchor piping for proper direction of expansion and contraction.
- L. Uponor PEX-a piping with F1960 expandable fittings shall be installed in accordance with Uponor's Hydronic Piping Design Assistance Manual to ensure a 25 year system warranty.
- M. Install in floor heat tubing as shown on plans and per manufacturer's requirements.

### **3.5 HANGERS AND SUPPORTS**

- A. Piping support must account for expansion and contraction, vibration, and dead load of piping and its contents, and seismic bracing requirements.
- B. Hanger, support, and anchor devices shall comply with requirements below for maximum spacing of supports. Install the following pipe attachments:
  1. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet long.
  2. Adjustable roller hangers and spring hangers for individual horizontal piping 20 feet or longer.
  3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
  4. Spring hangers to support vertical runs.
  5. Install hangers for steel piping with the following maximum spacing and minimum rod sizes:
    - a. NPS 3/4: Maximum span, 7 feet; minimum rod size, 1/4 inch.
    - b. NPS 1: Maximum span, 7 feet; minimum rod size, 1/4 inch.
    - c. NPS 1-1/2: Maximum span, 9 feet; minimum rod size, 3/8 inch.
    - d. NPS 2: Maximum span, 10 feet; minimum rod size, 3/8 inch.
    - e. NPS 2-1/2: Maximum span, 11 feet; minimum rod size, 3/8 inch.
    - f. NPS 3: Maximum span, 12 feet; minimum rod size, 3/8 inch.

6. Install hangers for drawn-temper copper piping with the following maximum spacing and minimum rod sizes:
  - a. NPS 3/4: Maximum span, 5 feet; minimum rod size, 1/4 inch.
  - b. NPS 1: Maximum span, 6 feet; minimum rod size, 1/4 inch.
  - c. NPS 1-1/2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
  - d. NPS 2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
  - e. NPS 2-1/2: Maximum span, 9 feet; minimum rod size, 3/8 inch.
  - f. NPS 3: Maximum span, 10 feet; minimum rod size, 3/8 inch.
7. Support vertical runs at roof, at each floor, and at 10-foot intervals between floors.
8. PEX-a Piping Hanger Spacing: Install hangers for PEX-a piping with the following maximum spacing:
  - a. 1 inch and below: Maximum span, 32 inches.
  - b. 1-1/2 inch and above: Maximum span, 48 inches.
9. PEX-a Piping Hanger Spacing with PEX-a Support Channel: Install hangers for PEX-a piping with horizontal support channel in accordance with local jurisdiction and manufacturer's recommendations, with the following maximum spacing:
  - a. Maximum span, 8 feet.
10. PEX-a Riser Supports: Install CTS riser clamps at the base of each floor and at the top of every other floor. Install mid-story guides between each floor.
11. Pipe Joint Connections: Install per manufacturer's recommendations. Use manufacturer-recommended cold-expansion tool for F1960 connections.

### **3.6 PIPE JOINT CONSTRUCTION**

- A. Refer to Division 23 Section "Basic HVAC Materials and Methods" for joint construction requirements for soldered and brazed joints in copper tubing; threaded, welded, and flanged joints in steel piping.
- B. Mechanical Joints: Assemble joints according to fitting manufacturer's written instructions.

### **3.7 HYDRONIC SPECIALTIES INSTALLATION**

- A. Install manual (not automatic) full port ball valve operated air vents at high points in piping, at heat-transfer coils, and elsewhere as required for system air venting. Install ball isolation valves with chained caps.
  1. Graham Hall/Student Center hot water system being tied into (40% Propylene Glycol):
    - a. The plumbing contractor shall be responsible for cleaning and flushing the new hydronic piping. The existing hydronic system shall be drained as necessary for proposed tie ins and filled with existing drained and/or new hydronic solution, no cleaning and flushing on existing piping.
    - b. Upon completion of the proposed work & system flushing, the salvaged solution shall be pumped back in.
    - c. After proposed work is complete, the plumbing/hydronics contractor is to provide a complete analysis of the hydronic system to confirm proper water treatment. Submit analysis/recommendations to Sichmeller engineering & owner. If solution analysis indicates solution is not satisfactory, this contractor to make adjustments as recommended by inhibitor supplier & retest until analysis is satisfactory.
  2. New chilled water cooling system serving new building (35% glycol):
    - a. The plumbing contractor shall be responsible for cleaning and flushing the new hydronic system piping prior to pumping in new cooling solution/startup.
    - b. After proposed work is complete, the plumbing/hydronics contractor is to provide a complete analysis of the hydronic system to confirm proper glycol % and treatment. Submit analysis/recommendations to Sichmeller engineering & owner. If solution analysis indicates solution is not satisfactory, this contractor to make



adjustments as recommended by glycol supplier & retest until analysis is satisfactory.

3. New hot water heating system serving new building (30% glycol):
  - a. The plumbing contractor shall be responsible for cleaning and flushing the new hydronic system piping prior to pumping in new cooling solution/startup.
  - b. After proposed work is complete, the plumbing/hydronics contractor is to provide a complete analysis of the hydronic system to confirm proper glycol % and treatment. Submit analysis/recommendations to Sichmeller engineering & owner. If solution analysis indicates solution is not satisfactory, this contractor to make adjustments as recommended by glycol supplier & retest until analysis is satisfactory.
4. Install automatic air vents in mechanical equipment rooms only at high points of system piping, at heat-transfer coils, and elsewhere as required for system air venting.

### **3.8 TERMINAL EQUIPMENT CONNECTIONS**

- A. Size for supply and return piping connections shall be same as for equipment connections.
- B. Install control valves in accessible locations close to connected equipment.
- C. Install flow control valves and strainer valves as shown on piping details.

### **3.9 FIELD QUALITY CONTROL**

- A. Testing Agency: Engage a qualified independent testing and inspecting agency to perform field tests and inspections and to prepare test reports.
- B. Prepare hydronic piping and perform testing according to ASME B31.9. Prepare written report of testing.

### **3.10 ADJUSTING AND CLEANING**

- A. Consult with and comply with boiler manufacturer's recommendations.
- B. After completing systems installation, including outlet fittings and devices, inspect finish. Remove burrs, dirt, and construction debris, and repair damaged finishes including chips, scratches, and abrasions.
- C. Flush hydronic piping systems with clean water. Remove and clean or replace strainer screens. After cleaning and flushing hydronic piping systems, but before balancing, remove disposable fine-mesh strainers in pump suction diffusers.
- D. Preparation for testing: Prepare hydronic piping in accordance with ASME B 31.9.
- E. Testing: Test hydronic piping as specified in ASME B 31.9 "Building Services Piping."
- F. System Cleaning:
  1. Fill the entire system with clean, fresh water and properly vent. Repair piping leaks as early in this procedure as they are discovered. Inspect existing piping system and notify engineer immediately for any leaks requiring repairs. With valves positioned by bypass the boiler and terminal equipment, start the pump to circulate water through the system. Check strainers at pumps and at terminal equipment (new and existing) frequently and clean as often as needed. If the water is extremely dirty or murky, flush continuously, using the system pump, until the water being flushed out of the pipe loop has become clear. To flush in this manner requires care to be certain that make-up water is being added fast enough to replace what is being flushed out. Accomplish this by opening the make-up water bypass valve around the automatic pressure reducer valve and adjust the manual valve so that the pump suction pressure gauge continues to indicate the same positive pressure that existed before the manual drain and make-up valves were opened. Continue for at least two hours. Once the water is clear and debris flushed out, stop the pump.
  2. To complete the cleaning, fill the system with fresh water, adding a cleaning agent such as trisodium phosphate (TSP). Disconnect all power to the terminal units so that they will

not operate while the system is being cleaned. Then circulate cleaning solution throughout the system, with boiler controls temporarily adjusted to raise the solution temperature to about 105 deg F to 110 deg F. Do not allow the temperature to rise above 110 deg F. Alternate operation of the primary and standby pumps and circulate the warm solution for several hours. Then turn off the boiler and pump, completely drain the system, and refill with fresh water. Repeat the cleaning process only if there is indication of foreign matter still in the system or if a test of the water indicated that it is slightly acid.

3. Water should be slightly alkaline, with a pH no higher than 8.0 and no lower than 7.0.
  4. Graham Hall/Student Center: Add glycol to new and existing hydronic piping systems as necessary to provide a total of 40% by volume.
  5. Lincoln Hall: Add glycol to new Cooling hydronic piping system to provide a total of 35% by volume.
  6. Lincoln Hall Add glycol to new Heating hydronic piping system to provide a total of 30% by volume.
- G. Install laminated engraved placard near boilers with 1" engraved letters indicating glycol type & concentration in boiler room.
- H. Mark calibrated nameplates of pump discharge valves after hydronic system balancing has been completed, to permanently indicate final balanced position.
- I. Chemical Treatment: Provide a water analysis prepared by chemical treatment supplier to determine type and level of chemicals required to prevent scale and corrosion. Perform treatment after completing system testing and retest as necessary. If solution analysis is not satisfactory, make adjustments as recommended by glycol supplier and retest as necessary until analysis is satisfactory.

### **3.11 COMMISSIONING**

- A. Fill system and perform initial chemical treatment.
- B. Check expansion tanks to determine that they are not air bound and that system is completely full of water.
- C. Perform these adjustments before operating the system:
  1. Open valves to fully open position. Close coil bypass valves.
  2. Check pump for proper direction of rotation.
  3. Set automatic fill valves for required system pressure.
  4. Check air vents at high points of system and determine if all are installed and operating freely (automatic type), or bleed air completely (manual type).
  5. Set temperature controls so all coils are calling for full flow.
  6. Check operation of automatic bypass valves.
  7. Check and set operating temperatures of boilers, chillers, to design requirements.
  8. Lubricate motors and bearings.

### **3.12 MISCELLANEOUS CONNECTIONS**

- A. Make all hydronic connections. This includes boiler connections, connections of heating coils to equipment supplied and/or mounted under HVAC Section. This includes piping, valves, strainers, air vents, thermometers, immersion bulbs, flow switches, drains, unions, etc.
- B. Install all control valves supplied by Automatic Temperature Control Contractor.

### **3.13 AUTOMATIC TEMPERATURE CONTROL**

- A. Install the automatic temperature control dampers, air flow monitoring devices, openings for air flow switches, alarms and control devices as provided by the Automatic Temperature Control Contractor. These dampers and devices shall be installed under the direct supervision of the Section 23 0900, CONTROLS & CONTROL SEQUENCES Temperature Control Contractor and in strict accordance with the manufacturer's recommendations.

**3.14 DEMONSTRATION AND TRAINING**

- A. Training of the Owner's operation and maintenance personnel is required in cooperation with the Owner, General Contractor, and the Commissioning Professional. Provide competent, factory-authorized personnel to provide instruction to operation and maintenance personnel concerning the location, operation, troubleshooting, routine servicing and maintenance of the installed systems. The instruction shall be scheduled in coordination with the Owner and the Commissioning Professional after submission and approval of formal training agendas. Refer to Sections 01 9113 General Commissioning Requirements.

**3.15 FUNCTIONAL PERFORMANCE TESTING**

- A. System functional performance testing is part of the Commissioning Process as detailed in Section 01 9113 General Commissioning Requirements. Functional performance testing shall be performed by the contractor and witnessed and documented by the Commissioning Professional. Installation checklists shall be successfully completed by the contractor and submitted to the Commissioning Professional prior to functional performance testing.

**END OF SECTION 23 2113**

**SECTION 232123  
HVAC HYDRONIC PUMPS**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. This section specifies a system or part of a system being commissioned as defined in 01 9113 General Commissioning Requirements. Testing of these systems, as well as Operations & Maintenance (O&M) Manuals and Training of the Owner's personnel, is required in cooperation with the Owner, General Contractor, and the Commissioning Professional. Project Closeout is dependent on successful completion of all commissioning procedures, documentation, and issue closure. Refer to 01 9113 General Commissioning Requirements for detailed commissioning requirements.

**1.2 SUMMARY**

- A. The Work covered in this section of the Specifications is intended to include the furnishing of all equipment, materials and labor reasonably incidental to the complete operating installation of the base mounted end-suction ground loop pumps and pertaining equipment as indicated on the drawing.
- B. This Section includes the following:
  - 1. In-Line Circulator Pumps for Boilers
  - 2. Base Mounted End-Suction Pumps Rated for VFD Application.
  - 3. Vertical In-Line Pumps Rated for VFD Application.

**1.3 PERFORMANCE REQUIREMENTS**

- A. Pump Pressure Ratings: At least equal to system's maximum operating pressure at point where installed, but not less than specified.

**1.4 SUBMITTALS**

- A. Shop Drawings: Shop drawings as specified in Section 230500 shall include the following:
  - 1. In-Line Circulator Pumps for Boilers.
  - 2. Base Mounted End-Suction Pumps Rated for VFD Application (heating loop and chilled water loop).
  - 3. Vertical In-Line Pumps Rated for VFD Application (Graham/Student Center heating loop)
- B. Product Data: Include certified performance curves and rated capacities; furnished specialties; final impeller dimensions; and accessories for each pump indicated. Indicate pump's operating point on curves.
- C. Shop Drawings: Shop drawings as specified in Section 230500 shall include the following:
  - 1. Power, signal, and control wiring diagrams differentiating between manufacturer-installed wiring and field-installed wiring.
- D. Show pump layout and connections. Include Setting Drawings with templates for installing foundation and anchor bolts and other anchorages.
- E. Operation and maintenance data including startup instructions.
- F. Refer to Section 01 9113 General Commissioning Requirements for commissioning-related submittals and submittal review processes.

**1.5 QUALITY ASSURANCE**

- A. UL Compliance: Fabricate and label pumps to comply with UL 778, "Motor-Operated Water Pumps," for construction requirements.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Single-Source Responsibility: Obtain each category of pumps from one source and by a single manufacturer.
- D. Provider shall be responsible for providing certified factory authorized equipment start-up and, when noted, an in the field certified training session. New pump start-up shall be for the purpose of determining pump alignment, lubrication, voltage, and amperage readings. All proper electrical connections, pump's balance, discharge and suction gauge readings, and

adjustment of head, if required. A copy of the start-up report shall be made and sent to both the contractor and to the Engineer.

## **PART 2 - PRODUCTS**

### **2.1 IN LINE CIRCULATOR PUMPS**

- A. The contractor shall furnish and install inline pumps as illustrated on the plans and in accordance with the following specifications:
  - 1. The pumps shall be of the horizontal, permanently lubricated type, specifically designed and guaranteed for quiet operation.
  - 2. The pumps shall have a steel shaft supported by permanently lubricated, sealed precision ball bearings. The pumps are to be equipped with a water-tight seal to prevent leakage. Mechanical seal faces to be carbon on silicon carbide. The motor shall be non-overloading at any point on the pump performance curve.
  - 3. The motor shall be of the drip-proof, sealed precision ball-bearing, quiet-operating construction. The permanent split-capacitor motor shall be equipped with thermal overload protection.
  - 4. Pumps to be suitable for 225°F (107°C) operating temperature at 150 psig (10 bar)

### **2.2 BASE MOUNTED END-SUCTION PUMPS RATED FOR VFD APPLICATIONS**

- A. Furnish circulating pumps rated for VFD application where shown on the Drawings. Type, size, and performance shall be as tabulated in the schedule and on the drawings.
- B. **MANUFACTURERS**
  - 1. The specifying engineer reserves the right to specify a primary supplier / lead spec manufacturer on all supplied schedule and specification documents. These primary suppliers have led their respective industry in research and development and their products have had proven track records in the field. These primary suppliers, in the opinion of this engineering firm, produce a superior product to the alternately listed manufacturers. The contractor may choose to supply equivalent equipment as manufactured by the alternately specified manufacturer. This alternately specified equipment shall be supplied on a deduct alternate basis and based on the approval of the supplied alternate manufacturer's submittals. The use of a primary supplier and deduct alternates protects the specifying engineer's design concept, but allows for a check-and-balance system to protect the post-commissioning owner.
  - 2. Contractor shall furnish new end suction long coupled pumps for chilled water and hot water heating systems as indicated on the drawings. Pumps shall manufacturer as specified under base bid. Equivalent units as manufactured by other manufacturers may be submitted as deduct alternates. Pumps shall meet types, sizes, capacities, and characteristics as scheduled on the Equipment Schedule drawings. Pump substitutions shall be provided with connection sizes equal to those scheduled. Pump connections shall not be downsized. Pump substitutions shall not be provided at efficiencies less than those scheduled.
  - 3. Or engineer prior approved equal.
- C. **COMPONENTS**
  - 1. The pumps shall be long coupled, base mounted, single stage, end suction, vertical split case design, in cast iron stainless steel fitted, specifically designed for quiet operation. Suitable standard operations at 225°F and 175 PSIG working pressure or optional operations at up to 250°F and 250 PSIG working pressures. Working pressures shall not be de-rated at temperatures up to 250F. The pump internals shall be capable of being services without disturbing piping connections, electrical motor connections or pump to motor alignment.
  - 2. The pumps shall be composed of three separable components a motor, bearing assembly, and pump end (wet end). The motor shaft shall be connected to the pump shaft via a replaceable flexible coupling.
  - 3. A bearing assembly shall support the shaft via two heavy-duty regreaseable ball bearings. Bearing assembly shall be replaceable without disturbing the system piping and shall have foot support at the coupling end. Pump bearings shall be regreaseable without removal of the bearings from the bearing assembly. Thermal expansion of the shaft toward the impeller shall be prevented via an inboard thrust bearing.

4. The bearing assembly shall have a solid SAE1144 steel shaft. A stainless steel shaft sleeve shall be employed to completely cover the wetted area under the seal.
  5. Pump shall be equipped with an internally-flushed mechanical seal assembly installed in an enlarged tapered seal chamber. Application of an internally flushed mechanical seal shall be adequate for seal flushing without requiring external flushing lines. Seal assembly shall have Buna bellows and seat gasket, stainless steel spring, and be of a carbon ceramic design with the carbon face rotating against a stationary ceramic face.
  6. Bearing assembly shaft shall connect to a stainless steel impeller. Impeller shall be both hydraulically and dynamically balanced to ANSI/HI 9.6.4-2009, balance grade G6.3 and secured by a stainless steel locking cap screw or nut.
  7. Pump should be designed to allow for true back pull-out allowing access to the pump's working components, without disturbing motor or piping, for ease of maintenance.
  8. A center drop-out type coupling, capable of absorbing torsional vibration, shall be employed between the pump and motor. Pumps for variable speed application shall be provided with a suitable coupling sleeve. Coupling shall allow for removal of pump's wetted end without disturbing pump volute or movement of the pump's motor and electrical connections. On variable speed applications the coupling sleeve should be constructed of a neoprene material to maximize performance life.
  9. Pumps for variable speed application shall be provided with shaft grounding kits to maximize performance life.
  10. An ANSI and OSHA rated coupling guard shall shield the coupling during operation. Coupling guard shall be dual rated ANSI B15.1 and OSHA 1910.219 compliant coupling guard and contain viewing windows for inspection of the coupling. No more than .25 inches of either rotating assembly shall be visible beyond the coupling guard.
  11. Pump volute shall be of a cast iron design for heating systems with integrally cast pedestal volute support, rated for 175 PSIG with integral cast iron flanges drilled for 125# ANSI companion flanges. (Optional 250 PSIG working pressures are available and are 250# flange drilled.) Volute shall include gauge ports at nozzles, and vent and drain ports.
  12. Motors shall meet scheduled horsepower, speed, voltage, and enclosure design. Pump and motors shall be factory aligned, and shall be realigned after installation by the manufacturer's representative. Motors shall be non-overloading at any point on the pump curve and shall meet NEMA specifications and conform to standards outlined in EISA 2007.
  13. Base plate shall be of structural steel or fabricated steel channel configuration fully enclosed at sides and ends, with securely welded cross members and fully open grouting area (for field grouting). The minimum base plate stiffness shall conform to ANSI/HI 1.3.8.2.1-2009 for grouted Horizontal Baseplate Design standards.
  14. Pump shall be of a maintainable design and, for ease of maintenance, should use machine fit parts and not press fit components.
  15. The pump(s) vibration limits shall conform to Hydraulic Institute ANSI/HI 9.6.4-2009 for recommended acceptable unfiltered field vibration limits (as measured per ANSI/HI 9.6.4-2009 Figure 9.6.4.2.3.1) for pumps with rolling contact bearings.
  16. Pump manufacturer shall be ISO-9001 certified.
  17. Each pump shall be hydrostatically tested 1.5 times the maximum rated working pressure and name-plated before shipment.
  18. Pump shall conform to ANSI/HI 9.6.3.1-2012 standard for Preferred Operating Region (POR) unless otherwise approved by the engineer.
- D. Provide accessories as scheduled on the plans.
- E. Provide laser alignment in field per manufacturer's requirements.

### **2.3 VERTICAL IN-LINE PUMPS RATED FOR VFD APPLICATIONS**

- A. Furnish and install circulating pumps rated for VFD application where shown on the Drawings. Type, size, and performance shall be as tabulated in the schedule and on the drawings.
- B. MANUFACTURERS
  1. The specifying engineer reserves the right to specify a primary supplier / lead spec manufacturer on all supplied schedule and specification documents. These primary suppliers have led their respective industry in research and development and their

products have had proven track records in the field. These primary suppliers, in the opinion of this engineering firm, produce a superior product to the alternately listed manufacturers. The contractor may choose to supply equivalent equipment as manufactured by the alternately specified manufacturer. This alternately specified equipment shall be supplied on a deduct alternate basis and based on the approval of the supplied alternate manufacturer's submittals. The use of a primary supplier and deduct alternates protects the specifying engineer's design concept, but allows for a check-and-balance system to protect the post-commissioning owner.

2. Contractor shall furnish new close-coupled vertical inline pump for hydronic systems as indicated on the drawings. Pumps shall be manufacturer specified under base bid. Equivalent units as manufactured by other manufacturers may be submitted as deduct alternates. Pumps shall meet types, sizes, capacities, and characteristics as scheduled on the Equipment Schedule drawings. Pump substitutions shall be provided with connection sizes equal to those scheduled. Pump connections shall not be downsized. Pump substitutions shall not be provided at efficiencies less than those scheduled.
3. Or engineer prior approved equal.

C. COMPONENTS

1. The pumps shall be close-coupled, inline for vertical or horizontal installation, in cast iron stainless steel fitted construction specifically designed for quiet operation. Suitable standard operations at 225°F and 175 PSIG working pressure (or optional operations at up to 250°F and 250 PSIG working pressures). Working pressures shall not be de-rated at temperatures up to 250°F. The pump internals shall be capable of being serviced without disturbing piping connections.
2. As an option an EPR/Carbon/Tungsten/Carbide/SS seal (250°F maximum operating temperature), FKM/Carbon/Ceramic/SS seal, or EPR-Silicon Carbide/Silicon Carbide/SS seal may be used in lieu of the standard Buna/Carbon/Ceramic/SS seal (225° F maximum operating temperature).
3. The pumps shall have a solid alloy steel shaft that is integral to the motor. A non-ferrous shaft sleeve shall be employed to completely cover the wetted area under the seal.
4. The motor bearings shall support the shaft via heavy-duty grease lubricated ball bearings.
5. Pump shall be equipped with an internally flushed mechanical seal assembly installed in an enlarged tapered seal chamber. Seal assembly shall have a stainless steel housing, Buna bellows and seat gasket, stainless steel spring, and be of a carbon ceramic design with the carbon face rotating against a stationary ceramic face. (As an option, a stuffing box designed may be used in lieu of the traditional internally flushed mechanical seal design. Pump shall be flushed single seal, flushed double seal, or packing gland type seal arrangements.)
6. Pump shaft shall connect to a stainless steel impeller. Impeller shall be hydraulically and dynamically balanced to Hydraulic Institute Standards ANSI/HI 9.6.4.5-2000. The allowable residual imbalance conforms to ANSI grade 6.3, keyed to the shaft and secured by a stainless steel locking capscrew or nut.
7. Pump should be designed to allow for true back pull-out access to the pump's working components for ease of maintenance.
8. Pump volute shall be of a Class 30 cast iron design for heating systems rated for 175 PSIG with integral cast iron flanges drilled for 125# ANSI companion flanges (Optional 250 and 300 PSIG working pressures are available and are 250# flange drilled). Volute shall include gauge ports at nozzles, and vent and drain ports. The volute shall be designed with a base ring matching an ANSI 125# flange that can be used for pump support.
9. Motors shall meet scheduled horsepower, speed, voltage, and enclosure design. Motors shall have heavy-duty grease lubricated ball bearings to offset the additional bearing loads associated with the closed-coupled pump design. Motors shall be non-overloading at any point on the pump curve and shall meet NEMA specifications.
10. Pumps shall conform to ANSI/HI 9.6.3.1 standard for Preferred Operating Region (POR) unless otherwise approved by the engineer.
11. Pump shall be of a maintainable design and for ease of maintenance should use machine

- fit parts and not press fit components.
  - 12. Pump manufacturer shall be ISO-9001 certified.
  - 13. Each pump shall be factory tested and name-plated before shipment.
  - 14. As an option, the pump may include an internal stainless steel casing wear rings.
  - 15. Where noted on schedule pumping equipment may require one or all of the following optional tests: Certified Lab tests (unwitnessed), Hydraulic Institute Level B tests, or Witnessed Tests.
  - 16. Pumps & motors shall be rated for VFD application and shall be provided with a shaft grounding kits.
- D. Provide accessories as scheduled on the plans.

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. Examine areas, equipment foundations, and conditions, with Installer present, for compliance with requirements for installation and other conditions affecting performance of the pumps.
- B. Examine roughing-in for piping systems to verify actual locations of piping connections before pump installation.
- C. Examine supporting structure for suitable conditions where pumps are to be installed.
- D. Do not proceed until unsatisfactory conditions have been corrected.

#### **3.2 PUMP INSTALLATION**

- A. Install pumps according to manufacturer's written installation and alignment instructions.
- B. Install pumps to provide access for periodic maintenance, including removing motors, impellers, couplings, and accessories.
- C. Support pumps and piping separately so piping is not supported by pumps.
- D. Set base mounted pumps on concrete foundation. Provide & install inertia bases where shown on plans. Disconnect coupling halves before setting. Do not reconnect couplings until alignment operations have been completed.
  - 1. Support pump base plate on rectangular metal blocks and shims, or on metal wedges with small taper, at points near foundation bolts to provide a gap of  $\frac{3}{4}$  to 1-1/2 inches between pump base and foundation for grouting.
  - 2. Adjust metal supports or wedges until pump and driver shafts are level. Check coupling faces and suction and discharge flanges of pump to verify that they are level and plumb.

#### **3.3 ALIGNMENT**

- A. Align pump and motor shafts and piping connections after setting them on foundations, after grout has been set and foundation bolts have been tightened, and after piping connections have been made.
- B. Comply with pump and coupling manufacturer's written instructions.
- C. Adjust alignment of pump and motor shafts for angular and parallel alignment by 1 of 2 methods specified in the H.I.'s Standards for Centrifugal, Rotary & Reciprocating pumps, "Instructions for Installation, Operation, and Maintenance."
- D. After alignment is correct, tighten foundation bolts evenly but not too firmly. Fill base plate completely with nonshrink, nonmetallic grout, with metal blocks and shims or wedges in place. After grout has cured, fully tighten foundation bolts.
- E. Alignment Tolerances: According to manufacturer's recommendations.

#### **3.4 CONNECTIONS**

- A. Install shutoff valve and strainer on pump suction and check valve and shutoff valve on pump discharge, except where other arrangement is indicated.
- B. Install piping adjacent to machine to allow service and maintenance.
- C. Connect piping to pumps. Install valves that are the same size as piping connected to pumps.
- D. Install suction and discharge pipe sizes equal to or greater than diameter of pump nozzles.
- E. Retain paragraph above or first two paragraphs below if specialty valves are required for vertical in-line pumps.
- F. Install suction diffuser and shutoff valve on suction side of pumps.
- G. Install triple-duty valve on discharge side of pumps where indicated.
- H. Install manual balancing valve on discharge side of pumps where indicated.
- I. Install non-slam check valve on discharge side of pumps where indicated.
- J. Install flexible connectors on suction and discharge sides of base-mounted pumps and where indicated. Install between pump casing and valves, except where other arrangement is



indicated.

- K. Install thermometers where indicated.
- L. Install pressure gages on pump suction diffuser, pump suction, and pump discharge per details on plans. Install at integral pressure-gage tapings where provided.
- M. Install temperature and pressure gage connector plugs in suction and discharge piping around each pump.
- N. Install electrical connections for power, controls, and devices. Electrical power and control wiring and connections are specified in Division 26 Sections.

**3.5 FIELD QUALITY CONTROL**

- A. Check suction piping connections for tightness to avoid drawing air into pumps.
- B. Clean strainers.
- C. Set pump controls.

**3.6 AUTOMATIC TEMPERATURE CONTROL**

- A. Install the automatic temperature control dampers, air flow monitoring devices, openings for air flow switches, alarms and control devices as provided by the Automatic Temperature Control Contractor. These dampers and devices shall be installed under the direct supervision of the Section 23 0900, CONTROLS & CONTROL SEQUENCES Temperature Control Contractor and in strict accordance with the manufacturer's recommendations.

**3.7 DEMONSTRATION AND TRAINING**

- A. Training of the Owner's operation and maintenance personnel is required in cooperation with the Owner, General Contractor, and the Commissioning Professional. Provide competent, factory-authorized personnel to provide instruction to operation and maintenance personnel concerning the location, operation, troubleshooting, routine servicing and maintenance of the installed systems. The instruction shall be scheduled in coordination with the Owner and the Commissioning Professional after submission and approval of formal training agendas. Refer to Sections 01 9113 General Commissioning Requirements.

**3.8 FUNCTIONAL PERFORMANCE TESTING**

- A. System functional performance testing is part of the Commissioning Process as detailed in Section 01 9113 General Commissioning Requirements. Functional performance testing shall be performed by the contractor and witnessed and documented by the Commissioning Professional. Installation checklists shall be successfully completed by the contractor and submitted to the Commissioning Professional prior to functional performance testing.

**END OF SECTION 232123**

**SECTION 23 7000  
VENTILATION AND AIR CONDITIONING**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. This section specifies a system or part of a system being commissioned as defined in 01 9113 General Commissioning Requirements. Testing of these systems, as well as Operations & Maintenance (O&M) Manuals and Training of the Owner's personnel, is required in cooperation with the Owner, General Contractor, and the Commissioning Professional. Project Closeout is dependent on successful completion of all commissioning procedures, documentation, and issue closure. Refer to 01 9113 General Commissioning Requirements for detailed commissioning requirements.

**1.2 SUMMARY**

- A. The work in this section of the specification and the accompanying drawings consists of performing all labor and furnishing of all material and equipment necessary to install air handling systems as indicated on drawings and specified herein, including minor items obviously necessary for complete and operating systems.
- B. Also included is the work involved to remove & or relocate existing associated equipment, remodeling of existing systems, including connections between new and existing systems.

**1.3 SUBMITTALS**

- A. Shop Drawings: Shop drawings as specified in Section 23 0500 shall include the following:
  - 1. VAV Air Handling Unit with DX Cooling & Hot Water Reheat Coil
  - 2. DX Air Cooled Condensing Unit
  - 3. VAV Air Handling Unit with Cooling Water & Hot Water Reheat Coils
  - 4. Shutoff VAV Terminal Units
  - 5. Air Cooled Scroll Liquid Chiller
  - 6. Inline Exhaust Fans
  - 7. Dryer Exhaust Booster Fan
  - 8. Ductless Split Systems
  - 9. Stationary Louvers
  - 10. Registers, Grilles, & Diffusers
  - 11. Smoke & Fire Dampers
  - 12. Motorized Damper
  - 13. Exposed Spiral Duct
  - 14. Filter List & Filters – At the end of the project the HVAC contractor to provide an additional set of disposable filters.
  - 15. Spare Parts
- B. Refer to Section 01 9113 General Commissioning Requirements for commissioning-related submittals and submittal review processes.

**PART 2 - PRODUCTS**

**2.1 INTERNAL DUCT INSULATION**

- A. See HVAC Systems Insulation.
- B. All internal duct insulation shall be 1/2" as specified duct liner with black fire resistant skin surface. Liner shall have an overall density of 2.0 lbs./cu. ft. Installation shall meet NFPA 90A and 90B fire resistant requirements.
- C. Apply the insulation in fabricated pieces sized to the interior duct surfaces with the black coated or denser surface exposed to the air stream. Insulation shall be firmly held in place with B.F. 85-10 or 85-60, C.M.C. 17-477, 1-C 225 fire resistant adhesive covering no less than 100% of the duct surface. Further secure insulation on the top and sides of horizontal ducts and all

sides of vertical ducts with Omark or KSM capacitor discharge studs and caps on 15" centers. Secure transverse edges with capacitor discharge studs and caps on 6" centers.

- D. Duct sizes indicated on the drawings are the internal dimensions. Where insulation is applied to the inside of ducts, the metal size of the duct shall be increased to result in internal dimensions equal to that shown on the drawings.

**2.2 SHEET METAL WORK – LOW & MEDIUM PRESSURE SYSTEMS**

- A. See plans and insulation specifications for exposed ducts to be paint grip.
- B. Unless otherwise specified, construct ducts from galvanized iron fabricated and erected in a workmanlike manner. Fabricate plenums and special fittings, as shown on the Drawings, or as required. Access doors to plenums shall be double wall construction with heavy hardware. All ductwork shall be of the gauges hereinafter specified and constructed to the best grade Inland, U.S. Steel, United Sheet Metal or equal brands, heavily galvanized.
- C. Metal gauges for low and medium pressure duct systems shall be of metal gauges and reinforcing as recommended by SMACNA or as follows:

Max. Dimension of Rect. Ducts or Dia. of Round	Galvanized Sheet
<u>Low Pressure Ducts</u>	<u>Steel Gauge Number</u>
Up thru 12"	26
Over 12" thru 30"	24
Over 30" thru 54"	22
Over 54" thru 84"	20
Over 84"	18

Maximum Dimension of Rectangular Ducts or Diameter of Round	Galvanized Sheet
<u>Medium Pressure Ducts</u>	<u>Steel Gauge Number</u>
Up thru 18"	24
Over 19" thru 48"	22
Over 49" thru 72"	20
Over 73" thru 96"	18

- D. Ductwork shall be constructed, braced, reinforced and sealed as recommended by ASHRAE and SMACNA. Low pressure ductwork shall be suitable for pressures up to 2 inch w.g. Medium pressure ductwork shall be suitable for pressures up to 3 inch w.g. All ductwork 18 inches and greater in width shall be cross-broken. See SMACNA requirements for proper sealing of ductwork. All supply air ductwork between VAV air handling units and VAV terminals shall be medium pressure construction.
- E. Low pressure ductwork with the longest side 36" wide and over, or medium pressure ductwork shall be constructed using Ductmate 35/25 or equal slide on systems, per Ductmate Industries Installation Procedures and Duct Construction Standards, latest edition. The non-proprietary SMACNA T-22 Flanged Connection may be used as defined on Page 1-25 and 1-37, of the 1985 SMACNA Manual, First Edition. Ductmate 35/25 may be used for transverse joint construction, 35" wide and smaller. Ductmate 440 Butyl Gasket, or equal, shall be used between all rectangular transverse flanged duct connections, Ductmate's 440 Butyl Gasket, shall be used with the Ductmate Systems. For rectangular ductwork located outdoors, exposed to weather, construct ductwork per, 'Transverse Joints Rectangular' with using a continuous metal cleat on top joints of ducts for added weather protection. Slide on systems shall be Ductmate, Ward Industries, Inc., or equal.
- F. No obstruction shall be permitted in the ductwork to retard the flow of air. If it is necessary to run a pipe or conduit through a duct, the duct size shall be increased to compensate for the obstruction.

- G. Where space permits, duct turns shall be constructed with an inside radius equal to or greater than the duct width or duct turn vanes may be used. Where space does not permit duct turns as described above, duct turn vanes shall be used.
- H. Where interior duct insulation is required, increase the duct size to maintain the free area shown on the Drawings.
- I. Provide exterior insulated drip pans, 3 inches deep, under or adjacent to all roof and wall openings including but not limited to under all intake or relief hoods, power roof ventilators, and louvers. Drip pans to be soldered watertight.
- J. Power operated dampers not furnished as a component of the ventilating machines will be furnished under the Temperature Control Specifications. They shall be installed in the ductwork under this specification. Caulk around all sides of high efficiency damper frames.
- K. Flexible connections shall be installed between suction and discharge openings in fan units and the ducts with which they are connected as shown on the Drawings, to prevent transmission of vibration noises. Material shall be watertight and fire retardant canvas weighing not less than 20 ounces per square yard, or shall be glass fabric on high temperature systems where fire hazard exists. Both materials shall be approved by Underwriter's Laboratories. The flexible material shall be furnished with all necessary angles, bolts, clips or other fasteners.
- L. Furnish and install access panels in the ductwork adjacent to all motorized dampers, fire dampers, louvers, reheat coils, and equipment which may require servicing or cleaning. Panels shall be tight fitting and shall be located so as to make them easily accessible. All panels installed in insulated ductwork shall be double wall, insulated type. Panels shall be Ruskin, Air Balance, Ventlok, ADCO, or equal.
- M. Dynamic rated fire dampers shall have an 18 inch square access panel or an 18 inch long removable duct section shall be installed adjacent to dynamic rated fire dampers in addition to a smaller inspection access panel. The removable section shall be assembled using Ductmate or equal duct joints. The joint at the damper shall be assembled with plastic fastener clips. Ductwork 24 inches and wider shall have an 18 inch by 18 inch access door in lieu of removable section.
- N. Ductwork installed above UL fire rated ceiling assemblies shall be installed in strict accordance with the provisions required by the UL Design Number designated in the Underwriters Laboratories Fire Resistance Directory.
- O. All ductwork visible through the face of a register or grille shall be painted with a flat black paint.
- P. All rigid and flexible ductwork materials installed shall have composite fire and smoke hazard ratings as tested by procedures ASTM 84, NFPA 255 and UL 723 not to exceed 25 Flame Spread and 50 Smoke Developed.
- Q. Concealed low pressure round ductwork may be rigid spiral ductwork or snaplock type with adjustable elbows.
- R. All exposed round ductwork and round ductwork to the inlet of VAV terminals shall be United, Semco, Norlock, Foremost or equal, rigid spiral duct and fittings.
- S. All exposed ductwork to be PAINTGRIP and shall be United, Semco, Norlock, Foremost or equal, rigid spiral duct and fittings. Refer to architectural reflected ceiling plans.
- T. Round ductwork shall be supported at 6 feet o.c. where building framing does not provide such support. Support shall be minimum 3/4 inch metal strap suspended from the roof or framing. Flexible duct shall not exceed 8 feet in length or pass through walls. Flexible round ductwork may only be used for final connections to supply registers and diffusers and shall not be used on return or exhaust ductwork.

### **2.3 DUCT HANGERS AND SUPPORTS**

- A. Securely attach all ductwork to the building construction in a manner to be free of vibration and swaying under all conditions of operation. Hanger attachments shall be appropriate for the building structure and shall be subject to the A/E's approval. Hang ducts from beams and joist whenever possible.

- B. Ducts shall be substantially supported with hangers located according to SMACNA standards.

#### 2.4 DUCT INSTALLATION

- A. Duct sizes shown on the drawings are nominal inside dimensions. Where internal insulation is provided, duct sizes must be increased appropriately to maintain indicated inside dimensions.
- B. All ductwork will be run substantially as shown on the plans with bends and curves. Changes in size or cross section shall be made with long tapers. The A/E reserves the right to slightly change the run of certain ducts without extra cost to the Owner, if necessary to avoid unforeseen structural or other interferences.
- C. Where ducts run through bar joists or other ceiling spaces and structural, mechanical, or electrical interference is encountered, maintain same cross sectional area as indicated on plans with a maximum of 4-1/2 to 1 aspect ratio.
- D. All openings in duct for grilles, registers, etc. shall be capped dust-tight with G.I. Metal caps during the construction period.
- E. Round branch duct connections to rectangular mains shall be made with round manual balancing dampers meeting the following specifications: Dampers shall consist of a 20 ga. Galvanized steel; 3/8" square plated steel axles turning in acetal bearings. Damper shall include optional 1-1/2" standoff bracket (with extended pin) to accommodate for the thickness of external duct insulation. Dampers have quadrant operator and shall be suitable for pressures to 1.0" w.g., velocities to 2000 f.p.m. and temperatures to 180 degrees F. Testing and ratings to be in accordance with AMCA Standard 500. Basis of design is Greenheck model MBDR-50.
- F. Exhaust/relief air, and air intake ducts shall be equipped with 3" deep watertight pans to collect moisture and condensate. Seal all joints with sealant.
- G. All changes in direction shall be made with curved elbows having a centerline radius equal to 1-1/2 times the duct width. Where space conditions prevent the use of curved elbows and/or where square turns are indicated, provide square turn elbows with turning vanes. Vanes may be either commercial type ducturns or equal, or shop fabricated to conform to SMACNA standards. Vanes shall be double thickness type pre-assembled on runners before installing in each elbow. Brace adequately and avoid rough edges to prevent objectionable noise.

#### 2.5 ACCESS PANELS

- A. Provide access panels to permit inspection and maintenance of all hot water coils, motorized volume dampers, smoke dampers, control equipment, and other equipment requiring maintenance. Panels shall be located in position dictated by the equipment such that maintenance may be performed. Panels shall not be located in top side of ducts.
- B. Panels shall be attached to duct with zinc plated cam latches. 18" x 18" and smaller panels shall have a minimum of two (2) latches. Larger panels shall have a minimum of four (4) latches. Panel shall set in rigid frame with sponge rubber gasketing to prevent air leakage. Where ductwork is insulated, panels shall be of double wall construction with 1" rigid insulation fill.
- C. Where duct size permits, access panels shall be a minimum 18" x 16" or 2" smaller than duct size, whichever is smaller.

#### 2.6 CURBS AND FLASHING

- A. Curb for roof mounted equipment shall be provided by this contractor, unless otherwise specified and scheduled. This contractor shall also provide counterflashing. The counterflashing shall be galvanized sheet metal, and all joints shall be soldered watertight.
- B. Curb on all roof-mounted equipment shall be fully insulated.
- C. Curbs on equipment with fresh air intake shall be minimum 18" high.
- D. Flashing will be provided under the General Contract.
- E. Roofing work to be by the roofing contractor.
- F. Coordinate the roof slope with construction manager prior to submitting shop drawings.

**2.7 (OWNER PROVIDED CONTRACTOR INSTALLED) VAV AIR HANDLING UNIT WITH DX COOLING & HOT WATER REHEAT COIL (AHU-1G & CU-1G)**

A. SECTION INCLUDES

1. VAV System Indoor Air Handling Unit with DX Cooling and Hot Water Heat
- B. Equipment listed as provided by Owner for this project will be provided by the owner through O'Connor Company. A List of this equipment will be provided to the bidders by the O'Connor Company with an associated value. The bidding contractor shall provide warranty labor for all equipment in their bid and the equipment provided through the O'Connor company. Contact Michael Heeney, 605-336-0333, michael.heeney@oconnorco.com for list of equipment and associated value.
  1. Shop Drawing Submittals will be issued via addendum.

**2.8 (OWNER PROVIDED CONTRACTOR INSTALLED) DX AIR COOLED CONDENSING UNIT (CU-1G)**

A. SECTION INCLUDES

1. DX Air Cooled Condensing Unit
- B. Equipment listed as provided by Owner for this project will be provided by the owner through O'Connor Company. A List of this equipment will be provided to the bidders by the O'Connor Company with an associated value. The bidding contractor shall provide warranty labor for all equipment in their bid and the equipment provided through the O'Connor Company. Contact Michael Heeney, 605-336-0333, michael.heeney@oconnorco.com for list of equipment and associated value.
- C. Contractor to provide & install temporary refrigeration linesets and permanent UV resistant refrigeration linesets for CU-1G. Coordinate with O'Connor Co. for lineset sizing. Temporary refrigeration piping shall not be reused for permanent piping.
- D. Contractor to install condensing unit in temporary and reinstall condensing unit in permanent locations. See plans.
  1. Shop Drawing Submittals will be issued via addendum.

**2.9 VAV AIR HANDLING UNIT WITH COOLING WATER & HOT WATER REHEAT COILS (AHU-100, -200,& -300)**

A. SECTION INCLUDES

1. VAV System Indoor Air Handling Units.

B. REFERENCES

1. AFBMA 9 - Load Ratings and Fatigue Life for Ball Bearings.
2. AMCA 99 - Standards Handbook.
3. AMCA 210 - Laboratory Methods of Testing Fans for Rating Purposes.
4. AMCA 300 - Test Code for Sound Rating Air Moving Devices.
5. AMCA 500 - Test Methods for Louver, Dampers, and Shutters.
6. AHRI 410 - Forced-Circulation Air-Cooling and Air-Heating Coils.
7. AHRI 430 - Central-Station Air-Handling Units.
8. AHRI 435 - Application of Central-Station Air-Handling Units.
9. ASTM B117 - Standard Practice for Operating Salt Spray Apparatus.
10. NEMA MG1 - Motors and Generators.
11. NFPA 70 - National Electrical Code.
12. SMACNA - HVAC Duct Construction Standards - Metal and Flexible.
13. UL 723 - Test for Surface Burning Characteristics of Building Materials.
14. UL 900 - Test Performance of Air Filter Units.
15. UL 1995 - Standard for Heating and Cooling Equipment.
16. UL 94 - Test for Flammability of Plastic Materials for Parts in Devices and Appliances.
17. IBC 2023- International Building Code.
18. NFPA 90A - Standard for the Installation of Air Conditioning and Ventilating Systems.
19. NFPA 5000 - Building Construction and Safety Code.
20. ASHRAE 90.1 Energy Code.

21. AHRI Standard 1060 - Rating Air-to-Air Heat Exchangers for Energy Recovery Ventilation Equipment.
22. GSA 2003 Facilities Standard - 5.9 HVAC Systems and Components.

C. SUBMITTALS

1. Shop Drawings: Indicate assembly, unit dimensions, weight loading, required clearances, construction details, field connection details, and electrical characteristics and connection requirements. Computer generated fan curves for each air handling unit shall be submitted with specific design operating point noted. A computer generated psychometric chart shall be submitted for each cooling coil with design points and final operating point clearly noted. Sound data for discharge, radiated and return positions shall be submitted by octave band for each unit. Calculations for required baserail heights to satisfy condensate trapping requirements of cooling coil shall be included.
2. Product Data:
  - a. Provide literature that indicates dimensions, weights, capacities, ratings, fan performance, finishes of materials, electrical characteristics, and connection requirements.
  - b. Provide data of filter media, filter performance data, filter assembly, and filter frames.
  - c. Provide manufacturer's installation instructions.

D. QUALIFICATIONS

1. Manufacturer: Company specializing in manufacturing Air Handler products specified in this section must show a minimum five years documented experience and complete catalog data on total product.

E. SAFETY AGENCY LISTED & CERTIFICATION

1. Air Handling units shall be cETLus safety listed to conform with UL Standard 1995 and CAN/CSA Standard C22.2 No. 236. Units shall be accepted for use in New York City by the Department of Building, MEA 342-99-E.
2. Air handler furnished with double width, double inlet (DWDI) fans and/or plenum fans where applicable, shall be certified in accordance with the central station air handling units certification program, which is based on AHRI Standard 430. (NOTE: Above does not apply to fan array)
3. Air handling unit water heating & cooling coils shall be certified in accordance with the forced circulation air cooling and air heating coils certification program, which is based on AHRI Standard 410.

F. DELIVERY, STORAGE, AND HANDLING

1. Deliver, store, protect and handle products to site.
2. Accept products on site on factory-furnished shipping skids. Inspect for damage.
3. Store in clean dry place and protect from construction traffic. Handle carefully to avoid damage to components, enclosures, and finish.

G. MANUFACTURERS

1. The following manufacturers are approved for use.
2. Daikin Applied 'Vision' Air Handler shall be the basis of design.
3. Or, manufacturer subject to engineer's prior approval.

H. GENERAL DESCRIPTION

1. Configuration: Fabricate as detailed on drawings.
2. Performance: Conform to AHRI 430. See schedules on prints. (NOTE: above does not apply to fan array)
3. Acoustics: Sound power levels (dB) for the unit shall not exceed the specified levels shown on the unit schedule. The manufacturer shall provide the necessary sound treatment to meet these levels if required.

I. UNIT CONSTRUCTION

1. Fabricate unit with heavy gauge channel posts and panels secured with mechanical fasteners. All panels, access doors, and ship sections shall be sealed with permanently applied bulb-type gasket. Shipped loose gasketing is not allowed.
2. Panels and access doors shall be constructed as a 2-inch nominal thick; thermal broke double wall assembly, injected with foam insulation with an R-value of not less than R-13.
3. The inner liner shall be constructed of G90 galvanized steel.
4. The outer panel shall be constructed of G90 galvanized steel.
5. The floor plate shall be constructed as specified for the inner liner.
6. Unit will be furnished with solid inner liners.
7. Panel deflection shall not exceed L/240 ratio at 125% of design static pressure, maximum 5 inches of positive or 6 inches of negative static pressure. Deflection shall be measured at the panel midpoint.
8. The casing leakage rate shall not exceed 0.50 cfm per square foot of casing surface area at design static pressure up to a maximum of +5" w.c. in positive pressure sections and -6" w.c. in negative pressure sections (.0025 m3/s per square meter of cabinet area at 1.24 kPa static pressure)
9. Module to module field assembly shall be accomplished with an overlapping, full perimeter internal splice joint that is sealed with bulb type gasketing on both mating modules to minimize on-site labor and meet indoor air quality standards.
10. Access doors shall be flush mounted to cabinetry, with minimum of two six inch long stainless steel piano-type hinges, latch and full size handle assembly. Access doors shall swing outward for unit sections under negative pressure. Access doors on positive pressure sections, shall have a secondary latch to relieve pressure and prevent injury upon access.
11. A 6-inch formed G60 galvanized steel base rail shall be provided by the unit manufacturer for structural rigidity and condensate trapping.. The base rail shall be constructed with 12-gauge nominal for unit sizes 003 - 035 and 10-gauge nominal for unit sizes 040 - 090. The following calculation shall determine the required height of the baserail to allow for adequate drainage. Use the largest pressure to determine base rail height.  $[(\text{Negative})(\text{Positive}) \text{ static pressure (in)}] (2) + 4" = \text{required baserail height}$ . Should the unit baserail not be factory supplied at this height, the contractor is required to supply a concrete housekeeping pad to make up the difference.

J. FAN ASSEMBLIES

1. Acceptable fan assembly shall be a single width, single inlet, class II, direct-drive type plenum fan dynamically balanced as an assembly, as shown in schedule. Maximum fan RPM shall be below first critical fan speed. Fan assemblies shall be dynamically balanced by the manufacturer on all three planes. Provide access to motor and fan assembly through hinged access door.
2. Fan and motor shall be mounted internally on a steel base. Factory mount motor on slide base that can be slid out the side of the unit if removal is required. Provide access to motor, drive, and bearings through hinged access door. Fan and motor assembly shall be mounted on rubber-in-shear vibration type isolators inside cabinetry.
3. Fan and motor shall be mounted internally on a steel base. Factory mount motor on slide base that can be slid out the side of the unit if removal is required. Provide access to motor, drive, and bearings through hinged access door. Fan and motor assembly shall be mounted on 2" deflection spring vibration type isolators inside cabinetry.

K. BEARINGS, SHAFTS, AND DRIVES

1. Bearings: Basic load rating computed in accordance with AFBMA - ANSI Standards. The bearings shall be provided on the motor with the fan wheel mounted directly on the motor shaft, AMCA arrangement 4.
2. Shafts shall be solid, hot rolled steel, ground and polished, keyed to shaft, and protectively coated with lubricating oil. Hollow shafts are not acceptable.



3. The fan wheel shall be direct coupled to the motor shaft. The wheel width shall be determined by motor speed and fan performance characteristics.

L. ELECTRICAL

1. Fan motors shall be manufacturer provided and installed, Open Drip Proof, premium efficiency (meets or exceeds EPAct requirements), VFD controlled, 460V / 60HZ / 3P. Complete electrical characteristics for each fan motor shall be as shown in schedule.
2. The air handler(s) shall be ETL and ETL-Canada listed by Intertek Testing Services, Inc. Units shall conform to bi-national standard ANSI/UL Standard 1995/CSA Standard C22.2 No. 236.
3. Wiring Termination: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclosed terminal lugs in terminal box sized to NFPA 70.
4. Manufacturer shall provide ASHRAE 90.1 Energy Efficiency equation details for individual equipment to assist Building Engineer for calculating system compliance.
5. Installing contractor shall provide GFI receptacle within 25 feet of unit to satisfy National Electrical Code requirements.
6. All electrical connection components shall be field provided and mounted as shown on project schedule.

M. COOLING AND HEATING COILS

1. Certification: Acceptable water cooling, water heating, steam, and refrigerant coils shall be certified in accordance with AHRI Standard 410 and bear the AHRI label. Coils exceeding the scope of the manufacturer's certification and/or the range of AHRI's standard rating conditions will be considered provided the manufacturer is a current member of the AHRI Forced Circulation Air-Cooling and Air-Heating Coils certification programs and that the coils have been rated in accordance with AHRI Standard 410. Manufacturer must be ISO 9002 certified.
2. Water Heating Coil:
  - a. Water heating coil shall be provided. Provide access to coil(s) for service and cleaning. Enclose coil headers and return bends fully within unit casing. Unit shall be provided with coil connections that extend a minimum of 5" beyond unit casing for ease of installation. Drain and vent connections shall be provided exterior to unit casing. Coil connections must be factory sealed with grommets on interior and exterior panel liners to minimize air leakage and condensation inside panel assembly. If not factory packaged, Contractor must supply all coil connection grommets and sleeves. Coils shall be removable through side and/or top panels of unit without the need to remove and disassemble the entire section from the unit.
  - b. Headers shall consist of seamless copper tubing to assure compatibility with primary surface. Headers to have intruded tube holes to provide maximum brazing surface for tube to header joint, strength, and inherent flexibility. Header diameter should vary with fluid flow requirements.
  - c. Fins shall have a minimum thickness of 0.0075 inch aluminum plate construction. Fins shall have full drawn collars to provide a continuous surface cover over the entire tube for maximum heat transfer. Tubes shall be mechanically expanded into the fins to provide a continuous primary to secondary compression bond over the entire finned length for maximum heat transfer rates. Bare copper tubes shall not be visible between fins.
  - d. Coil tubes shall be 5/8 inch OD seamless copper, 0.020 inch nominal tube wall thickness, expanded into fins, brazed at joints.
  - e. Coil connections shall be carbon steel, threaded connection. Connection size to be determined by manufacturer based upon the most efficient coil circuiting. Vent and drain fittings shall be furnished on the connections, exterior to the air handler. Vent connections provided at the highest point to assure proper venting. Drain connections shall be provided at the lowest point to insure complete drainage and prevent freeze-up.

- f. Coil shall be furnished as an uncased galvanized steel to allow for thermal movement and slide into a pitched track for fluid drainage.
3. Water Cooling Coil:
  - a. Water cooling coil shall be provided. Provide access to coil(s) for service and cleaning. Enclose coil headers and return bends fully within unit casing. Unit shall be provided with coil connections that extend a minimum of 5" beyond unit casing for ease of installation. Drain and vent connections shall be provided exterior to unit casing. Coil connections must be factory sealed with grommets on interior and exterior panel liners to minimize air leakage and condensation inside panel assembly. If not factory packaged, Contractor must supply all coil connection grommets and sleeves. Coils shall be removable through side and/or top panels of unit without the need to remove and disassemble the entire section from the unit.
  - b. Headers shall consist of seamless copper tubing to assure compatibility with primary surface. Headers to have intruded tube holes to provide maximum brazing surface for tube to header joint, strength, and inherent flexibility. Header diameter should vary with fluid flow requirements.
  - c. Fins shall have a minimum thickness of 0.0075 inch aluminum plate construction. Fins shall have full drawn collars to provide a continuous surface cover over the entire tube for maximum heat transfer. Tubes shall be mechanically expanded into the fins to provide a continuous primary to secondary compression bond over the entire finned length for maximum heat transfer rates. Bare copper tubes shall not be visible between fins.
  - d. Coil tubes shall be 5/8 inch OD seamless copper, 0.020 inch nominal tube wall thickness, expanded into fins, brazed at joints.
  - e. Coil connections shall be carbon steel, threaded connection. Connection size to be determined by manufacturer based upon the most efficient coil circuiting. Vent and drain fittings shall be furnished on the connections, exterior to the air handler. Vent connections provided at the highest point to assure proper venting. Drain connections shall be provided at the lowest point to insure complete drainage and prevent freeze-up.
  - f. Coil casing shall be a formed channel frame of galvanized steel.

N. FILTERS

1. Furnish angled filter section with 2-inch pleated (MERV 13) filter. Provide side loading and removal of filters.
2. Filter media shall be UL 900 listed, Class I or Class II.

O. ADDITIONAL SECTIONS

1. Access section shall be provided for access between components.
2. Blender / air mixer section to provide proper air mixing and distribution of the outside and return airstreams. Provide proper spacing provided in the direction of airflow as recommended by the blender manufacturer - Blender Products.
3. Economizer section shall be provided with top outside air opening and end return air opening and top exhaust air opening with or without parallel low leak airfoil damper blades. Dampers shall be hollow core galvanized steel airfoil blades, fully gasketed and have continuous vinyl seals between damper blades in a galvanized steel frame. Dampers shall have stainless steel jamb seals along end of dampers. Linkage and ABS plastic end caps shall be provided when return and outside air dampers sized for full airflow. Return and outside air dampers of different sizes or very large dampers and exhaust dampers must be driven separately. Damper Leakage: Leakage rate shall be less than two tenths of one percent leakage at 2 inches static pressure differential. Leakage rate tested in accordance with AMCA Standard 500.

P. INSTALLATION

1. Install in accordance with manufacturer's Installation & Maintenance instructions.

Q. ENVIRONMENTAL REQUIREMENTS

1. Do not operate units for any purpose, temporary or permanent, until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.

R. EXTRA MATERIALS

1. Provide one extra set of filters for each unit as shown on project schedule.

**2.10 SHUTOFF VAV/REHEAT TERMINALS**

A. GENERAL

1. Furnish and install single duct, variable volume air distribution assemblies with hydronic reheat of the type, size, and performance shall be as tabulated in the schedule and on the drawings.
2. The assemblies shall be pressure independent and shall reset to any air flow between zero and the maximum cataloged air volume. At an inlet velocity of 2,000 fpm, the differential static pressure for any unit with attenuator section, sizes 4 through 16, shall not exceed 0.11" w.g.
3. Sound ratings of air distribution assemblies, shall not exceed 25 NC.
4. Performance shall be ARI Certified.
5. The air flow sensor shall be of a cross configuration located at the inlet of the assembly. The sensor shall have twelve total pressure sensing ports and a center averaging chamber designed to accurately average the flow across the inlet of the assembly. Sensor shall provide accuracy within 5% with a 90° sheet metal elbow directly at the inlet of the assembly. The air flow sensor shall amplify the sensed air flow signal.
6. The assembly casing shall be constructed of 22 gauge zinc coated steel, internally lined with 1/2 inch thick, dual density fiberglass insulation which complies with UL-181 and NFPA-90A. Any cut edges of fiberglass exposed to the airstream shall be coated with NFPA-90A approved sealant.
7. The primary air valve damper shall be heavy gauge metal, with peripheral gasket, pivoted in self-lubricating bearings. In the full closed position, air leakage past the closed damper shall not exceed 2% of the nominal catalog rating at 3" inlet static pressure, as rated by ARI Standard 880.

B. CONTROLS

1. The terminal unit controller shall be a dedicated, microprocessor-based, pressure independent VAV controller complete with electronic flow transducer. The controller shall be capable of stand-alone operation and have the ability to network with a building automation system, personal computer or portable operator interface device.
2. The electric actuator shall be 24 VAC bi-directional, direct coupled to the damper shaft. The actuator must be capable of operating in the stalled position without overheating or mechanical damage.
3. The terminal unit manufacturer shall provide a flow cross or two (2) pipe sensor suitable for interfacing with a differential pressure sensor.
4. The temperature control contractor shall furnish the terminal equipment controller, flow transducer, and electric actuator for installation on each terminal unit by the terminal unit manufacturer. The cost of factory mounting, wiring, enclosure to meet local code and any factory testing and programming of the terminal equipment controller shall be included by the terminal manufacturer.
5. All components shall be calibrated and pretested to ensure a fully functional unit.
6. The zone sensor shall be furnished by the Temperature Control Contractor and shall include temperature setpoint adjustment and access for connection of a hand-held operator terminal or portable computer.
7. The DDC control package shall be calibrated and factory set for the maximum and minimum flow rates as scheduled on the drawings.
8. The air terminal unit shall be designed, installed and field adjusted, if necessary, to maintain controlled pressure independent air flow.
9. All control components shall be mounted inside a protective metal enclosure.

C. WATER REHEAT COILS

1. Provide factory mounted hot water reheat coils as scheduled.
  2. The coils shall be aluminum plate fin with copper tubes and sweat connections. Coil connections can be right hand or left hand and shall be coordinated with heating contractor. Control valves, automatic air vents and drain vents, shall be supplied and field installed by others.
- D. Provide & install accessories as scheduled on the plans.

#### **2.11 DUCTLESS SPLIT SYSTEM AIR SOURCE HEAT PUMPS**

- A. Furnish and install ductless split system where shown on plans or as described in schedules.
- B. The refrigeration system shall be split consisting of an evaporator section and remote air cooled condensing unit. The evaporator and remote air cooled condensing unit shall be factory assembled and tested.
- C. Provide & install powder coated wall mount bracket for units located in Penthouse M300 and Receiving 161.
- D. Provide & install hardwired thermostat. Wireless remote thermostat will not be acceptable. See Execution section for installation of thermostats. Contractor shall provide clear lockable covers for any thermostats the Owner desires, coordinate with Owner.
- E. Provide and install options and accessories as described in schedule.
- F. Provide each unit with one additional set of replaceable filters for Owner's use.
- G. Provide & install accessories as scheduled on the plans.

#### **2.12 AIR COOLED SCROLL LIQUID CHILLER**

- A. Section includes design, performance criteria, refrigerants, controls, and installation requirements for air-cooled scroll compressor chillers.
- B. REFERENCES
  1. Comply with applicable Standards/Codes of AHRI 550/590, ANSI/ASHRAE 15, ETL, cETL, NEC, and OSHA as adopted by the State.
  2. Units shall meet the efficiency standards of the current version of ASHRAE Standard 90.1, and FEMP standard 2012.
- C. SUBMITTALS
  1. Submit shop drawings and product data in accordance with the specifications.
  2. Submittals shall include the following:
    - a. Dimensioned plan and elevation view drawings, required clearances, and location of all field connections
    - b. Summary of all auxiliary utility requirements such as electricity, water, etc. Summary shall indicate quality and quantity of each required utility.
    - c. Single line schematic drawing of the field power hookup requirements, indicating all items that are furnished.
    - d. Schematic diagram of control system indicating points for field interface/connection.
    - e. Diagram shall fully delineate field and factory wiring.
    - f. Installation and operating manuals.
- D. QUALITY ASSURANCE
  1. Qualifications: Equipment manufacturer must specialize in the manufacture of the products specified and have five years experience with the type of equipment and refrigerant offered.
  2. Regulatory Requirements: Comply with the codes and standards specified.
  3. Chiller manufacturer plant must be ISO Registered.
- E. DELIVERY AND HANDLING

1. Chiller shall be delivered to the job site completely assembled and charged with refrigerant and oil by the manufacturer.
2. Comply with the manufacturer's instructions for rigging and handling equipment.

F. WARRANTY

1. Standard Warranty (Domestic): The refrigeration equipment manufacturer's guarantee shall be for a period of five years from date of equipment start-up but not more than 66 months from shipment. The guarantee shall provide for repair or replacement due to failure by material and workmanship that prove defective within the above period, excluding refrigerant.
2. 1<sup>st</sup> through 5<sup>th</sup> Year Labor Warranty: Included
3. Refrigerant Warranty: None.
4. Delay Warranty Start: None.

G. MAINTENANCE

1. Maintenance of the chillers shall be the responsibility of the owner and performed in accordance with the manufacturer's instructions.

H. ACCEPTABLE MANUFACTURERS

1. Daikin Applied
2. (Prior Approved Equal)

I. UNIT DESCRIPTION

1. Provide and install as shown on the plans factory-assembled, factory-charged air-cooled scroll compressor packaged chillers in the quantity specified. Each chiller shall consist of hermetic tandem scroll compressor sets (total four compressors), brazed plate evaporator, air-cooled condenser section, microprocessor-based control system and all components necessary for controlled unit operation.
2. Chiller shall be functionally tested at the factory to ensure trouble free field operation.

J. DESIGN REQUIREMENTS

1. Flow Range: The chiller shall have the ability to support variable flow range down to 40% of nominal design (based on AHRI conditions).
2. Operating Range: The chiller shall have the ability to control leaving chilled fluid temperature from a minimum of 35F to 65F. (a wider range is acceptable)
3. General: Provide a complete scroll compressor packaged chiller as specified herein and as shown on the drawings. The unit shall be in accordance with the standards referenced in section 1.02 and any local codes in effect.
4. Performance: Refer to the schedule of performance on the drawings. The chiller shall be capable of stable operation to a minimum percentage of full load (without hot gas bypass) of 25%. Performance shall be in accordance with AHRI Standard 550/590.
5. Acoustics: Sound pressure levels for the unit shall not exceed the following specified levels. All manufacturers shall provide the necessary sound treatment (parts and labor) to meet these levels if required. Sound data shall be provided with the quotation. Test shall be in accordance with AHRI Standard 370.

Sound Pressure (at 30 feet)											
63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz	Overall dBA	75% Load dBA	50% Load dBA	25% Load dBA
66	68	65	65	62	56	57	55	67	66	64	63
Sound Power											

63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz	Overall dBA	75% Load dBA	50% Load dBA	25% Load dBA
93	95	92	92	89	83	82	82	94	93	91	90

K. CHILLER COMPONENTS

1. Compressor
  - a. The compressors shall be sealed hermetic, scroll type with crankcase oil heater and suction strainer. The compressor motor shall be refrigerant gas cooled, high torque, hermetic induction type, two-pole, with inherent thermal protection on all three phases and shall be mounted on RIS vibration isolator pads. The compressors shall be equipped with an internal module providing compressor protection and communication capability.
2. Evaporator
  - a. The evaporator shall be a compact, high efficiency, dual circuit, brazed plate-to-plate type heat exchanger consisting of parallel stainless steel plates. Vent and drain connections shall be provided in the inlet and outlet chilled water piping by the installing contractor.
  - b. The evaporator shall be protected with an external, electric resistance heater plate. The evaporator and suction piping to the compressors shall be insulated with 3/4" (19 mm) thick CFC and HCFC-free closed-cell flexible elastomeric foam insulation material with 100% adhesive coverage. The insulation shall have an additional outer protective layer of 3mm thick PE embossed film to provide superior damage resistance. Insulation without the protective outer film shall not be acceptable. UV resistance level shall meet or exceed a rating of 'Good' in accordance with the UNI ISO 4892 - 2/94 testing method. This combination of a heater plate and insulation shall provide freeze protection down to -20°F (-29°C) ambient air temperature.
  - c. The water-side maximum design pressure shall be rated at a minimum of 435 psig (3000 kPa). Evaporators shall be designed and constructed according to, and listed by Underwriters Laboratories (UL).
3. Condenser
  - a. Condenser fans shall be propeller type arranged for vertical air discharge and individually driven by direct-drive fan motors. The fans shall be equipped with a heavy-gauge vinyl-coated fan guard. Fan motors shall be TEAO type with permanently lubricated ball bearings, inherent overload protection, three-phase, direct-drive, 1140 rpm. Each fan section shall be partitioned to avoid cross circulation.
  - b. Coil shall be microchannel design and shall have a series of flat tubes containing multiple, parallel flow microchannels layered between the refrigerant manifolds. Tubes shall be 9153 aluminum alloy. Tubes made of 3102 alloy or other alloys of lower corrosion resistance shall not be accepted. Coils shall consist of a two-pass arrangement. Each condenser coil shall be factory leak tested with high-pressure air under water. Coils shall withstand 1000+ hour acidified synthetic sea water fog (SWAAT) test (ASTM G85-02) at 120°F (49°C) with 0% fin loss and develop no leaks.
4. Refrigerant Circuit
  - a. Each of the two refrigerant circuits shall include a refrigerant filter-drier, sight glass with moisture indicator, liquid line solenoid valve (no exceptions), expansion valve, and insulated suction line.
  - b. Each of the two refrigerant circuits shall include a replaceable-core refrigerant filter-drier, sight glass with moisture indicator, liquid line solenoid valve (no exceptions), expansion valve, and insulated suction line.
5. Construction
  - a. Unit formed sheet metal components shall be painted using a corrosion resistant paint system, for aesthetics and long-term durability. Paint system will include a

base primer with a high-quality polyester resin topcoat. Painted galvanized parts shall be G60 or greater and finished, unabraded panel surfaces shall be capable to be exposed to an ASTM B117 salt spray environment and exhibit no visible red rust at a minimum of 3,000 hours exposure. Finished, abraded surfaces shall be tested per ASTM D1654, having a mean scribe creepage not exceeding 1/16" at 1,000 hours minimum exposure to an ASTM B117 salt spray environment.

6. Control System
  - a. A centrally located weatherproof control panel shall contain the field power connection points, control interlock terminals, and control system. Box shall be designed in accordance with NEMA 3R rating. Power and starting components shall include factory circuit breaker for fan motors and control circuit, individual contactors for each fan motor, solid-state compressor three-phase motor overload protection, inherent fan motor overload protection and two power blocks (one per circuit) for connection to remote, contractor supplied disconnect switches. Hinged access doors shall be lockable. Barrier panels or separate enclosures are required to protect against accidental contact with line voltage when accessing the control system.
  - b. Shall include optional single-point power connection to power block with compressor circuit breakers (disconnect provided & installed by EC).
7. Unit Controller
  - a. An advanced DDC microprocessor unit controller with a 5-line by 22-character liquid crystal display provides the operating and protection functions. The controller shall take preemptive limiting action in case of high discharge pressure or low evaporator pressure. The controller shall contain the following features as a minimum:
  - b. The unit shall be protected in two ways: (1) by alarms that shut the unit down and require manual reset to restore unit operation and (2) by limit alarms that reduce unit operation in response to some out-of-limit condition. Shut down alarms shall activate an alarm signal.
  - c. Shutdown Alarms
    - 1) No evaporator water flow (auto-restart)
    - 2) Sensor failures
    - 3) Low evaporator pressure
    - 4) Evaporator freeze protection
    - 5) High condenser pressure
    - 6) Outside ambient temperature (auto-restart)
    - 7) Motor protection system
    - 8) Phase voltage protection (Optional)
  - d. Limit Alarms
    - 1) Condenser pressure stage down, unloads unit at high discharge pressures.
    - 2) Low ambient lockout, shuts off unit at low ambient temperatures.
    - 3) Low evaporator pressure hold, holds stage #1 until pressure rises.
    - 4) Low evaporator pressure unload, shuts off one compressor.
  - e. Unit Enable Section
    - 1) Enables unit operation from either local keypad, digital input, or BAS
  - f. Unit Mode Selection
    - 1) Selects standard cooling, glycol, or test operation mode
  - g. Analog Inputs:
    - 1) Reset of leaving water temperature, 4-20 mA\
    - 2) Current Limit
  - h. Digital Inputs
    - 1) Unit off switch
    - 2) Remote start/stop
    - 3) Flow switch
    - 4) Motor protection
  - i. Digital Outputs

- 1) Shutdown alarm; field wired, activates on an alarm condition, off when alarm is cleared
- 2) Evaporator pump; field wired, starts pump when unit is set to start
- j. Condenser fan control - The unit controller shall provide control of condenser fans based on compressor discharge pressure.
8. Building Automation System (BAS) Interface
  - 1) Factory mounted DDC controller(s) shall support operation on a BACnet®, Modbus® network via one of the data link / physical layers listed below as specified by the successful Building Automation System (BAS) supplier.
  - 2) BACnet MS/TP master (Clause 9)
  - 3) The information communicated between the BAS and the factory mounted unit controllers shall include the reading and writing of data to allow unit monitoring, control and alarm notification as specified in the unit sequence of operation and the unit points list.
  - 4) All communication from the chiller unit controller as specified in the points list shall be via standard BACnet objects. Proprietary BACnet objects shall not be allowed. BACnet communications shall conform to the BACnet protocol (ANSI/ASHRAE135-2001). A BACnet Protocol Implementation Conformance Statement (PICS) shall be provided along with the unit submittal.

L. OPTIONS AND ACCESSORIES

1. The following options are to be included:
  - a. Low Ambient Control: Provide fan cycling control to allow unit operation down to 32°F.
  - b. High Ambient Control: Provide control for operation in ambient temperatures from 105°F to 125°F.
  - c. BAS interface module to provide interface with the BACnet MSTP protocol.
  - d. The following accessories, if selected, are to be included:
    - 1) Spring vibration isolators for field installation
    - 2) Factory-provided, field-installed thermal dispersion type flow switch
    - 3) Wye strainer, to be installed at the evaporator inlet and sized for the design flow rate, with perforation diameter of 0.063" with blowdown valve and Victaulic couplings (factory mounted or field installed)
    - 4) Factory installed 115V GFI convenience outlet, field wired by E.C.

M. INSTALLATION

1. General: Rig and Install in full accordance with Manufacturer's requirements, Project drawings, and Contract documents.
2. Location: Locate chiller as indicated on drawings, including cleaning and service maintenance clearance per Manufacturer instructions. Adjust and level chiller on support structure.
3. Components: Installing Contractor shall provide and install all auxiliary devices and accessories for fully operational chiller.
4. Adjust and level chiller in alignment on supports.
5. Install manufacturer-supplied strainer in the chilled water return line at the evaporator inlet that meets manufacturer perforation size specifications.
6. Electrical: Coordinate electrical requirements and connections for all power feeds with Electrical Contractor (Division 26).
7. Controls: Coordinate all control requirements and connections with Controls Contractor.
8. Finish: Installing Contractor shall paint damaged and abraded factory finish with touch-up paint matching factory finish.

**2.13 IN-LINE EXHAUST FANS**

- A. Furnish and install inline exhaust fan where shown on the Drawings. Type, size, and performance shall be as tabulated in the schedule and on the drawings. Provide & install accessories as scheduled on the plans.



- B. Fan shall be duct mounted, direct driven centrifugal square inline.
- C. Fan shall be manufactured at an ISO 9001 certified facility. Fan shall be listed by Underwriters Laboratories (UL 705) and UL listed for Canada (cUL 705). Fan shall bear the AMCA certified ratings seal for sound and air performance.
- D. The fan shall be of bolted construction utilizing corrosion resistant fasteners. Housing shall be minimum 18 gauge galvanized steel with integral duct collars. Bolted access doors shall be provided on three sides, sealed with closed cell neoprene gasketing. Housing shall be pre-drilled to accommodate universal mounting feet for vertical or horizontal installation. Unit shall bear an engraved aluminum nameplate. Nameplate shall indicate design CFM and static pressure. Unit shall be shipped in ISTA certified transit tested packaging.
- E. Wheel shall be centrifugal backward inclined, constructed of 100% aluminum, including a precision machined cast aluminum hub. Wheel inlet shall overlap an aerodynamic aluminum inlet cone to provide maximum performance and efficiency. Wheel shall be balanced in accordance with AMCA standard 204-05, balance quality and vibration levels for fans.
- F. Motor shall be NEMA design B with a minimum of class B insulation rated for continuous duty and furnished at the specified voltage, phase and enclosure.
- G. Motor shall be a permanent split capacitor motor rated for continuous duty and furnished with factory wired and mounted speed controller.
- H. Provide and install options and accessories as described in schedule.

#### **2.14 DRYER EXHAUST BOOSTER FANS**

- A. Description:
  - 1. The 2015 IRC restricts the use of dryer booster fans to those Certified to the DEDPV, Dryer Exhaust Duct Power Ventilator supplement to UL705 & CSA C22.2 #113-12. The booster fan shall maintain clothes dryer exhaust air velocities at proper levels when dryer exhaust duct lengths exceed dryer manufacturer recommendations.
- B. Housing:
  - 1. 22 gauge G90 galvanized steel. Features rubber isolated mounting brackets which minimize vibration transfer.
- C. Control:
  - 1. Automatically activates fan based on operation of dryer. An LED indicator panel, mounted near the dryer, displays operational status and faults. It communicates via a factory-connected low voltage cable to an on-board booster fan control. The control monitors pressure and temperature within the duct to operate the booster fan in sync with the dryer and to stop booster fan operation if duct temperature is excessive or signal if the duct becomes blocked.
- D. Material Handling Impeller:
  - 1. The reverse inclined, particulate handling Impeller shall repel lint and be constructed of 18 gauge G90 galvanized steel.
- E. Motor:
  - 1. PSC, permanently lubricated ball bearing motor shall be located outside the dryer exhaust air stream to prevent exposure to heat, lint and moisture.
- F. Supply Power:
  - 1. Six foot 115 VAC power cord shall be factory installed and pre-wired. Requires installation adjacent to a standard electrical outlet.
- G. Installation Notes:
  - 1. Can be installed with discharge in horizontal or vertical orientations. Vertical orientations must discharge facing up.
  - 2. Suitable for installation in ambient temperatures between: -20° F and 140° F. Suitable for dryer duct temperatures up to 167° F.
- H. Warranty:
  - 1. Five (5) year, no-clog guarantee & warranty

## 2.15 STATIONARY LOUVERS

- A. Furnish and install louvers as hereinafter specified where shown on plans or as described in schedules. Louvers shall be stationary drainable type with drain gutters in each blade and downspouts in jambs and mullions. Louvers shall have a minimum of 57% free area based on a 48" x 48" high size. Stationary drainable blades shall be contained within a 4" frame. Louver components shall be factory assembled by the louver manufacturer. Louver sizes too large for shipping shall be built up by the contractor from factory assembled louver sections. Blades shall be 0.080 inch thick extruded aluminum at 37-1/2 degree angle on approximately 5" centers. A birdscreen shall be contained within a removable frame.
- B. Provide & install access door in ductwork to access birdscreen.
- C. Provide & install accessories as scheduled on the plans.

## 2.16 REGISTERS, GRILLES, AND DIFFUSERS

- A. Furnish and install registers, grilles, and diffusers where shown on the Drawings. Type, size, and performance shall be as tabulated in the schedule and on the drawings. Provide & install accessories as scheduled on the plans.
- B. Provide and install options and accessories as described in schedule.

## 2.17 MOTORIZED CONTROL DAMPER

- A. Furnish and install, as shown on plans, Ruskin CD-50 low leakage damper OR equal.
- B. Damper blade shall be of not less than 16 gauge galvanized steel formed for strength and high velocity performance with closed-cell neoprene edging. Damper blades shall not exceed 8 inches in width. Blades shall be secured to 1/2 inch diameter zinc plated axles by zinc plated bolts and nuts. All blade bearings shall be nylon. Blade side edges shall seal off against spring stainless steel seals. Teflon coated thrust bearings shall be provided at each end of every blade to minimize torque requirements and ensure smooth operation. All blade linkage hardware shall be constructed of corrosion resistant, zinc plated steel and brass. Dampers shall be suitable for operation within the following temperature limits, -40 degrees to 200 degrees F. and have a maximum leakage of 6 cfm per square foot at 4" water gauge.
- C. Damper to be 120V normally closed spring return.
- D. Provide & install accessories as scheduled on the plans.

## 2.18 SMOKE DAMPERS

- A. General Requirements: Label according to UL 555S by an NRTL.
- B. Smoke Detector: Integral, factory wired for single-point connection.
- C. Frame: Hat-shaped, 0.094-inch-thick, galvanized sheet steel, with welded interlocking, gusseted or mechanically attached corners and mounting flange.
- D. Vertical blades are available for special applications.
- E. Blades: Roll-formed, horizontal, interlocking, 0.034-inch-thick, galvanized sheet steel.
- F. Leakage: Class I.
- G. Rated pressure and velocity to exceed design airflow conditions.
- H. Mounting Sleeve: Factory-installed, 0.039-inch-thick, galvanized sheet steel; length to suit wall or floor application.
- I. Damper Motors: two-position action.
- J. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors as required for the application.
  - 1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
  - 2. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Section 15900 "HVAC Instrumentation and Controls."

3. Permanent-Split-Capacitor or Shaded-Pole Motors: With oil-immersed and sealed gear trains.
  4. Spring-Return Motors: Equip with an integral spiral-spring mechanism where indicated. Enclose entire spring mechanism in a removable housing designed for service or adjustments. Size for running torque rating of 150 in. x lbf and breakaway torque rating of 150 in. x lbf.
  5. Outdoor Motors and Motors in Outdoor-Air Intakes: Equip with O-ring gaskets designed to make motors weatherproof. Equip motors with internal heaters to permit normal operation at minus 40 deg F.
  6. Nonspring-Return Motors: For dampers larger than 25 sq. ft., size motor for running torque rating of 150 in. x lbf and breakaway torque rating of 300 in. x lbf.
  7. Electrical Connection: 115 V, single phase, 60 Hz.
- K. Smoke dampers shall be by the same manufacturer and shall be smoke tight, and shall be complete with 120V electric actuator. Actuator shall be wired by Division 26.

#### **2.19 THROWAWAY FILTERS**

- A. Provide one additional set of throwaway filters for the entire system. Furnish and install throwaway type filters for air handling systems, 1 or 2-inch thick disposable type, ASHRAE 52.1, U.L. Class 2, Merv 13, filters as manufactured by Flanders Airpure, American Air Filter, Farr, Cambridge, or equal where shown on the Drawings.
- B. Provide entire system with one additional set of disposable filters for the owner's use.

#### **2.20 AUTOMATIC TEMPERATURE CONTROL**

- A. Install the automatic temperature control dampers, air flow monitoring devices, openings for air flow switches, alarms and control devices as provided by the Automatic Temperature Control Contractor. These dampers and devices shall be installed under the direct supervision of the Section 23 0900, CONTROLS & CONTROL SEQUENCES Temperature Control Contractor and in strict accordance with the manufacturer's recommendations.

#### **2.21 DUCTLESS SPLIT SYSTEMS CONTROL WIRING**

- A. Unless otherwise indicated, install all temperature controls work needed to operate ductless split system equipment in strict accordance with the manufacturer's recommendations.
- B. Installation: All devices in mechanical rooms shall be panel mounted whenever possible. Wiring to remote mounted devices in mechanical rooms and inaccessible spaces shall be run in conduit. Wiring in accessible ceilings may be run with plenum rated cable providing it is securely fastened to the structural members at 4' intervals. Low voltage control wiring shall be installed in conduit a minimum of 12' above finished floor. In general, all wiring in conjunction with the HVAC systems shall be furnished by this contractor under this section of the specifications in accordance with Division 26 of the specifications.
- C. Room thermostats and remote sensors shall be wall mounted type and shall be mounted to match installation height of adjacent switches/sensors by EC, or where there are no adjacent switches/sensors, 46" on center above finished floor. Coordinate mounting location with EC to locate t-stats/sensors and wall switches. Thermostats and sensors shall not be mounted on outside walls.

#### **2.22 SPARE PARTS**

- A. Provide all air handlers, air conditioners, ductless splits with one additional set of disposable filters.

#### **2.23 DEMONSTRATION AND TRAINING**

- A. Training of the Owner's operation and maintenance personnel is required in cooperation with the Owner, General Contractor, and the Commissioning Professional. Provide competent, factory-authorized personnel to provide instruction to operation and maintenance personnel concerning the location, operation, troubleshooting, routine servicing and maintenance of the installed systems. The instruction shall be scheduled in coordination with the Owner and the Commissioning Professional after submission and approval of formal training agendas. Refer to Sections 01 9113 General Commissioning Requirements.

**2.24 FUNCTIONAL PERFORMANCE TESTING**

- A. System functional performance testing is part of the Commissioning Process as detailed in Section 01 9113 General Commissioning Requirements. Functional performance testing shall be performed by the contractor and witnessed and documented by the Commissioning Professional. Installation checklists shall be successfully completed by the contractor and submitted to the Commissioning Professional prior to functional performance testing.

**END OF SECTION 23 7000**

## SECTION 26 05 00 - BASIC ELECTRICAL REQUIREMENTS

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. Requirements applicable to all Division 26 Sections. Also refer to Division 1 - General Requirements. This section is also applicable to Interior Communications Pathways Section 27 05 28. This section is also applicable to Fire Alarm and Detection Systems Section 28 31 00.
- B. All materials and installation methods shall conform to the applicable standards, guidelines and codes referenced herein and within each specification section.

#### 1.2 REFERENCES

- A. NFPA 70 - National Electrical Code (NEC)

#### 1.3 SCOPE OF WORK

- A. This Specification and the associated drawings govern furnishing, installing, testing and placing into satisfactory operation the Electrical Systems.
- B. The Contractor shall furnish and install all new materials as indicated on the drawings, and/or in these specifications, and all items required to make the portion of the Electrical Work a finished and working system.
- C. Separate contracts will be awarded for the following work.
- D. All work will be awarded under a single General Contract. The division of work listed below is for the Contractor's convenience and lists normal breakdown of the work.
- E. Separate contracts will be awarded for the following work. The division of work listed below is for the contractors' convenience and lists a normal breakdown of the work. Please refer to the Construction Manager's scope statements for complete scope of work description.
- F. Description of Systems shall be as follows:
  - 1. Electrical power system to and including luminaires, equipment, motors, devices, etc.
  - 2. Electrical power service system from the Campus Utility Company to and including service entrance equipment, distribution and metering.
  - 3. Grounding system.
  - 4. Fire alarm system.
  - 5. Wiring system for temperature control system as shown on the drawings.
  - 6. Wiring of equipment furnished by others.
  - 7. Removal work and/or relocation and reuse of existing systems and equipment.
  - 8. Telecommunications rough-in, as shown on drawings, for installation of telecommunications equipment by others under separate contract.
  - 9. Technology Systems as described in Division 27/28 and on the T-series documents as described in the Suggested Matrix of Scope Responsibility.
  - 10. Furnish and install firestopping systems for penetrations of fire-rated construction associated with this Contractor's work.
- G. Work Not Included:
  - 1. Telecommunications cabling will be by Division 27, in raceways and conduits furnished and installed as part of the Electrical work.
  - 2. Temperature control wiring for plumbing and HVAC equipment (unless otherwise

indicated) will be by other Contractors.

#### **1.4 OWNER FURNISHED PRODUCTS**

- A. Contractor shall make all electrical system connections shown on the drawings **or** required for fully functional units.
- B. Contractor is responsible for all damage to Owner-furnished equipment caused during installation.

#### **1.5 WORK SEQUENCE**

- A. All work that will produce excessive noise or interference with normal building operations, as determined by the Owner, shall be scheduled with the Owner. It may be necessary to schedule such work during unoccupied hours. The Owner reserves the right to determine when restricted construction hours are required.

#### **1.6 DIVISION OF WORK BETWEEN MECHANICAL, ELECTRICAL, & CONTROL CONTRACTORS**

- A. Division of work is the responsibility of the Prime Contractor. Any scope of work described at any location on the contract document shall be sufficient for including said requirement in the project. The Prime Contractor shall be solely responsible for determining the appropriate subcontractor for the described scope. In no case shall the project be assessed an additional cost for scope that is described on the contract documents on bid day. The following division of responsibility is a guideline based on typical industry practice.
- B. Definitions:
  - 1. "Mechanical Contractors" refers to Contractors listed in Division 21/22/23 of this Specification.
  - 2. "Technology Contractors" refers to the Contractors furnishing and installing systems listed in Division 27/28 of this Specification.
  - 3. Motor Power Wiring: The single phase or 3 phase wiring extending from the power source (transformer, panelboard, feeder circuits, etc.) through disconnect switches and motor controllers to, and including the connections to the terminals of the motor.
  - 4. Motor Control Wiring: The wiring associated with the remote operation of the magnetic coils of magnetic motor starters or relays, or the wiring that permits direct cycling of motors by means of devices in series with the motor power wiring. In the latter case, the devices are usually single phase, have "Manual-Off-Auto" provisions, and are usually connected into the motor power wiring through a manual motor starter.
  - 5. Control devices such as start-stop push buttons, thermostats, pressure switches, flow switches, relays, etc., generally represent the types of equipment associated with motor control wiring.
  - 6. Motor control wiring is single phase and usually 120 volts. In some instances, the voltage will be the same as the motor power wiring. When the motor power wiring exceeds 120 volts, a control transformer is usually used to give a control voltage of 120 volts.
  - 7. Temperature Control Wiring: The wiring associated with the operation of a motorized damper, solenoid valve or motorized valve, etc., either modulating or two-position, as opposed to wiring that directly powers or controls a motor used to drive equipment such as fans, pumps, etc. This wiring will be from a 120-volt source and may continue as 120 volt, or be reduced in voltage (24 volt), in which case a control transformer shall be furnished as part of the temperature control wiring.
  - 8. Control Motor: An electric device used to operate dampers, valves, etc. It may be two-position or modulating. Conventional characteristics of such a motor are 24 volts, 60 cycles, 1 phase, although other voltages may be encountered.
  - 9. Low Voltage Technology Wiring: The wiring associated with the technology systems, used for analog or digital signals between equipment.
  - 10. Telecommunications/Technology Rough-in: Relates specifically to the backboxes, necessary plaster rings and other miscellaneous hardware required for the installation or mounting of telecommunications/technology information outlets.

C. General:

1. The purpose of these Specifications is to outline the Electrical and Mechanical Contractors' responsibilities related to electrical work required for items such as temperature controls, mechanical equipment, fans, chillers, compressors, etc. The exact wiring requirements for much of the equipment cannot be determined until the systems have been selected and submittals approved. Therefore, the electrical drawings show only known wiring related to such items. All wiring not shown on the electrical drawings, but required for mechanical systems, is the responsibility of the Mechanical Contractor.
2. Where the drawings require the Electrical Contractor to wire between equipment furnished by Mechanical Contractor, such wiring shall terminate at terminals provided in the equipment. Mechanical Contractor shall furnish complete wiring diagrams and supervision to Electrical Contractor and designate terminal numbers for correct wiring.
3. Control low (24V) and control line (120V) voltage wiring, conduit, and related switches and relays required for the automatic control and/or interlock of motors and equipment, including final connection, are to be furnished and installed under Divisions 21, 22 and 23. Materials and installation to conform to Class 1 or 2 requirements.
4. The Electrical Contractor shall establish electrical utility elevations prior to fabrication and installation. The Electrical Contractor shall coordinate utility elevations with other trades. When a conflict arises, priority shall be as follows:
  - a. Luminaires.
  - b. Gravity flow piping, including steam and condensate.
  - c. Electrical bus duct.
  - d. Sheet metal.
  - e. Cable trays, including access space.
  - f. Other piping.
  - g. Conduits and wireway.

D. Mechanical Contractor Responsibility:

1. Assumes responsibility for internal wiring of all equipment furnished by Mechanical Contractor.
2. Assumes all responsibility for miscellaneous items furnished by the Mechanical Contractor that require wiring but are not shown on the electrical drawings or specified in the Electrical Specification. If items such as relays, flow switches, or interlocks are required to make the mechanical system function correctly or are required by the manufacturer, they are the responsibility of the Mechanical Contractor.
3. Assumes all responsibility for Temperature Control wiring, if the Temperature Control Contractor is a Subcontractor to the Mechanical Contractor.
4. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.

E. Temperature Control Contractor or Subcontractor Responsibility:

1. Wiring of all devices needed to make the Temperature Control System functional.
2. Verifying any control wiring on the electrical drawings as being by the Electrical Contractor. All wiring required for the Control System, but not shown on the electrical drawings, is the responsibility of the Temperature Control Contractor or Subcontractor.
3. Coordinating equipment locations (such as PEs, EPs, relays, transformers, etc.) with the Electrical Contractor, where wiring of the equipment is by the Electrical Contractor.

F. Electrical Contractor's Responsibility:

1. Furnishes and installs all combination starters, manual starters and disconnect devices shown on the Electrical Drawings or indicated to be by the Electrical Contractor in the Mechanical Drawings or Specifications.
2. Installs and wires all remote-control devices furnished by the Mechanical Contractor or

- Temperature Control Contractor when so noted on the Electrical Drawings.
3. Furnishes and installs motor control and temperature control wiring, when noted on drawings.
  4. Furnishes, installs, and connects all relays, etc., for automatic shutdown of certain mechanical equipment (supply fans, exhaust fans, etc.) upon actuation of Fire Alarm System.
  5. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, Contractor shall coordinate with other Contractors to determine a viable layout.

G. General (Electrical/Technology):

1. "Electrical Contractor" as referred to herein shall be responsible for scope listed in Division 27/28 of this specification when the "Suggested Matrix of Scope Responsibility" indicated work shall be furnished and installed by the EC. Refer to the Contract Documents for this "Suggested Matrix of Scope Responsibility".
2. The purpose of these Specifications is to outline the Electrical and Technology Contractor's work responsibilities as related to Telecommunications Rough-in, conduit, cable tray, power wiring and Low Voltage Technology Wiring.
3. The exact wiring requirements for much of the equipment cannot be determined until the systems have been purchased and submittals approved. Therefore, only known wiring, conduits, raceways and electrical power related to such items is shown on the Technology drawings. Other wiring, conduits, raceways, junction boxes and electrical power not shown on the Technology Drawings but required for operation of the systems is the responsibility of the Technology Contractor and included in said Contractor's bid.
4. Where the Electrical Contractor is required to install conduit, conduit sleeves and/or power connections in support of Technology systems, the final installation shall not be until a coordination meeting between the Electrical Contractor and Technology Contractor has convened to determine the exact location and requirements of the installation.
5. Where the Electrical Contractor is required to install cable tray that will contain Low Voltage Technology Wiring, installation shall not begin prior to a coordination review of the cable tray shop drawings by the Technology Contractor.

H. Technology Contractor's Responsibility:

1. Assumes all responsibility for the low voltage technology wiring of all systems, including cable support where open cable is specified.
2. Assumes all responsibility for all required backboxes, conduit and power connections not specifically shown as being furnished and installed by the Electrical Contractor on the "Suggested Matrix of Scope Responsibility".
3. Assumes all responsibility for providing and installing all ladder rack and other cable management hardware (as defined herein).
4. Responsible for providing the Electrical Contractor with the required grounding lugs or other hardware for each piece of technology equipment which is required to be bonded to the telecommunications ground bar.
5. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.

## 1.7 COORDINATION DRAWINGS

A. If alternate 17 is accepted, BIM modeling drawings would serve to satisfy requirements for 1.7.

B. Definitions:

1. Coordination Drawings: A compilation of the pertinent layout and system drawings that show the sizes and locations, including elevations, of system components and required access areas to ensure that no two objects will occupy the same space.
  - a. Mechanical trades shall include, but are not limited to, mechanical equipment,



ductwork, fire protection systems, plumbing piping, medical gas systems, hydronic piping, steam and steam condensate piping, and any item that may impact coordination with other disciplines.

- b. Electrical trades shall include, but are not limited to, electrical equipment, conduit 1.5" and larger, conduit racks, cable trays, pull boxes, transformers, raceway, busway, lighting, ceiling-mounted devices, and any item that may impact coordination with other disciplines.
  - c. Technology trades shall include, but are not limited to, technology equipment, racks, conduit 1.5" and larger, conduit racks, cable trays, ladder rack, pull boxes, raceway, ceiling-mounted devices, and any item that may impact coordination with other disciplines.
  - d. Maintenance clearances and code-required dedicated space shall be included.
  - e. The coordination drawings shall include all underground, underfloor, in-floor, in chase, and vertical trade items.
2. Spaces with open/cloud ceiling architecture shall indicate the overhead utilities and locate equipment as required to maintain clearance above lights. The intent for the installation is to maintain a maximum allowable vertical clearance and an organized/clean manner in the horizontal. Notify Architect/Engineer of the maximum clearance which can be maintained. Failure to comply will result in modifications with no cost to Owner.
    - a. In cloud ceiling architecture, when open cabling/wire and/or cable tray crosses gaps between ceiling clouds and/or walls, cabling is to transition to conduits to span the gaps in order to conceal cabling from below.
  3. Contractors shall use the coordination process to identify the proper sequence of installation of all utilities above ceilings and in other congested areas, to ensure an orderly and coordinated end result, and to provide adequate access for service and maintenance.

C. Participation:

1. Contractors and subcontractors responsible for work defined above shall participate in the coordination drawing process.
2. One contractor shall be designated as the Coordinating Contractor for purposes of preparing a complete set of composite electronic CAD coordination drawings that include all applicable trades, and for coordinating the activities related to this process. The Coordinating Contractor for this project shall be the Mechanical Contractor.
  - a. Coordinating Contractor shall utilize personnel familiar with requirements of this project and skilled as draftspersons/CAD operators, competent to prepare the required coordination drawings.
3. Electronic CAD drawings shall be submitted to the Coordinating Contractor for addition of work by other trades. IMEG will provide electronic file copies of ventilation drawings for contractor's use if the contractor signs and returns an "Electronic File Transfer" waiver provided by IMEG. IMEG will not consider blatant reproductions of original file copies an acceptable alternative for coordination drawings.

D. Drawing Requirements:

1. The file format and file naming convention shall be coordinated with and agreed to by all contractors participating in the coordination process and the Owner.
  - a. Scale of drawings:
    - 1) General plans: 1/4 Inch = 1'-0" (minimum).
    - 2) Mechanical, electrical, communication rooms, and including the surrounding areas within 10 feet: 1/2 Inch = 1'-0" (minimum).

- 3) Shafts and risers: 1/2 Inch = 1'-0" (minimum).
  - 4) Sections of shafts and mechanical and electrical equipment rooms: 1/4 Inch = 1'-0" (minimum).
  - 5) Sections of congested areas: 1/2 Inch = 1'-0" (minimum).
2. Ductwork layout drawings shall be the baseline system for other components. Ductwork layout drawings shall be modified to accommodate other components as the coordination process progresses.
  3. There may be more drawings required for risers, top and bottom levels of mechanical rooms, and shafts.
  4. The minimum quantity of drawings will be established at the first coordination meeting and sent to the A/E for review. Additional drawings may be required if other areas of congestion are discovered during the coordination process.

E. General:

1. Coordination drawing files shall be made available to the A/E and Owner's Representative. The A/E will only review identified conflicts and give an opinion, but will not perform as a coordinator.
2. A plotted set of coordination drawings shall be available at the project site.
3. Coordination drawings are not shop drawings and shall not be submitted as such.
4. The contract drawings are schematic in nature and do not show every fitting and appurtenance for each utility. Each contractor is expected to have included in the bid sufficient fittings, material, and labor to allow for adjustments in routing of utilities made necessary by the coordination process and to provide a complete and functional system.
5. The contractors will not be allowed additional costs or time extensions due to participation in the coordination process.
6. The contractors will not be allowed additional costs or time extensions for additional fittings, reroutings or changes of duct size, that are essentially equivalent sizes to those shown on the drawings and determined necessary through the coordination process.
7. The A/E reserves the right to determine space priority of equipment in the event of spatial conflicts or interference between equipment, piping, conduit, ducts, and equipment provided by the trades.
8. Changes to the contract documents that are necessary for systems installation and coordination shall be brought to the attention of the A/E.
9. Access panels shall preferably occur only in gypsum board walls or plaster ceilings where indicated on the drawings.
  - a. Access to mechanical, electrical, technology, and other items located above the ceiling shall be through accessible lay-in ceiling tile areas.
  - b. Potential layout changes shall be made to avoid additional access panels.
  - c. Additional access panels shall not be allowed without written approval from the A/E at the coordination drawing stage.
  - d. Providing additional access panels shall be considered after other alternatives are reviewed and discarded by the A/E and the Owner's Representative.
  - e. When additional access panels are required, they shall be provided without additional cost to the Owner.
10. Complete the coordination drawing process and obtain sign-off of the drawings by all contractors prior to installing any of the components.
11. Conflicts that result after the coordination drawings are signed off shall be the responsibility of the contractor or subcontractor who did not properly identify their work requirements, or installed their work without proper coordination.
12. Updated coordination drawings that reflect as-built conditions may be used as record documents.

## 1.8 QUALITY ASSURANCE

- A. Contractor's Responsibility Prior to Submitting Pricing/Bid Data:
1. Contractor is responsible for constructing complete and operating systems. The Contractor acknowledges and understands that the Contract Documents are a two-dimensional representation of a three-dimensional object, subject to human interpretation. This representation may include imperfect data, interpreted codes, utility guides, three-dimensional conflicts, and required field coordination items. Such deficiencies can be corrected when identified prior to ordering material and starting installation. The Contractor agrees to carefully study and compare the individual Contract Documents and report at once in writing to the Architect/Engineer any deficiencies the Contractor may discover. The Contractor further agrees to require each subcontractor to likewise study the documents and report at once any deficiencies discovered.
  2. Contractor shall resolve all reported deficiencies with the Architect/Engineer prior to awarding any subcontracts, ordering material, or starting any work with the Contractor's own employees. Any work performed prior to receipt of instructions from the Architect/Engineer will be done at the Contractor's risk.
- B. Qualifications:
1. Only products of reputable manufacturers as determined by the Architect/Engineer are acceptable.
  2. All Contractors and subcontractors shall employ only workmen who are skilled in their trades. At all times, the number of apprentices at the job site shall be less than or equal to the number of journeymen at the job site.
- C. Compliance with Codes, Laws, Ordinances:
1. Conform to all requirements of the City/State of Aberdeen, SD Codes, Laws, Ordinances and other regulations having jurisdiction.
  2. Conform to all published standards of Northern State University.
  3. If there is a discrepancy between the codes and regulations and these specifications, the Architect/Engineer shall determine the method or equipment used.
  4. If the Contractor notes, at the time of bidding, that any parts of the drawings or specifications do not comply with the codes or regulations, Contractor shall inform the Architect/Engineer in writing, requesting a clarification. If there is insufficient time for this procedure, Contractor shall submit with the proposal a separate price to make the system comply with the codes and regulations.
  5. All changes to the system made after the letting of the contract to comply with codes or requirements of the Inspector, shall be made by the Contractor without cost to Owner.
  6. If there is a discrepancy between manufacturer recommendations and these specifications, manufacturer recommendations shall govern.
  7. If there are no local codes having jurisdiction, the current issue of the National Electrical Code shall be followed.
- D. Permits, Fees, Taxes, Inspections:
1. Procure all applicable permits and licenses.
  2. Abide by all laws, regulations, ordinances, and other rules of State or Political Subdivision where the work is done, or as required by any duly constituted public authority.
  3. Pay all charges for permits or licenses.
  4. Pay all fees and taxes imposed by State, Municipal, and other regulatory bodies.
  5. Pay all charges arising out of required inspections by an authorized body.
  6. Pay all charges arising out of required contract document reviews associated with the project and as initiated by the Owner or authorized agency/consultant.
  7. Where applicable, all fixtures, equipment and materials shall be listed by Underwriter's Laboratories, Inc. or a nationally recognized testing organization.

8. Pay all telephone company charges related to the service or change in service.

E. Examination of Drawings:

1. The drawings for the electrical work are completely diagrammatic, intended to convey the scope of the work and to indicate the general arrangements and locations of equipment, outlets, etc., and the approximate sizes of equipment.
2. Contractor shall determine the exact locations of equipment and rough-ins, and the exact routing of raceways to best fit the layout of the job. Conduit entry points for electrical equipment including, but not limited to, panelboards, switchboards, switchgear and unit substations, shall be determined by Contractor unless noted in the contract documents.
3. Scaling of the drawings will not be sufficient or accurate for determining these locations.
4. Where job conditions require reasonable changes in arrangements and locations, such changes shall be made by the Contractor at no additional cost to the Owner.
5. Because of the scale of the drawings, certain basic items, such as junction boxes, pull boxes, conduit fittings, etc., may not be shown, but where required by other sections of the specifications or required for proper installation of the work, such items shall be furnished and installed.
6. If an item is either shown on the drawings or called for in the specifications, it shall be included in this contract.
7. The Contractor shall determine quantities and quality of material and equipment required from the documents. Where discrepancies arise between drawings, schedules and/or specifications, the greater and better-quality number shall govern.
8. Where used in electrical documents the word "furnish" shall mean supply for use, the word "install" shall mean connect up complete and ready for operation, and the word "provide" shall mean to supply for use and connect up complete and ready for operation.
9. Any item listed as furnished shall also be installed unless otherwise noted.
10. Any item listed as installed shall also be furnished unless otherwise noted.

F. Electronic Media/Files:

1. Construction drawings for this project have been prepared utilizing Revit.
2. Contractors and Subcontractors may request electronic media files of contract drawings and/or copies of the specifications. Specifications will be provided in PDF format.
3. Upon request for electronic media, the Contractor shall complete and return a signed "Electronic File Transmittal" form provided by IMEG.
4. If the information requested includes floor plans prepared by others, Contractor will be responsible for obtaining approval from the appropriate Design Professional for use of that part of the document.
5. Electronic contract documents can be used for preparation of shop drawings and as-built drawings only. The information may not be used in whole or in part for any other project.
6. The drawings prepared by IMEG for bidding purposes may not be used directly for ductwork layout drawings or coordination drawings.
7. Use of these CAD documents by Contractor does not relieve them from their responsibility for coordination of work with other trades and verification of space available for installation.
8. The information is provided to expedite the project and assist the Contractor with no guarantee by IMEG as to the accuracy or correctness of the information provided. IMEG accepts no responsibility or liability for the Contractor's use of these documents.

G. Field Measurements:

1. Verify all pertinent dimensions at the job site before ordering any conduit, conductors, wireways, bus duct, fittings, etc.

**1.9 SUBMITTALS**

- A. Submittals shall be required for the following items, and for additional items where required elsewhere in the specifications or on the drawings.

1. Submittals list:

<b>Referenced Section</b>	<b>Submittal Item</b>	<b>Coordination Drawing</b>
26 05 03	Through Penetration Firestopping	
26 05 17	Electric Heat Trace	
26 05 53	Electrical Identification	
26 05 73	Power System Study	
26 09 33	Lighting Control System	
26 20 00	Service Entrance	
26 24 13	Switchboards	Yes
26 24 16	Panelboards	Yes
26 27 26	Wiring Devices	Ceiling mount
26 28 16	Disconnect Switches	Yes
26 43 00	Surge Protection Devices	
26 51 00	Lighting	Yes
26 51 19	LED Lighting	Yes
26 52 15	Emergency Lighting Inverter	Yes
28 31 00	Fire Alarm and Detection Systems	Yes

B. General Submittal Procedures: In addition to provisions of Division 1, the following are required:

1. Transmittal: Each transmittal shall include the following:

- a. Date
- b. Project title and number
- c. Contractor's name and address
- d. Division of work (e.g., electrical, plumbing, heating, ventilating, etc.)
- e. Description of items submitted and relevant specification number
- f. Notations of deviations from the contract documents
- g. Other pertinent data

2. Submittal Cover Sheet: Each submittal shall include a cover sheet containing:

- a. Date
- b. Project title and number
- c. Architect/Engineer
- d. Contractor and subcontractors' names and addresses
- e. Supplier and manufacturer's names and addresses
- f. Division of work (e.g., electrical, plumbing, heating, ventilating, etc.)
- g. Description of item submitted (using project nomenclature) and relevant specification number
- h. Notations of deviations from the contract documents
- i. Other pertinent data
- j. Provide space for Contractor's review stamps

3. Composition:

- a. Submittals shall be submitted using specification sections and the project nomenclature for each item.
- b. Individual submittal packages shall be prepared for items in each specification section. All items within a single specification section shall be packaged together where possible. An individual submittal may contain items from multiple specifications sections if the items are intimately linked (e.g., pumps and motors).
- c. All sets shall contain an index of the items enclosed with a general topic description on the cover.

4. Content: Submittals shall include all fabrication, erection, layout, and setting drawings; manufacturers' standard drawings; schedules; descriptive literature, catalogs and brochures; performance and test data; wiring and control diagrams; dimensions; shipping

and operating weights; shipping splits; service clearances; and all other drawings and descriptive data of materials of construction as may be required to show that the materials, equipment or systems and the location thereof conform to the requirements of the contract documents.

5. Contractor Approval Stamp:
  - a. Contractor shall thoroughly review and approve all shop drawings before submitting them to Architect/Engineer. Contractor shall stamp, date and sign each submittal certifying it has been reviewed.
  - b. Unstamped submittals will be rejected.
  - c. Contractor review shall include, but not be limited to, verification of the following:
    - 1) Only approved manufacturers are used.
    - 2) Addenda items have been incorporated.
    - 3) Catalog numbers and options match those specified.
    - 4) Performance data matches that specified.
    - 5) Electrical characteristics and loads match those specified.
    - 6) Equipment connection locations, sizes, capacities, etc. have been coordinated with other affected trades.
    - 7) Dimensions and service clearances are suitable for the intended location.
    - 8) Equipment dimensions are coordinated with support steel, housekeeping pads, openings, etc.
    - 9) Constructability issues are resolved (e.g., weights and dimensions are suitable for getting the item into the building and into place, sinks fit into countertops, etc.).
  - d. Contractor shall review, stamp and approve all subcontractors' submittals as described above.
  - e. Contractor approval stamp is required on all submittals. Approval will indicate the Contractor's review of all material and a complete understanding of exactly what is to be furnished. Contractor shall clearly mark all deviations from the contract documents on all submittals. If deviations are not marked by the Contractor, then the item shall be required to meet all drawing and specification requirements.
6. Submittal Identification and Markings:
  - a. The Contractor shall clearly mark each item with the same nomenclature applied on the drawings or in the specifications.
  - b. The Contractor shall clearly indicate the size, finish, material, etc.
  - c. Where more than one model is shown on a manufacturer's sheet, the Contractor shall clearly indicate exactly which item and which data is intended.
  - d. All marks and identifications on the submittals shall be unambiguous.
7. Schedule submittals to expedite the project. Coordinate submission of related items.
8. Identify variations from the contract documents and product or system limitations that may be detrimental to the successful performance of the completed work.
9. Reproduction of contract documents alone is not acceptable for submittals.
10. Incomplete submittals will be rejected without review. Partial submittals will only be reviewed with prior approval from the Architect/Engineer.
11. Submittals not required by the contract documents may be returned without review.
12. The Architect/Engineer's responsibility shall be to review one set of shop drawing submittals for each product. If the first submittal is incomplete or does not comply with the drawings and/or specifications, the Contractor shall be responsible to bear the cost for the Architect/Engineer to recheck and handle the additional shop drawing submittals.
13. Submittals shall be reviewed and approved by the Architect/Engineer before releasing any equipment for manufacture or shipment.
14. Contractor's responsibility for errors, omissions or deviation from the contract documents in submittals is not relieved by the Architect/Engineer's approval.

15. Schedule shall allow for adequate time to perform orderly and proper review of submittals, including time for consultants and Owner if required, and resubmittals by Contractor if necessary, and to cause no delay in Work or in activities of Owner or other contractors.
  - a. Allow at least two weeks for Architect/Engineer review and processing of each submittal, excluding mailing.
16. Architect/Engineer reserves the right to withhold action on a submittal which, in the Architect/Engineer opinion, requires coordination with other submittals until related submittals are received. The Architect/Engineer will notify the Contractor, in writing, when they exercise this right.

C. Electronic Submittal Procedures:

1. Distribution: Email submittals as attachments to all parties designated by the Architect/Engineer, unless a web-based submittal program is used.
2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.
3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.
4. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.
  - a. Submittal file name: 26 XX XX.description.YYYYMMDD
  - b. Transmittal file name: 26 XX XX.description.YYYYMMDD
5. File Size: Files shall be transmitted via a pre-approved method. Larger files may require an alternative transfer method, which shall also be pre-approved.

**1.10 CHANGE ORDERS**

- A. A detailed material and labor takeoff shall be prepared for each change order, along with labor rates and markup percentages. Change orders shall be broken down by sheet or associated individual line item indicated in the change associated narrative, whichever provides the most detailed breakdown. Change orders with inadequate breakdown will be rejected.
- B. Itemized pricing with unit cost shall be provided from all distributors and associated subcontractors.
- C. Change order work shall not proceed until authorized.

**1.11 PRODUCT DELIVERY, STORAGE, HANDLING and MAINTENANCE**

- A. Exercise care in transporting and handling to avoid damage to materials. Store materials on the site to prevent damage.
- B. Keep all materials clean, dry and free from damaging environments.
- C. Coordinate the installation of heavy and large equipment with General Contractor and/or Owner. If Electrical Contractor does not have prior documented experience in rigging and lifting similar equipment, he/she shall contract with a qualified lifting and rigging service that has similar documented experience. Follow all equipment lifting and support guidelines for handling and moving.
- D. Contractor is responsible for moving equipment into the building and/or site. Contractor shall

review site prior to bid for path locations and any required building modifications to allow movement of equipment. Contractor shall coordinate the work with other trades.

#### **1.12 NETWORK / INTERNET CONNECTED EQUIPMENT**

- A. These specifications may require certain equipment or systems to have network, Internet and/or remote access capability ("Network Capability"). Any requirement for Network Capability shall be interpreted only as a functional capability and is not to be construed as authority to connect or enable any Network Capability. Network Capability may only be connected or enabled with the express written consent of the Owner.
- B. The following network connected equipment shall be equipped with restricted access protocols:
  - 1. Adjustable trip overcurrent protection devices
  - 2. Power monitoring and control
  - 3. Electrical controls
  - 4. Lighting control system
  - 5. Variable frequency drives
  - 6. Fire alarm and automatic detection

#### **1.13 WARRANTY**

- A. Provide one-year warranty for all fixtures, equipment, materials, and workmanship.
- B. The warranty period for all work in this specification Division shall commence on the date of Substantial Completion or successful system performance whichever occurs later. The warranty may also commence if a whole or partial system or any separate piece of equipment or component is put into use for the benefit of any party other than the installing contractor with prior written authorization of the Owner. In this instance, the warranty period shall commence on the date when such whole system, partial system or separate piece of equipment or component is placed in operation and accepted in writing by the Owner.
- C. Warranty requirements extend to correction, without cost to the Owner, of all work found to be defective or nonconforming to the contract documents. The Contractor shall bear the cost of correcting all damage due to defects or nonconformance with contract documents excluding repairs required as a result of improper maintenance or operation, or of normal wear as determined by the Architect/Engineer.

#### **1.14 INSURANCE**

- A. Contractor shall maintain insurance coverage as set forth in Division 1 of these specifications.

#### **1.15 GREEN GLOBES REQUIREMENTS**

- A. This project is pursuing a GREEN GLOBES rating. A certification in accordance with USGBC LEED Rating System for [New Construction v4]<Insert>. The Contractor shall provide all services and documentation necessary to achieve this rating.

#### **1.16 PROJECT COMMISSIONING**

- A. The Contractor shall work with the Commissioning Agent (CxA) as described in Section 01 91 00 and provide all services necessary for compliance with LEED Prerequisite EAp1, Fundamental Commissioning, and EAc3 Enhanced Commissioning.
- B. The Contractor shall work with the Commissioning Agent (CxA) as described in Section 01 91 00 and provide all services as described in the Commissioning Plan.



## **PART 2 - PRODUCTS**

### **2.1 GENERAL**

- A. All items of material having a similar function (e.g., safety switches, panelboards, switchboards, contactors, motor starters, dry type transformers) shall be of the same manufacturer unless specifically stated otherwise on drawings or elsewhere in specifications.

## **PART 3 - EXECUTION**

### **3.1 JOBSITE SAFETY**

- A. Neither the professional activities of Architect/Engineer, nor presence of Architect/Engineer or the employees and subconsultants at a construction site, shall relieve the Contractor and any other entity of their obligations, duties and responsibilities including, but not limited to, construction means, methods, sequence, techniques or procedures necessary for performing, superintending or coordinating all portions of the work of construction in accordance with the contract documents and any health or safety precautions required by any regulatory agencies. Architect/Engineer and personnel have no authority to exercise any control over any construction contractor or other entity or their employees in connection with their work or any health or safety precautions. The Contractor is solely responsible for jobsite safety. Architect/Engineer and Architect/Engineer consultants shall be indemnified and shall be made additional insureds under Contractor general liability insurance policy.

### **3.2 EXCAVATION, FILL, BACKFILL, COMPACTION**

- A. General:
  - 1. Prior to the commencement of any excavation or digging, the Contractor shall verify all underground utilities with the regional utility locator. Provide prior notice to the locator before excavations. Contact information for most regional utility locaters can be found by calling 811.
  - 2. The Contractor shall do all excavating, filling, backfilling, compacting, and restoration in connection with the work.
- B. Excavation:
  - 1. Make all excavations to accurate, solid, undisturbed earth, and to proper dimensions.
  - 2. If excavations are carried in error below indicated levels, concrete of same strength as specified for the foundations or thoroughly compacted sand-gravel fill, as determined by the Architect/Engineer shall be placed in such excess excavations under the foundation. Place thoroughly compacted, clean, stable fill in excess excavations under slabs on grade, at the Contractor's expense.
  - 3. Trim bottom and sides of excavations to grades required for foundations.
  - 4. Protect excavations against frost and freezing.
  - 5. Take care in excavating not to damage surrounding structures, equipment or buried pipe. Do not undermine footing or foundation.
  - 6. Perform all trenching in a manner to prevent cave-ins and risk to workmen.
  - 7. Where original surface is pavement or concrete, the surface shall be saw cut to provide clean edges and assist in the surface restoration.
  - 8. If satisfactory bearing soil is not found at the indicated levels, immediately notify the Architect/Engineer or their representative, and do no further work until the Architect/Engineer or their representative gives further instructions.
  - 9. Excavation shall be performed in all ground conditions, including rock, if encountered. Bidders shall visit the premises and determine the soil conditions by actual observations, borings, or other means. The cost of all such inspections, borings, etc., shall be borne by the bidder.

10. If a trench is excavated in rock, a compacted bed with a depth of 3" (minimum) of sand and gravel shall be used to support the conduit unless masonry cradles or encasements are used.
  11. Mechanical excavation of the trench to line and grade of the conduit or to the bottom level of masonry cradles or encasements is permitted, unless otherwise indicated on the electrical drawings.
  12. Mechanical excavation of the trench to line and grade where direct burial cables are to be installed is permitted provided the excavation is made to a depth to permit installation of the cable on a fine sand bed at least 3 inches deep.
- C. Dewatering:
1. Furnish, install, operate and remove all dewatering pumps and pipes needed to keep trenches and pits free of water.
- D. Underground Obstructions:
1. Known underground piping, conduit, feeders, foundations, and other obstructions in the vicinity of construction are shown on the drawings. Review all Bid Documents for all trades on the project to determine obstructions indicated. Take great care in making installations near underground obstructions.
  2. If objects not shown on the drawings are encountered, remove, relocate, or perform extra work as directed by the Architect/Engineer.
- E. Fill and Backfilling:
1. No rubbish or waste material is permitted for fill or backfill.
  2. Provide all necessary sand and/or CA6 for backfilling.
  3. Native soil materials may be used as backfill if approved by the Geotechnical Engineer.
  4. Dispose of the excess excavated earth as directed.
  5. Backfill materials (native soil material, sand, and/or CA6) shall be suitable for required compaction, clean and free of perishable materials, frozen earth, debris, earth with a high void content, and stones greater than 4 inches in diameter. Water is not permitted to rise in unbackfilled trenches.
  6. Backfill all trenches and excavations immediately after installing of conduit, or removing forms, unless other protection is directed.
  7. Around piers and isolated foundations and structures, backfill and fill shall be placed and consolidated simultaneously on all sides to prevent wedge action and displacement. Spread fill and backfill materials in 6" uniform horizontal layers with each layer compacted separately to required density.
  8. For conduits that are not concrete encased, lay all conduits on a compacted bed of sand at least 3" deep. Backfill around conduits with sand, in 6" layers and compact each layer.
  9. Conduits that are concrete encased or in a ductbank, conduit spacers, and cradles shall be installed on a bed of compacted CA-6 gravel. Refer to conduit section for backfilling and ductbank requirements.
  10. Backfill with native soil material (if approved) or sand up to grade for all conduits under slabs or paved areas. All other conduits shall have sand backfill to 6" above the top of the conduit.
  11. Place all backfill above the sand in uniform layers not exceeding 6" deep. Place then carefully and uniformly tamp each layer to eliminate lateral or vertical displacement.
  12. Where the fill and backfill will ultimately be under a building, floor or paving, each layer of fill shall be compacted to 95% of the maximum density as determined by AASHTO Designation T-99 or ASTM Designation D-698. Moisture content of soil at time of compaction shall not exceed plus or minus 2% of optimum moisture content as determined by AASHTO T-99 or ASTM D-698 test.
  13. After backfilling of trenches, no superficial loads shall be placed on the exposed surface of the backfill until a period of 48 hours has elapsed.

F. Surface Restoration:

1. Where trenches are cut through graded, planted or landscaped areas, the areas shall be restored to the original condition. Replace all planting and landscaping features removed or damaged to its original condition. At least 6" of topsoil shall be applied where disturbed areas are to be seeded or sodded. All lawn areas shall be sodded unless seeding is called out in the drawings or specifications.
2. Concrete or asphalt type pavement, seal coat, rock, gravel or earth surfaces removed or damaged shall be replaced with comparable materials and restored to original condition. Broken edges shall be saw cut and repaired as directed by Architect/Engineer.

### 3.3 ARCHITECT/ENGINEER OBSERVATION OF WORK

A. The contractor shall provide seven (7) calendar days' notice to the Architect/Engineer prior to:

1. Placing fill over underground and underslab utilities.
2. Covering exterior walls, interior partitions and chases.
3. Installing hard or suspended ceilings and soffits.

B. The Architect/Engineer will review the installation and provide a written report noting deficiencies requiring correction. The contractor's schedule shall account for these reviews and show them as line items in the approved schedule.

C. Above-Ceiling Final Observation:

1. All work above the ceilings must be complete prior to the Architect/Engineer's review. This includes, but is not limited to:
  - a. All junction boxes are closed and identified in accordance with Section 26 05 53 Electrical Identification.
  - b. Luminaires, including ceiling-mounted exit and emergency lights, are installed and operational.
  - c. Luminaire whips are supported above the ceiling.
  - d. Conduit identification is installed in accordance with Section 26 05 53 Electrical Identification.
  - e. Luminaires are suspended independently of the ceiling system when required by these contract documents.
  - f. All wall penetrations have been sealed.
2. To prevent the Above-Ceiling Final Observation from occurring too early, the Contractor shall review the status of the work and certify, in writing, that the work is ready for the Above-Ceiling Final Observation.
3. It is understood that if the Architect/Engineer finds the ceilings have been installed prior to this review and prior to seven days elapsing, the Architect/Engineer may not recommend further payments to the contractor until full access has been provided.

### 3.4 PROJECT CLOSEOUT

A. The following paragraphs supplement the requirements of Division 1.

B. IDPH Pre-Occupancy Requirements:

1. Each Contractor must submit all forms and certifications required by IDPH relating to their work at 85% completion of the project or when directed by the Owner/Architect/Engineer.

C. Final Jobsite Observation:

1. To prevent the Final Jobsite Observation from occurring too early, the Contractor shall

review the completion status of the project and certify that the job is ready for the final jobsite observation.

2. Attached to the end of this section is a typical list of items that represent the degree of job completeness expected prior to requesting a review. The Contractor shall sign the attached certification and return it to the Architect/Engineer so that the final observation can be scheduled.
3. It is understood that if the Architect/Engineer finds the job not ready for the final observation and additional trips and observations are required to bring the project to completion, the cost of the additional time and expenses incurred by the Architect/Engineer will be deducted from the Contractor's final payment.
4. Contractor shall notify Architect/Engineer 48 hours prior to installation of ceilings or lay-in ceiling tiles.

D. The following must be submitted before Architect/Engineer recommends final payment:

1. Operation and maintenance manuals with copies of approved shop drawings.
2. Record documents including reproducible drawings and specifications.
3. A report documenting the instructions given to the Owner's representatives complete with the number of hours spent in the instruction. The report shall bear the signature of an authorized agent of this Contractor and shall be signed by the Owner's representatives.
4. Provide spare parts, maintenance, and extra materials in quantities specified in individual specification sections. Deliver to and place in location as directed and submit receipt to Architect/Engineer.
5. Inspection and testing report by the fire alarm system manufacturer.
6. Start-up reports on all equipment requiring a factory installation or start-up.

E. Circuit Directories:

1. Provide custom typed circuit directory for each branch circuit panelboard. Provide updated custom typed circuit directory for each existing branch circuit panelboard with new or revised circuits per the scope of work. Label shall include equipment name or final approved room name, room number, and load type for each circuit (examples: SUMP SP-1 or ROOM 101 RECEIPT). Revise directory to reflect circuit changes required to balance phase loads. Printed copies of the bid document panel schedules are not acceptable as circuit directories.

### **3.5 OPERATION AND MAINTENANCE MANUALS**

A. General:

1. Provide an electronic copy of the O&M manuals as described below for Architect/Engineer's review and approval. The electronic copy shall be corrected as required to address the Architect/Engineer's comments. Once corrected, electronic copies and paper copies shall be distributed as directed by the Architect/Engineer.
2. Approved O&M manuals shall be completed and in the Owner's possession prior to Owner's acceptance and at least 10 days prior to instruction of operating personnel.

B. Electronic Submittal Procedures:

1. Distribution: Email the O&M manual as attachments to all parties designated by the Architect/Engineer.
2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.
3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.
4. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where

possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.

- a. O&M file name: O&M.div26.contractor.YYYYMMDD
- b. Transmittal file name: O&Mtransmittal.div26.contractor.YYYYMMDD

- 5. File Size: Files shall be transmitted via a pre-approved method. Larger files may require an alternative transfer method, which shall also be pre-approved.
- 6. Provide the Owner with an approved copy of the O&M manual on compact discs (CD), digital video discs (DVD), or flash drives with a permanently affixed label, printed with the title "Operation and Maintenance Instructions", title of the project and subject matter of disc/flash drive when multiple disc/flash drives are required.
- 7. All text shall be searchable.
- 8. Bookmarks shall be used, dividing information first by specification section, then systems, major equipment and finally individual items. All bookmark titles shall include the nomenclature used in the construction documents and shall be an active link to the first page of the section being referenced.

C. Operation and Maintenance Instructions shall include:

- 1. Title Page: Include title page with project title, Architect, Engineer, Contractor, all subcontractors, and major equipment suppliers, with addresses, telephone numbers, website addresses, email addresses and point of contacts. Website URLs and email addresses shall be active links in the electronic submittal.
- 2. Table of Contents: Include a table of contents describing specification section, systems, major equipment, and individual items.
- 3. Copies of all final approved shop drawings and submittals. Include Architect's/Engineer's shop drawing review comments. Insert the individual shop drawing directly after the Operation and Maintenance information for the item(s) in the review form.
- 4. Copies of all factory inspections and/or equipment startup reports.
- 5. Copies of warranties.
- 6. Schematic wiring diagrams of the equipment that have been updated for field conditions. Field wiring shall have label numbers to match drawings.
- 7. Dimensional drawings of equipment.
- 8. Detailed parts lists with lists of suppliers.
- 9. Operating procedures for each system.
- 10. Maintenance schedule and procedures. Include a chart listing maintenance requirements and frequency.
- 11. Repair procedures for major components.
- 12. Replacement parts and service material requirements for each system and the frequency of service required.
- 13. Instruction books, cards, and manuals furnished with the equipment.
- 14. Include record drawings of the one-line diagrams for each major system. The graphic for each piece of equipment shown on the one-line diagram shall be an active link to its associated Operation & Maintenance data.
- 15. Copies of all panel schedules in electronic Microsoft Excel spreadsheet (.xlsx) file. Each panelboard shall be a separate tab in the workbook.

### 3.6 INSTRUCTING THE OWNER'S REPRESENTATIVE

- A. Adequately instruct the Owner's designated representatives in the maintenance, care, and operation of the complete systems installed under this contract.
- B. Provide verbal and written instructions to the Owner's representatives by FACTORY PERSONNEL in the care, maintenance, and operation of the equipment and systems.
- C. Contractor shall make a DVD video recording of instructions to the Owner while explaining the system so additional personnel may view the instructions at a later date. The video recording

shall be the property of the Owner.

- D. The Owner has the option to make a video recording of all instructions. Coordinate schedule of instructions to facilitate this recording.
- E. The instructions shall include:
  - 1. Maintenance of equipment.
  - 2. Start-up procedures for all major equipment.
  - 3. Description of emergency system operation.
- F. Notify the Architect/Engineer of the time and place for the verbal instructions to be given to the Owner's representative so a representative can be present if desired.
- G. Minimum hours of instruction time for each item and/or system shall be as indicated in each individual specification section.
- H. Operating Instructions:
  - 1. Contractor is responsible for all instructions to the Owner's representatives for the electrical and specialized systems.
  - 2. If the Contractor does not have staff that can adequately provide the required instructions, the Contractor shall include in the bid an adequate amount to reimburse the Owner for the Architect/Engineer to perform these services.

### **3.7 RECORD DOCUMENTS**

- A. The following paragraphs supplement Division 1 requirements.
- B. Maintain at the job site a separate and complete set of electrical drawings and specifications with all changes made to the systems clearly and permanently marked in complete detail.
- C. Mark drawings and specifications to indicate approved substitutions; Change Orders, and actual equipment and materials used. All Change Orders, RFI responses, Clarifications and other supplemental instructions shall be marked on the documents. Record documents that merely reference the existence of above items are not acceptable. Should Contractor fail to complete Record Documents as required by this contract, Contractor shall reimburse Architect/Engineer for all costs to develop record documents complying with this requirement. Reimbursement shall be made at Architect/Engineer hourly rates in effect at the time of work.
- D. Record changes daily and keep the marked drawings available for the Architect/Engineer's examination at any normal work time.
- E. Upon completing the job, and before final payment is made, give the marked-up drawings to Architect/Engineer.
- F. Record actual routing of conduits exceeding 2 inches.

### **3.8 PAINTING**

- A. Paint all equipment that is marred or damaged prior to the Owner's acceptance. Paint and color shall match original equipment paint and shall be obtained from the equipment supplier if available. All equipment shall have a finished coat of paint applied unless specifically allowed to be provided with a prime coat only.
- B. Equipment in finished areas that will be painted to match the room decor will be painted by others. Should this Contractor install equipment in a finished area after the area has been

painted, the Contractor shall have the equipment and all its supports, hangers, etc., painted to match the room decor. Painting shall be performed as described in project specifications.

- C. Equipment cabinets, casings, covers, metal jackets, etc., located in equipment rooms or concealed spaces, shall be furnished in standard finish, free from scratches, abrasions, chippings, etc.
- D. Equipment in occupied spaces, or if standard to the unit, shall have a baked primer with baked enamel finish coat free from scratches, abrasions, chipping, etc. If color option is specified or is standard to the unit, verify with the Architect the color preference before ordering.
- E. Paint all equipment in unfinished areas such as boiler room, mechanical spaces, and storage rooms. Equipment furnished with a suitable factory finish need not be painted; provided the factory applied finish is not marred or spattered. If so, equipment shall be refinished with the same paint as was factory applied.
- F. All electrical conduit and equipment, fittings, hangers, structural supports, etc., in unfinished areas, such as equipment and storage room area, shall be painted two (2) coats of oil paint of colors selected by the Architect.
- G. Do NOT paint electric conduits in crawl spaces, tunnels, or spaces above suspended ceilings except that where conduit is in a damp location give exposed threads at joints two coats of sealer after joint is made up.
- H. After surfaces have been thoroughly cleaned and are free of oil, dirt or other foreign matter, paint all raceway and equipment with the following:
  - 1. Bare Metal Surfaces - Apply one coat of metal primer suitable for the metal being painted. Finish with two coats of Alkyd base enamel paint.
  - 2. Plastic Surfaces - Paint plastic surfaces with two coats of semi-gloss acrylic latex paint.
- I. In accordance with LEED EQc4.2: Low-Emitting Materials - Paints and Coatings, all paints and coatings used on the interior of the building must comply with the following criteria:
  - 1. Architectural paints and coatings applied to interior walls and ceilings must not exceed the volatile organic compound (VOC) content limits established in Green Seal Standard GS-11, Paints, 1st Edition, May 20, 1993.
  - 2. Anti-corrosive and anti-rust paints applied to interior ferrous metal substrates must not exceed the VOC content limit of 250 g/L (2 lb./gal) established in Green Seal Standard GC-03, Anti-Corrosive Paints, 2nd Edition, January 7, 1997.

### **3.9 ADJUST AND CLEAN**

- A. Thoroughly clean all equipment and systems prior to Owner final acceptance of the project.
- B. Clean all foreign paint, grease, oil, dirt, labels, stickers, etc. from all equipment.
- C. Remove all rubbish, debris, etc., accumulated during construction from the premises.

### **3.10 SPECIAL REQUIREMENTS**

- A. Coordinate the installation of all equipment, controls, devices, etc., with other trades to maintain clear access area for servicing.
- B. Install all equipment to maximize access to parts needing service or maintenance. Review the final location, placement, and orientation of equipment with the Owner's representative prior to setting equipment.

- C. Installation of equipment or devices without regard to coordination of access requirements and confirmation with the Owner's representative will result in removal and reinstallation of the equipment at the Contractor's expense.
- D. Raceway and Cable Routing Restrictions: Raceways and cable are restricted from being routed in the following locations, unless serving the space or permitted by the authority having jurisdiction.
  - 1. Elevator machine rooms and hoistways.
  - 2. Exit enclosures.
  - 3. Other areas restricted by code.
  - 4. Technology, data, server rooms.
  - 5. Fire pump and sprinkler rooms.
  - 6. Normal power in emergency power equipment rooms: Limited to feeders and branch circuits serving the emergency power equipment located in the room.
  - 7. Emergency power in normal power equipment rooms: Limited to feeders and branch circuits serving the normal power equipment located in the room.

### **3.11 INDOOR AIR QUALITY (IAQ) MAINTENANCE FOR OCCUPIED FACILITIES UNDER CONSTRUCTION**

- A. Within the Limits of Construction:
  - 1. The Electrical Contractor shall coordinate all work with the contractor responsible for IAQ.
  - 2. The means, methods and materials used by the Electrical Contractor shall be coordinated with the contractor responsible for IAQ and shall comply with the IAQ requirements set forth in Division 1 and Division 21/22/23 of these specifications.
- B. Outside the Limits of Construction:
  - 1. IAQ shall be the responsibility of the electrical contractor for work that is required outside the limits of construction.
  - 2. The Electrical Contractor is responsible for the IAQ set forth in Division 1 and Division 21/22/23 of these specifications.
  - 3. The Electrical Contractor shall review and coordinate all IAQ plans and procedures with the owner's IAQ representative.
- C. Contractors shall make all reasonable efforts to prevent construction activities from affecting the air quality of the occupied areas of the building or outdoor areas near the building. These measures shall include, but not be limited to:
  - 1. General Contractor shall erect and maintain dust barriers throughout the construction work. These barriers shall be reasonably airtight and shall prevent entry into the construction zone by unauthorized persons. Reasonably airtight means construction equivalent to full-height temporary or permanent walls with joints taped or sealed, and shafts and other penetrations sealed as well as possible. Fire resistant polyethylene is acceptable; if flame spread/smoke developed ratings are demonstrated to conform to the applicable building codes and licensing acts.
  - 2. The Contractor shall continuously maintain the construction zone under a negative pressure of at least 0.01" w.g. minimum relative to all adjacent areas of the building.
    - a. Exhaust fans used for this purpose shall filter air and discharge it outdoors or to the least populated area adjacent to the construction work using negative air machines designed specifically for this purpose. All filtration for air recirculated back into the building shall be HEPA (99.97% DOP efficiency) for work adjacent to healthcare or elderly facilities. If no work is adjacent to these areas, 95% filtration is acceptable. Filtering air discharged to outdoors shall be accomplished with 30% filters.
    - b. If air is discharged outdoors, maintain all required distances to doors, windows, air



- c. intakes, etc.
  - d. If high levels of Volatile Organic Compounds (VOCs) or odors are released, activated carbon or equivalent filtration shall also be employed. Exhaust shall not discharge near doors, air intakes, pedestrians, gathering areas, or operable windows.
  - e. Adjusting existing air handling equipment to assist in pressure control is acceptable, if approved by the Owner and the authority having jurisdiction.
  - f. Seal return, exhaust, and supply air openings in or near the construction zone that serve existing air handling systems, and rebalance the systems for proper operation. If this is impractical, add filters at the intakes of sufficient cross-sectional area to minimize the pressure drop and avoid the need for rebalancing.
  - g. Maintain pressure control one hour before and after all construction periods, and 24 hours per day in healthcare or elderly facilities.
3. All contractors shall endeavor to minimize the amount of contaminants generated during construction. Methods to be employed shall include, but not be limited to:
- a. Minimizing the amount of dust generated.
  - b. Reducing solvent fumes and VOC emissions.
  - c. Maintain good housekeeping practices, including sweeping and periodic dust and debris removal. There should be no visible haze in the air.
4. Request that the Owner designate an IAQ representative.
5. Review and receive approval from the Owner's IAQ representative for all IAQ-related construction activities and negative pressure containment plans.
6. Inform the IAQ representative of all conditions that could adversely impact IAQ, including operations that will produce higher than normal dust production or odors.
7. Schedule activities that may cause IAQ conditions that are not acceptable to the Owner's IAQ representative during unoccupied periods.
8. Request copies of and follow all Owner's IAQ and infection control policies.
9. Unless no other access is possible, the entrance to construction site shall not be through the existing facility.
10. To minimize growth of infectious organisms, do not permit damp areas in or near the construction area to remain for over 24 hours.
11. In addition to the criteria above, provide measures as recommended in the SMACNA "IAQ Guidelines for Occupied Buildings under Construction".

### **3.12 SYSTEM STARTING AND ADJUSTING**

- A. The electrical systems shall be complete and operating. System startup, testing, adjusting, and balancing to obtain satisfactory system performance is the responsibility of the Contractor. This includes all calibration and adjustment of electrical controls, balancing of loads, troubleshooting and verification of software, and final adjustments that may be needed.
- B. Complete all manufacturer-recommended startup procedures and checklists to verify proper equipment operation and does not pose a danger to personnel or property.
- C. All operating conditions and control sequences shall be tested during the start-up period. Testing all interlocks, safety shut-downs, controls, and alarms.
- D. The Contractor, subcontractors, and equipment suppliers shall have skilled technicians to ensure that all systems perform properly. If the Architect/Engineer is requested to visit the job site for trouble shooting, assisting in start-up, obtaining satisfactory equipment operation, resolving installation and/or workmanship problems, equipment substitution issues or unsatisfactory system performance, including call backs during the warranty period, through no fault of the design; the Contractor shall reimburse the Owner on a time and materials basis for services rendered at the Architect/Engineer's standard hourly rates in effect when the services are requested. The Contractor shall pay the Owner for services required that are product, installation or workmanship related. Payment is due within 30 days after services are rendered.

### **3.13 FIELD QUALITY CONTROL**

- A. General:
  - 1. Supply necessary instruments, meters, etc., for the tests as required. Supply competent technicians with training in the proper testing techniques.
  - 2. Any wiring device, electrical apparatus or luminaire, if grounded or shorted on any integral "live" part, shall have all defective parts or materials replaced.
  - 3. Test cable insulation of service conductors for proper insulation values. Tests shall include the cable, all splices, and all terminations. Each conductor shall be tested and shall test free of short circuits and grounds and have an insulation value not less than Electrical Code Standards. Take readings between conductors, and between conductors and ground.
  - 4. If the results obtained in the tests are not satisfactory, make adjustments, replacements, and changes as needed. Then repeat the tests, and make additional tests, as the Architect/Engineer or authority having jurisdiction deems necessary.
  
- B. Arc Energy Reduction Equipment Performance Testing:
  - 1. Test: Perform arc energy protection performance testing when system is installed. The test process shall use primary current injection or approved method per manufacturer instructions and procedures. Perform test for the following:
    - a. All arc energy reduction systems installed.
  - 2. Report: Provide copy of test result report with Operation and Maintenance manuals. Provide report to Authority Having Jurisdiction when requested.
  
- C. Other Equipment:
  - 1. Give other equipment furnished and installed by the Contractor all standard tests normally made to assure that the equipment is electrically sound, all connections properly made, phase rotation correct, fuses and thermal elements suitable for protection against overloads, voltage complies with equipment nameplate rating, and full load amperes are within equipment rating.
  
- D. If any test results are not satisfactory, make adjustments, replacements and changes as needed and repeat the tests and make additional tests as the Architect/Engineer or authority having jurisdiction deem necessary.

### **3.14 UTILITY REBATE**

- A. Submit utility rebate forms, where offered at project location, with rebate items completed. Rebate may include lighting, lighting controls, variable speed drives, heat pumps, package terminal A/C, air conditioners, chillers, water heaters, programmable thermostats, and motors.
  
- B. Contractor must submit notification of any value engineering or product substitution that will affect the utility rebate amount prior to approval.

## READINESS CERTIFICATION PRIOR TO FINAL JOBSITE OBSERVATION

To prevent the final job observation from occurring too early, we require that the Contractor review the completion status of the project and, by copy of this document, certify that the job is indeed ready for the final job observation. The following is a typical list of items that represent the degree of job completeness expected prior to your requesting a final job observation.

1. Penetrations of fire-rated construction fire sealed in accordance with specifications.
2. Electrical panels have typed circuit identification.
3. Smoke and fire/smoke dampers are wired and have been tested.
4. Per Section 26 05 00, cable insulation test results have been submitted.
5. Per Section 26 05 00, medium voltage testing report has been submitted.
7. Operation and Maintenance manuals have been submitted as per Section 26 05 00.
8. Bound copies of approved shop drawings have been submitted as per Section 26 05 00.
9. Report of instruction of Owner's representative has been submitted as per Section 26 05 00.
10. Fire alarm inspection and testing report has been submitted as per Sections 26 05 00 and 28 31 00.
11. Start-up reports from factory representative have been submitted as per Section 26 05 00.

Accepted by:

Prime Contractor \_\_\_\_\_

By \_\_\_\_\_ Date \_\_\_\_\_

Upon Contractor certification that the project is complete and ready for a final job observation, we require the Contractor to sign this agreement and return it to the Architect/Engineer so that the final observation can be scheduled.

It is understood that if the Architect/Engineer finds the job not ready for the final observation and that additional trips and observations are required to bring the project to completion, the costs incurred by the Architect/Engineers for additional time and expenses will be deducted from the Contractor's contract retainage prior to final payment at the completion of the job.

**END OF SECTION**

## SECTION 26 05 03 - THROUGH PENETRATION FIRESTOPPING

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. Through-Penetration Firestopping.

#### 1.2 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in manufacturing products specified in this Section.
- B. Installer: Individuals performing work shall be certified by the manufacturer of the system selected for installation.

#### 1.3 REFERENCES

- A. UL 263 - Fire Tests of Building Construction and Materials
- B. UL 723 - Surface Burning Characteristics of Building Materials
- C. ANSI/UL 1479 - Fire Tests of Through Penetration Firestops
- D. UL 2079 - Tests for Fire Resistance of Building Joint Systems
- E. UL Fire Resistance Directory Through Penetration Firestop Systems (XHEZ)
- F. Intertek / Warnock Hersey - Directory of Listed Products
- G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials
- H. ASTM E814 - Standard Test Method for Fire Tests of Through-Penetration Firestops
- I. The Building Officials and Code Administrators National Building Code
- J. 2018 International Building Code
- K. NFPA 5000 - Building Construction Safety Code

#### 1.4 SUBMITTALS

- A. Submit under provisions of Section 26 05 00.
- B. Submit Firestopping Installers Certification for all installers on the project.
- C. Shop Drawings: Submit for each condition requiring firestopping. Include descriptions of the specific penetrating item, actual wall/floor construction, manufacturer's installation instructions, and UL or Interek / Warnock Hersey Assembly number.
- D. Through-Penetration Firestop System Schedule: Indicate locations of each through-penetration firestop system, along with the following information:
  - 1. Types of penetrating items.
  - 2. Types of constructions penetrated, including fire-resistance ratings and, where applicable, thicknesses of construction penetrated.
  - 3. Through-penetration firestop systems for each location identified by firestop design designation of qualified testing and inspecting agency.

- 4. F ratings for each firestop system.
- E. Maintain a notebook on the job site at all times that contains copies of approved submittals for all through penetration firestopping to be installed. Notebook shall be made available to the Authority Having Jurisdiction at their request and turned over to the Owner at the end of construction as part of the O&M Manuals.
- F. Submit VOC rating of firestopping material in g/L (less water) with documentation that it meets the limits set forth in SCAQMD Rule 1168.

### **1.5 DELIVERY, STORAGE, AND HANDLING**

- A. Store, protect and handle products on site. Accept material on site in factory containers and packing. Inspect for damage. Protect from deterioration or damage due to moisture, temperature changes, contaminants, or other causes. Follow manufacturer instructions for storage.
- B. Install material prior to expiration of product shelf life.

### **1.6 PERFORMANCE REQUIREMENTS**

- A. General: For penetrations through the following fire-resistance-rated constructions, including both empty openings and openings containing penetrating items, provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated.
  - 1. Fire-resistance-rated walls including fire partitions, fire barriers, and smoke barriers.
  - 2. Fire-resistance-rated horizontal assemblies including floors, floor/ceiling assemblies, and ceiling membranes of roof/ceiling assemblies.
- B. Rated Systems: Provide through-penetration firestop systems with the following ratings determined per UL 1479:
  - 1. F-Rated Systems: Provide through-penetration firestop systems with F-ratings indicated, but not less than that equaling or exceeding fire-resistance rating of constructions penetrated.
  - 2. L-Rated Systems: Provide through-penetration firestop systems with L-ratings of not more than 5.0 cfm/sq.ft. at both ambient temperature and 400°F.
- C. For through-penetration firestop systems exposed to light, traffic, moisture, or physical damage, provide products that, after curing, do not deteriorate when exposed to these conditions both during and after construction.
- D. For through-penetration firestop systems exposed to view, provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.
- E. For through-penetration firestop systems in air plenums, provide products with flame-spread and smoke-developed indexes of less than 25 and 50, respectively, as determined per ASTM E 84.

### **1.7 MEETINGS**

- A. Pre-installation meeting: A pre-installation meeting shall be scheduled and shall include the Construction Manager, General Contractor, all Subcontractors associated with the installation of systems penetrating fire barriers, Firestopping Manufacturer Representative, and Owner.
  - 1. Review foreseeable methods related to firestopping work.
  - 2. Tour representative areas where firestopping is to be installed; inspect and discuss each type of condition and each type of substrate that will be encountered, and preparation to

be performed by other trades.

## **1.8 WARRANTY**

- A. Provide one year warranty on parts and labor.
- B. Warranty shall cover repair or replacement of firestop systems which fail in joint adhesion, cohesion, abrasion resistance, weather resistance, extrusion resistance, migration resistance, stain resistance, general durability, or appear to deteriorate in any manner not clearly specified by the manufacturer as an inherent quality of the material.

## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURERS**

- A. Products: Subject to compliance with requirements, provide one of the through-penetration firestop systems indicated for each application that are produced by one of the following manufacturers. All firestopping systems installed shall be provided by a single manufacturer.
  - 1. 3M; Fire Protection Products Division
  - 2. Hilti, Inc.
  - 3. RectorSeal Corporation, Metacaulk
  - 4. Tremco; Sealant/Weatherproofing Division
  - 5. Johns-Manville
  - 6. Specified Technologies Inc. (S.T.I.)
  - 7. Spec Seal Firestop Products
  - 8. AD Firebarrier Protection Systems
  - 9. Wiremold/Legrand: FlameStopper
  - 10. Dow Corning Corp
  - 11. Fire Trak Corp
  - 12. International Protective Coating Corp

### **2.2 THROUGH PENETRATION FIRESTOP SYSTEMS**

- A. Provide materials and systems classified by or listed by Intertek / Warnock Hersey to provide firestopping equal to time rating of construction being penetrated.
- B. All firestopping materials shall be free of asbestos, lead, PCBs, and other materials that would require hazardous waste removal.
- C. Firestopping shall be flexible to allow for normal penetrating item movement due to expansion and contraction.
- D. Provide firestopping systems capable of supporting floor loads where systems are exposed to possible floor loading or traffic.
- E. Provide firestopping systems allowing continuous insulation for all insulated pipes.
- F. Provide firestopping systems classified by UL or listed by Intertek / Warnock Hersey for penetrations through all fire rated construction. Firestopping systems shall be selected from the UL or listed by Intertek / Warnock Hersey Fire Resistance Directory Category XHEZ based on substrate construction and penetrating item size and material and shall fall within the range of numbers listed:
  - 1. Combustible Framed Floors and Chase Walls - 1 or 2 Hour Rated:

- a. F Rating = Floor/Wall Rating
- b. L Rating = Penetrations in Smoke Barriers

<b>Penetrating Item</b>	<b>UL System No.</b>
No Penetrating Item	FC 0000-0999*
Metallic Pipe or Conduit	FC 1000-1999
Non-Metallic Pipe or Conduit	FC 2000-2999
Electrical Cables	FC 3000-3999
Cable Trays	FC 4000-4999
Insulated Pipes	FC 5000-5999
Bus Duct and Misc. Electrical	FC 6000-6999
Duct without Damper and Misc. Mechanical	FC 7000-7999
Multiple Penetrations	FC 8000-8999

\*Alternate method of firestopping is patching opening to match original rated construction.

2. Non-Combustible Framed Walls - 1 or 2 Hour Rated:

- a. F Rating = Wall Rating
- b. L Rating = Penetrations in Smoke Barriers

<b>Penetrating Item</b>	<b>UL System No.</b>
No Penetrating Item	WL 0000-0999*
Metallic Pipe or Conduit	WL 1000-1999
Non-Metallic Pipe or Conduit	WL 2000-2999
Electrical Cables	WL 3000-3999
Cable Trays	WL 4000-4999
Insulated Pipes	WL 5000-5999
Bus Duct and Misc. Electrical	WL 6000-6999
Duct without Damper and Misc. Mechanical	WL 7000-7999
Multiple Penetrations	WL 8000-8999

\*Alternate method of firestopping is patching opening to match original rated construction.

3. Concrete or Masonry Floors and Walls - 1 or 2 Hour Rated:

- a. F Rating = Wall/Floor Rating
- b. L Rating = Penetrations in Smoke Barriers

<b>Penetrating Item</b>	<b>UL System No.</b>
No Penetrating Item	CAJ 0000-0999*
Metallic Pipe or Conduit	CAJ 1000-1999
Non-Metallic Pipe or Conduit	CAJ 2000-2999
Electrical Cables	CAJ 3000-3999
Cable Trays	CAJ 4000-4999
Insulated Pipes	CAJ 5000-5999
Bus Duct and Misc. Electrical	CAJ 6000-6999
Duct without Damper and Misc. Mechanical	CAJ 7000-7999
Multiple Penetrations	CAJ 8000-8999

\*Alternate method of firestopping is patching opening to match original rated construction.

G. Any opening in walls or floors not covered by the listed series of numbers shall be coordinated with the firestopping manufacturer.

H. Any openings in floors or walls not described in the UL or listed by Intertek / Warnock Hersey Fire Resistance Directory, or outlined in manufacturer's information shall be sealed in a manner agreed upon by the Firestopping Manufacturer, Owner, and the Authority Having Jurisdiction.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Ensure all surfaces that contact seal materials are free of dirt, dust, grease, oil, rust, or loose materials. Clean and repair surfaces as required. Remove laitance and form-release agents from concrete.
- B. Ensure substrate and penetrating items have been permanently installed prior to installing firestopping systems. Ensure penetrating items have been properly spaced and have proper clearance prior to installing firestopping systems.
- C. Surfaces to which sealing materials are to be installed must meet the selected UL or Intertek / Warnock Hersey system substrate criteria.
- D. Prime substrates where recommended in writing by through-penetration firestop system manufacturer. Confine primer to area of bond.

### **3.2 INSTALLATION**

- A. In existing construction, provide firestopping of openings prior to and after installation of penetrating items. Remove any existing coatings on surfaces prior to firestopping installation. Temporary firestopping shall consist of packing openings with fire resistant mineral wool for the full thickness of substrate, or an alternate method approved by the Authority Having Jurisdiction. All openings shall be temporarily firestopped immediately upon their installation and shall remain so until the permanent UL or listed by Intertek / Warnock Hersey listed firestopping system is installed.
- B. Install penetration seal materials in accordance with printed instructions of the UL or Intertek / Warnock Hersey Fire Resistance Directory and with manufacturer printed application instructions.
- C. Install dams as required to properly contain firestopping materials within openings and as required to achieve required fire resistance rating. Remove combustible damming after appropriate curing.

### **3.3 CLEANING AND PROTECTING**

- A. Clean excess fill materials adjacent to openings as Work progresses by methods and with cleaning materials that are approved in writing by through-penetration firestop system manufacturers and that do not cause damage.
- B. Provide final protection and maintain conditions during and after installation that ensure that through-penetration firestop systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, remove damaged or deteriorated through-penetration firestop systems immediately and install new materials to produce systems complying with specified requirements.

### **3.4 IDENTIFICATION**

- A. Provide and install labels adjacent to each firestopping location. Label shall be provided by the firestop system supplier and contain the following information in a contrasting color:
  - 1. The words "Warning - Through Penetration Firestop System - Do Not Disturb. Notify Building Management of Any Damage."
  - 2. Firestop System Supplier; UL or listed by Intertek / Warnock Hersey system number; date installed; contractor name and phone number; manufacturer's representative name, address, and phone number.



### **3.5 INSPECTION**

- A. All penetrations shall be inspected by manufacturer representative to ensure proper installation.
- B. Access to firestop systems shall be maintained for examination by the Authority Having Jurisdiction at their request.
- C. Proceed with enclosing through-penetration firestop system with other construction only after inspection reports are issued and firestop installations comply with requirements.
- D. Contractor shall allow for visual destructive review of 5% of installed firestop systems (minimum of one) to prove compliance with specifications and manufacturer's instructions and details. Destructive system removal shall be performed by the contractor and witnessed by Architect/Engineer and manufacturer's factory representative. Architect/Engineer shall have sole discretion of which firestop system installations will be reviewed. The contractor is responsible for all costs associated with this requirement including labor and material for removing and replacing the installed firestop system. If any firestop system is found to not be installed per manufacturer specific instructions and details, all firestop systems are subject to destructive review and replacement at Architect/Engineer discretion and Contractor expense.

**END OF SECTION**

## SECTION 26 05 05 - ELECTRICAL DEMOLITION FOR REMODELING

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. Electrical demolition

### PART 2 - PRODUCTS

#### 2.1 MATERIALS AND EQUIPMENT

- A. Materials and equipment for patching and extending work shall be as specified in individual Sections.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. DRAWINGS ARE INTENDED TO INDICATE THE SCOPE OF WORK REQUIRED AND DO NOT INDICATE EVERY BOX, CONDUIT, OR WIRE THAT MUST BE REMOVED. CONTRACTOR SHALL VISIT THE SITE PRIOR TO SUBMITTING A BID AND VERIFY EXISTING CONDITIONS.
- B. Where walls, ceilings, structures, etc., are indicated as being removed on general or electrical drawings, the Contractor shall be responsible for the removal of all electrical equipment, devices, fixtures, raceways, wiring, systems, etc., from the removed area.
- C. Where ceilings, walls, structures, etc., are temporarily removed and replaced by others, this Contractor shall be responsible for the removal, storage, and replacement of equipment, devices, fixtures, raceways, wiring, systems, etc.
- D. Where mechanical or technology equipment is indicated as being removed on electrical, mechanical, or technology drawings, the Contractor shall be responsible for disconnecting the equipment and removing all starters, VFD, controllers, electrical equipment, raceways, wiring, etc. associated with the device.
- E. Verify abandoned wiring and equipment serve only abandoned equipment or facilities. Extend conduit and wire to facilities and equipment that will remain in operation following demolition. Extension of conduit and wire to equipment shall be compatible with the surrounding area. Extended conduit and conductors to match existing size and material.
- F. Coordinate scope of work with all other Contractors and the Owner at the project site. Schedule removal of equipment and electrical service to avoid conflicts.
- G. Bid submittal shall mean the Contractor has visited the project site and has verified existing conditions and scope of work.

#### 3.2 PREPARATION

- A. Contractor shall obtain approval from the Owner before turning off power to circuits, feeders, panels, etc. Coordinate all outages with Owner.
- B. Coordinate utility service outages with Utility Company.
- C. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits, use personnel

experienced in such operations. Assume all equipment and systems must remain operational unless specifically noted otherwise on drawings.

- D. Disconnect electrical systems in walls, floors, structures, and ceilings scheduled for removal.
- E. Existing Electrical Service: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Obtain permission from Owner at least Insert hours before partially or completely disabling system. Minimize outage duration.
- F. Existing Fire Alarm System: Maintain existing system in service until new system is accepted. Disable system only to make switchovers and connections. Obtain permission from Owner at least 48 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area. Provide a watchman to make required premise observations during all outages, requirements as dictated by codes and Owner's insurance carrier.
- G. Refer to the drawings and specifications for fire alarm separation. Graham Hall to be separated from Lincoln Hall.
- H. Existing Telephone System: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Obtain permission from Owner at least 48 hours before partially or completely disabling system. Minimize outage duration.

### **3.3 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK**

- A. Demolish and extend existing electrical work under provisions of Division 1 of Specifications and this Section.
- B. Remove, relocate, and extend existing installations to accommodate new construction.
- C. Remove abandoned wiring and raceway to source of supply. Existing conduit in good condition may be reused in place by including an equipment ground conductor in reused conduit. Reused conduit and boxes shall have supports revised to meet current codes. Relocating conduit shall not be allowed.
- D. Remove exposed abandoned raceway, including abandoned raceway above accessible ceiling finishes. Cut raceway flush with walls and floors, and patch surfaces. Remove all associated clamps, hangers, supports, etc. associated with raceway removal.
- E. Disconnect and remove outlets and devices that are to be demolished. Remove outlet or devices' associated back box, supports, and conduit and conductors back to source. Patch opening created from removal of device to match surrounding finishes.
- F. Disconnect and remove abandoned panelboards and distribution equipment.
- G. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.
- H. Disconnect and remove abandoned luminaires. Remove brackets, stems, hangers, and other accessories. Ballasts in light fixtures installed prior to 1980 shall be incinerated in EPA approved incinerator or disposed of in EPA certified containers and deposited in an EPA landfill certified for PCB disposal or recycled by permitted ballast recycler. Punctured or leaking ballasts must be disposed of according to Federal Regulations under the Toxic Substance Control Act. Provide Owner and Architect/Engineer with a Certificate of Destruction to verify proper disposal.
- I. Repair adjacent construction and finishes damaged during demolition and extension work.

Patch openings to match existing surrounding finishes.

- J. Maintain access to existing electrical installations that remain active. Modify installation or provide junction boxes and access panel as appropriate.
- K. Extend existing installations using materials and methods compatible with existing electrical installations, or as specified. Extended conduit and conductors to match existing size and material.
- L. Disconnect and remove fire alarm devices in Briscoe Hall for owner stock. Coordinate with owner for packaging and location devices are to be stored.
- M. HID and fluorescent lamps, determined by the Toxicity Characteristic Leachate procedure (TCLP), to be hazardous waste shall be disposed of in an EPA-permitted hazardous waste disposal facility or by a permitted lamp recycler.
- N. Regulatory Requirements: Comply with governing EPA notification regulations before beginning demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- O. Floor slab on grade is a structural slab. All penetrations shall be X-rayed prior to cutting and/or drilling to avoid rebar or utilities encased in floor construction. Provide rebar dowels to replace damaged rebar and pin existing slab with patched slab. Refer to structural plans for additional information.
- P. Floor slabs may contain conduit systems. This Contractor is responsible for taking any measures required to ensure no conduits or other services are damaged. This includes X-ray or similar non-destructive means. Where conduit is in concrete slab, cut conduit flush with floor, pull out conductors, and plug conduit ends.
- Q. This Contractor is responsible for all costs incurred in repair, relocations, or replacement of any cables, conduits, or other services if damaged without proper investigation.

### **3.4 EXISTING ENCLOSURES - NEW EQUIPMENT**

- A. Existing enclosures may be reused to house new equipment including branch panels, industrial controls, and similar systems pending documented verification of the following provided with the applicable new equipment submittals.
  - 1. New equipment or panelboard is listed for the existing enclosure or application.
  - 2. Existing enclosure and new equipment is field evaluated by the manufacturer or nationally recognized testing laboratory for available fault current, condition, and application.
  - 3. Authority Having Jurisdiction (AHJ) approval.

### **3.5 CLEANING AND REPAIR**

- A. Clean and repair existing materials and equipment that remain or are to be reused.
- B. Panelboards: Clean exposed surfaces and check tightness of electrical connections. Replace damaged circuit breakers and provide closure plates for vacant positions. Provide typed circuit directory showing revised circuiting arrangement.
- C. ELECTRICAL ITEMS (E.G., LIGHTING FIXTURES, RECEPTACLES, SWITCHES, CONDUIT, WIRE, ETC.) REMOVED AND NOT RELOCATED REMAIN THE PROPERTY OF THE OWNER. CONTRACTOR SHALL PLACE ITEMS RETAINED BY THE OWNER IN A LOCATION COORDINATED WITH THE OWNER. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE DISPOSAL OF MATERIAL THE OWNER DOES NOT WANT.

**3.6      INSTALLATION**

- A.      Install relocated materials and equipment under the provisions of Division 1 of Specifications.

**END OF SECTION**

## SECTION 26 05 13 - WIRE AND CABLE

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. Building wire
- B. Cabling for remote control, signal, and power limited circuits
- C. Metal-clad cable (MC)

#### 1.2 RELATED WORK

- A. Section 26 05 53 - Electrical Identification: Refer to electrical identification for color and identification labeling requirements.

#### 1.3 REFERENCES

- A. NEMA WC 70 - Power Cables Rated 2,000V or Less for the Distribution of Electrical Energy
- B. NFPA 70 - National Electrical Code (NEC)
- C. UL 44 - Thermoset-Insulated Wires and Cables
- D. UL 83 - Thermoplastic-Insulated Wires and Cables
- E. UL 854 - Service-Entrance Cables
- F. UL 1581 - Standard for Electrical Wires, Cables, and Flexible Cords
- G. UL 2196 - Fire Resistive, Fire Resistant and Circuit Integrity Cables

### PART 2 - PRODUCTS

#### 2.1 BUILDING WIRE

- A. All Feeders and Branch Circuits 8 AWG and larger: Copper, stranded conductor, 600-volt insulation, THHN/THWN or XHHW-2.
- B. Feeders and Branch Circuits 10 AWG and Smaller: Copper, solid or stranded conductor, 600-volt insulation, THHN/THWN, unless otherwise noted on the drawings.
- C. Motor Feeder from Variable Frequency Drives: Copper conductor, 600-volt XHHW-2 insulation, stranded conductor, unless otherwise noted on the drawings. Three conductor stranded copper, 600-volt XHHW-2 insulation, with copper ground and overall helical copper tape shield. Shield shall be terminated at both ends of cable with an approved termination.
- D. Control Circuits: Copper, stranded conductor 600-volt insulation, THHN/THWN.
- E. Each 120 and 277-volt branch circuit shall have a dedicated neutral conductor. Neutral conductors shall be considered current-carrying conductors for wire derating.

#### 2.2 CABLING FOR REMOTE CONTROL, SIGNAL, AND POWER LIMITED CIRCUITS

- A. Wire for the following specialized systems shall be as designated on the drawings, or

elsewhere in these specifications. If not designated on the drawings or specifications, the system manufacturer's recommendations shall be followed.

1. Fire alarm
  2. Low voltage switching and lighting control
  3. Electronic control
  4. Other specialized cabling, signal, and power limited cabling. Refer to the appropriate Division 23, 27, or 28 requirements; including, but not limited, to the following:
    - a. Building Automation Systems and Controls, Division 23.
    - b. Distributed Antenna System (First Responder), Division 28.
    - c. Electronic Access Control, Intrusion Detection Systems, Video Surveillance, Division 28.
    - d. [Rescue Assistance Communication System, Division 28.]
- B. Control Cable for Class 1 Remote Control and Signal Circuits: Copper conductor, 600-volt insulation, rated 60°C, individual conductors twisted together, shielded, and covered with a PVC jacket.
- C. Control Cable for Class 2 or Class 3 Remote Control and Signal Circuits: Copper conductor, 300-volt insulation, rated 60°C, individual conductors twisted together, shielded, and covered with a PVC jacket; UL listed.
- D. Plenum Cable for Class 2 or Class 3 Remote Control and Signal Circuits: Copper conductor, 300-volt insulation, rated 60°C, individual conductors twisted together, shielded, and covered with a nonmetallic jacket; UL listed for use in air handling ducts, hollow spaces used as ducts, and plenums.

### **2.3 METAL-CLAD CABLE (MC)**

- A. Conductors shall be copper, 600-volt insulation, THHN. Metal clad cable shall be constructed in strict accordance with Underwriters Laboratories, Inc. Standard for Metal-Clad Cables, UL 15694, exterior of metal interlocked armor.
- B. Minimum conductor size for branch circuit wiring shall be 12 AWG, with larger wires used only where specified.
- C. Metal-clad cables may be used for branch circuit wiring as defined in the Electrical Code, subject to acceptance by State and local codes.
- D. Metal-clad cable shall NOT be used for circuits serving the Essential Electrical System.

## **PART 3 - EXECUTION**

### **3.1 WIRE AND CABLE INSTALLATION SCHEDULE**

- A. Above Accessible Ceilings:
  1. Building wire shall be installed in raceway.
  2. Metal clad cable, Type MC, 1/2" size with minimum #12 conductors and ground, shall be allowed for flexible whips to individual luminaires on non-essential circuits. The flexible whips shall be between 18" to 72" in length per Electrical Code.
- B. All Other Locations: Building wire in raceway.
- C. Above Grade: All conductors installed above grade shall be type "THHN".

- D. Underground or In Slab: All conductors shall be type "THWN".
- E. Low Voltage Cable (less than 100 volts): Low voltage cables in ducts, plenums, and other air handling spaces shall be plenum listed. Low voltage cables in non-accessible areas shall be installed in conduit. Low voltage cable may be installed without conduit in accessible areas using the following types of cable supports. Cable support types/systems shall comply with the warranty requirements of the low voltage cable manufacturer.
  - 1. J-hooks
  - 2. Bridle rings with saddle supports
- F. Low Voltage Cable (less than 100 volts): Low voltage cable shall be installed in raceway.
- G. Fire-Rated 2-Hour Feeders and Circuit Requiring Continuous Operation (CI): Refer to Part 2 of this section for acceptable products and assemblies. Installation shall meet UL 2196.

### **3.2 CONTRACTOR CHANGES**

- A. The basis of design is copper conductors installed in raceway based on ambient temperature of 30°C, NEC Table 310.16 (2011 - 2017 edition 310.15(B)(16)). Service entrance conductors are based on copper conductor installed in underground electrical ducts, NEC Table B.2(7) (2011 - 2017 edition Table B310.15(B)(2)(7); 2008 or later edition B.301.7) or calculated in accordance with Annex B Application Information for Ampacity Calculation..
- B. The Contractor shall be responsible for derating and sizing conductors and conduits to equal or exceed the ampacity of the basis of design circuits, if he/she chooses to use methods or materials other than the basis of design.
- C. Underground electrical duct ampacity rating shall be in accordance with NEC Table 310.16 (2011 - 2017 edition 310.15(B)(16)) or calculated in accordance with Annex B Application Information for Ampacity Calculation. The calculations and a sketch of the proposed installation shall be submitted prior to any conduit being installed.
- D. Conductor length(s) listed on plans and schedules. The drawings are diagrammatic with intent to convey the components of the electrical distribution system. Conductor length(s) when listed on plans and schedules are for engineering calculation purposes. Conductor length(s) shall NOT be used for bidding purposes.
- E. Record drawing shall include the calculations and sketches.

### **3.3 GENERAL WIRING METHODS**

- A. Use no wire smaller than 12 AWG for power and lighting circuits, and no smaller than 14 AWG for control wiring.
- B. Use no wire smaller than 18 AWG for low voltage control wiring below 100 volts.
- C. Use 10 AWG conductor for 20 ampere, 120-volt branch circuit home runs longer than 75 feet, and for 20 ampere, 277-volt branch circuit home runs longer than 200 feet.
- D. Use no wire smaller than 8 AWG for outdoor lighting circuits.
- E. The ampacity of multiple conductors in one conduit shall be derated per the Electrical Code. In no case shall more than 4 conductors be installed in one conduit to such loads as motors larger than 1/4 HP, panelboards, motor control centers, etc.
- F. Where installing parallel feeders, place an equal number of conductors for each phase of a circuit in same raceway or cable.



- G. Splice only in junction or outlet boxes.
- H. Neatly train and lace wiring inside boxes, equipment, and panelboards.
- I. Make conductor lengths for parallel circuits equal.
- J. All conductors shall be continuous in conduit from last outlet to their termination.
- K. Terminate all spare conductors on terminal blocks, and label the spare conductors.
- L. Cables or wires shall not be laid out on the ground before pulling.
- M. Cables or wires shall not be dragged over earth or paving.
- N. Care shall be taken so as not to subject the cable or wire to high mechanical stresses that would cause damage to the wire and cable.
- O. At least six (6)-inch loops or ends shall be left at each outlet for installation connection of luminaires or other devices.
- P. All wires in outlet boxes not connected to fixtures or other devices shall be rolled up, spliced if continuity of circuit is required, and insulated.

#### **3.4 WIRING INSTALLATION IN RACEWAYS**

- A. Pull all conductors into a raceway at the same time. Use UL listed wire pulling lubricant for pulling 4 AWG and larger wires.
- B. Install wire in raceway after interior of building has been physically protected from the weather and all mechanical work likely to injure conductors has been completed.
- C. Pulling shall be continuous without unnecessary stops and starts with wire or cable only partially through raceway.
- D. Where reels of cable or wire are used, they shall be set up on jacks close to the point where the wire or cable enters the conduit or duct so that the cable or wire may be unreeled and run into the conduit or duct with a minimum of change in the direction of the bend.
- E. Conductors shall not be pulled through conduits until plastering or masonry work is completed and conduits are free from moisture. Care shall be taken so that long pulls of wire or pulls around several bends are not made where the wire may be permanently stretched and the insulation damaged.
- F. Only nylon rope shall be permitted to pull cables into conduit and ducts.
- G. Completely and thoroughly swab raceway system before installing conductors.
- H. Conductor Supports in Vertical Raceways:
  - 1. Support conductors in vertical raceways in accordance with the Electrical Code Spacing of Conductors Supports.
  - 2. Supports shall be of insulated wedge type (OZ Gedney Type S, or equal) and installed in a tapered insulated bushing fitting or a metal woven mesh with a support ring that fits inside conduit fitting installed in an accessible junction box (Hubbell Kellems support grip or equal).

### **3.5 CABLE INSTALLATION**

- A. Provide protection for exposed cables where subject to damage.
- B. Use suitable cable fittings and connectors.
- C. Run all open cable parallel or perpendicular to walls, ceilings, and exposed structural members. Follow the routing as illustrated on the drawings as closely as possible. Cable routing on drawings scaled 1/4"=1'-0" or less shall be considered diagrammatical, unless noted otherwise. The correct routing, when shown diagrammatically, shall be chosen by the Contractor based on information in the contract documents; in accordance with the manufacturer's written instructions, applicable codes, the NECA's "Standard of Installation", recognized industry standards; and coordinated with other contractors.
- D. Open cable shall be supported by the appropriate size J-hooks or other means if called for on the drawings. Wire and cable from different systems shall not be installed in the same J-hook. J-hooks shall be sized with 20% spare capacity. J-hooks shall provide proper bend radius support for data cable and fiber cables.
- E. Open cable installed above suspended ceilings shall not rest on the suspended ceiling construction, nor utilize the ceiling support system for wire and cable support.
- F. J-hook support spans shall be based on the smaller of the manufacturer's load ratings and code requirements. In no case shall horizontal spans exceed 5 feet and vertical spans exceed 4 feet. All J-hooks shall be installed where completely accessible and not blocked by piping, ductwork, inaccessible ceilings, etc. J-hooks shall be independently rigidly attached to a structural element. J-hooks shall be installed to provide 2" horizontal separation and 6" vertical separation between systems.
- G. Open cable shall only be installed where specifically shown on the drawings, or permitted in these specifications.

### **3.6 FIRE-RATED CABLE AND ASSEMBLY INSTRUCTIONS**

- A. Terminations of the fire-rated cable must be outside of the fire zone.
- B. Fire-rated cable shall be installed according to the manufacturer's instructions, recommendations, and UL listing.
- C. Route fire-rated cable and assemblies separate from other feeders and distribution. Install cable and assemblies in locations protected from physical damage.
- D. Refer to Electrical Identification Section 26 05 53 for specific identification requirements.

### **3.7 WIRING CONNECTIONS AND TERMINATIONS**

- A. Splice and tap only in accessible junction boxes.
- B. Use solderless, tin-plated copper, compression terminals (lugs) applied with circumferential crimp for conductor terminations, 8 AWG and larger.
- C. Use solderless, tin-plated, compression terminals (lugs) applied with indenter crimp for copper conductor terminations, 10 AWG and smaller.
- D. Use solderless pressure connectors with insulating covers for copper wire splices and taps, 8 AWG and smaller. For 10 AWG and smaller, use insulated spring wire connectors with plastic caps.

- E. Use compression connectors applied with circumferential crimp for conductor splices and taps, 6 AWG and larger. Tape uninsulated conductors and connectors with electrical tape to 150 percent of the insulation value of conductor. Cold shrink connector insulator with 1kV rating shall be used in damp and wet locations.
- F. Thoroughly clean wires before installing lugs and connectors.
- G. Make splices, taps and terminations to carry full ampacity of conductors without perceptible temperature rise.
- H. Phase Sequence: All apparatus shall be connected to operate in the phase sequence A-B-C representing the time sequence in which the phase conductors so identified reach positive maximum voltage.
- I. As a general rule, applicable to switches, circuit breakers, starters, panelboards, switchgear and the like, the connections to phase conductors are intended thus:
  - 1. Facing the front and operating side of the equipment, the phase identification shall be:
    - a. Left to Right - A-B-C
    - b. Top to Bottom - A-B-C
- J. Connection revisions as required to achieve correct rotation of motors shall be made at the load terminals of the starters or disconnect switches.
- K. Use antioxidant joint compound on all aluminum conductor terminations. Apply antioxidant joint compound per manufacturer's recommendations.

### **3.8 MC CABLE INSTALLATION**

- A. AC/MC shall NOT be used for circuits serving the Essential Electrical System.
- B. Cable shall be supported by an approved means every 4.5' and within 12" of outlet boxes, junction boxes, cabinets, or fittings.
- C. Cable may be unsupported in the following conditions:
  - 1. Cable is no longer than 2' in length at terminals where flexibility is necessary.
  - 2. Cable is not more than 4.5' from the last point of support for connections within an accessible ceiling to light fixtures or equipment.
- D. Conductor ampacity shall be derated as required by the Electrical Code where more than three current carrying conductors are used.
- E. Each 120 and 277-volt circuit shall have a dedicated neutral conductor. Neutral conductors shall be considered current-carrying conductors for cable derating.
- F. Cables shall be cut using a rotary cutter as recommended by the manufacturer to eliminate nicking and cutting of the conductors.
- G. Bending radius shall comply with the requirements listed in the Electrical Code for the type and size of cable being installed, but shall not be less than 5-times diameter of cable in any case.
- H. At cable terminations, a fitting shall be provided to protect wires from abrasion, unless design of the outlet boxes or fittings is such as to afford equivalent protection, and, in addition, an insulating bushing or its equivalent protection shall be provided between conductors and armor.
- I. All wiring devices supplied by nonmetallic-sheathed cables shall be mounted in an outlet box.

### **3.9 FIELD QUALITY CONTROL**

- A. Field inspection and testing will be performed under provisions of Division 1.
- B. Building Wire and Power Cable Testing: Perform an insulation-resistance test on each conductor with respect to ground and adjacent conductors. Test shall be made by means of a low-resistance ohmmeter, such as a "Megger". The applied potential shall be 500 volts dc for 300 volt rated cable and 1000 volts dc for 600 volt rated cable. The test duration shall be one minute. Insulation resistance must be greater than 100 mega-ohm for 600 volt and 25 mega-ohm for 300 volt rated cables per NETA Acceptance Testing Standard. Verify uniform resistance of parallel conductors.
- C. MI cable shall have the insulation resistance of each cable tested with a 500-volt dc megohmmeter prior to energizing the cables. Tabulate resistance values and submit to Architect/Engineer for acceptance.
- D. Inspect wire and cable for physical damage and proper connection.
- E. Torque test conductor connections and terminations to manufacturer recommended values.
- F. Perform continuity test on all power and equipment branch circuit conductors. Verify proper phasing connections.
- G. Provide documentation of the manufacturer's recommended lug torque value for copper and aluminum conductors, the date the lugs were torqued, and installed torque readings. Documentation indicating that the torque wrench has been calibrated not more than 30 days prior to tightening of lugs shall be provided.
- H. Protection of wire and cable from foreign materials:
  - 1. It is the Contractor's responsibility to provide adequate physical protection to prevent foreign material application or contact with any wire or cable type. Foreign material is defined as any material that would negatively impact the validity of the manufacturer's performance warranty. This includes, but is not limited to, overspray of paint (accidental or otherwise), drywall compound, or any other surface chemical, liquid, or compound that could come in contact with the cable, cable jacket, or cable termination components.
- I. Overspray of paint on any wire or cable will not be accepted. It shall be the Contractor's responsibility to replace any component containing overspray, in its entirety, at no additional cost to the project. Cleaning of the cables with harsh chemicals is not allowed.

**END OF SECTION**

## SECTION 26 05 17 - ELECTRIC HEAT TRACE FOR ROOF AND GUTTER

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. Self Regulating Heat tracing cables for Gutter deicing
- B. Deicing controller
- C. Heat Cable installation accessories.

#### 1.2 REFERENCES

- A. NFPA 70 - National Electrical Code (NEC)
- B. ASTM 2633 - Standard Test Method for Thermoplastic Insulations
- C. ASTM B193 - Standard Test Method for Resistivity of Electrical Conductor Materials
- D. UL 746B - Polymeric Materials - Long Term Property Evaluations
- E. Division 07 - Roof Installation
- F. National Electric Code (NEC): Article 426 Fixed Outdoor Electric Deicing & Snow Melting Equipment
- G. IEEE 515.1-2012: Standard for testing, design, installation and maintenance of electrical resistance trace heating for commercial applications.

#### 1.3 SUBMITTALS

- A. Submit shop drawings under provisions of Section 26 05 00. Product Data: For Roof & Gutter Deicing System Components including the following:
  - 1. Manufacturer Data Sheet
  - 2. Installation Instructions
  - 3. Electrical Requirements
  - 4. Factory Shop Drawings indicating the location of the heating cable in gutters and downspouts, sensors & controls.
  - 5. Wiring Diagrams for controller & sensors
- B. For each type of product indicated.
  - 1. Field Test Reports: Submit written test reports to include test procedures used.
  - 2. Test results that comply with requirements.
  - 3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.
- C. Submit manufacturer instructions under provisions of Section 26 05 00.
- D. Factory drawings that show wiring, terminations, and appurtenances.

#### **1.4 COORDINATION**

- A. Coordinate layout and installation of electrical heating cables and system components with General Contractor and heat trace vendor

#### **1.5 WARRANTY**

- A. Provide a ten (10) year warranty under provisions of Section 26 05 00.

#### **1.6 QUALITY ASSURANCE**

- A. Manufacturers Qualifications
  - 1. Minimum of 20 years of experience in design, engineering, manufacturer and support of roof & gutter system and components.
  - 2. Manufacturer shall be ISO-9001:2008 Registered
- B. Installer Qualifications
  - 1. System installer shall have a complete understanding of product from manufacturer prior to installation of roof & gutter deicing system.
  - 2. Electrical Connections shall be performed by a licensed electrician.

#### **1.7 DELIVERY, STORAGE AND HANDLING**

- A. Store products in manufacturer unopened packaging and dry location with a temperature range of 0°F (-18°C) to 100°F (38°C) until ready for installation.
- B. Protect Heating Cable from exposure to moisture, water & mechanical damage until ready for installation.

#### **1.8 WARRANTY**

- A. Provide manufacturer standard warranty form which manufacturer agrees to repair or replace products that fail in material or workmanship within the following periods following the date of substantial completion:
  - 1. Heating Cable & Components: One Year
  - 2. Controls & Sensors: One Year

### **PART 2 - PRODUCTS**

#### **2.1 HEAT-TRACING CABLE**

- A. Basis of Design Manufacturer: Subject to compliance with requirements, provide a self-regulating, roof & gutter deicing system by Chromalox, Pittsburgh, PA, 800-443-2640, [www.chromalox.com](http://www.chromalox.com).
  - 1. Submit comparable products of one of the following for approval by Engineer:
    - a. Raychem
- B. Self-Regulating Heating Cable:
  - 1. Chromalox CPR Self-Regulating, Heating Cable
  - 2. Cable shall be capable of crossing over itself without overheating.

3. 208V operating system.
4. Provide power end seals and splices as required.
5. Materials:
  - a. Self-regulating, heating cable shall consist of two (2) 16 AWG nickel-copper bus wires embedded in radiation cross-linked, continuous, self-regulating polymer core.
  - b. Self-regulating, heating cable shall have modified polyolefin dielectric jacket cover.
  - c. The self-regulating, heating cable shall have a tinned-copper braid.
  - d. The self-regulating, heating cable shall have a fluoropolymer over jacket.
  - e. The self-regulating, heating cable shall be suited for use on wood, plastic, sheet metal, tile and asphalt building materials.
  - f. The self-regulating, heating cable have a power output of 5 watts per foot @ 32°F in snow and ice.
  - g. The heating cable shall be part of a UL Listed and CSA Certified System.
6. Chromalox Connection Kits
  - a. Manufacturer to provide connection kits for power, splice, tee and end seal shall be:
  - b. Chromalox RG Series crimp & heat shrink style connection system
  - c. Power Connection Kits shall be rated NEMA 4X to prevent water ingress and corrosion.
  - d. Connection Kits shall be UV stabilized
  - e. Connections kits shall be UL Listed and CSA Certified.
7. Chromalox Heating Cable Installation Accessories
  - a. Roof clips RCK-1 shall be capable of being installed with mechanical fastening or adhesive.
  - b. Downspout Hangers RDK-1 to support heating cable in the gutter downspout.
  - c. Self-Regulating Heating Cable:SPECIFIER: Modify wattage in paragraphs below to suit conditions. Refer to Ray-Chem XL-Trace design guide. Coordinate with mechanical for pipe type, insulation, and number of runs required. Larger pipes may require multiple runs, show pipe run on plans.

## 2.2 CONTROLS

- A. Snow Melt Distribution and Control Panel:
  1. Branch circuit and control panel. NEMA 3R/4 enclosure. 208 volt 3 phase-amp main lug circuit breaker panel with Insert 2 pole 30mA ground fault protection branch breakers. Snow melt control panel with adjustable hold-on timer, automatic/off/manual switch.
  2. Manufacturers:
    - a. Chromalox #515127 Chroma FP-BN-BacNet Communication Capable Controller.
- B. Ambient Thermostat:
  1. Remote bulb unit with adjustable temperature range from 15°F to 150°F snap action, open-on-rise, single-pole double throw switch with 22A 125/250/480VAC ratings. Provide one pipe thermostat for each circuit of heat trace.
  2. Manufacturer:
    - a. Chomolox

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine surface and substrates to receive heating cables for compliance with requirements for installation, tolerances, and other conditions affecting performance.
  - 1. Ensure surfaces and pipes in contact with electrical heating cables are free of burrs and sharp protrusions.
  - 2. Ensure surfaces and substrates are level and plumb.
  - 3. Installer to verify that all roofing & gutter surfaces have been properly prepared for heating cable installation. Notify architect of unsatisfactory conditions exist prior to installing Roof & Gutter Deicing System.
- B. Test cables for electrical continuity before installing.
- C. Test cables for insulation resistance before installing.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.
- E. Installer to field verify all dimensions as shown on Roof & Gutter Deicing System shop drawings

### **3.2 INSTALLATION**

- A. Install products in accordance with manufacturer's instructions.
- B. The heating cable shall be protected from where it leaves the pavement to the junction box by installing the cable in rigid metal conduit. Use one conduit for each heating cable.
- C. Avoid crossing expansion, construction, or control joints with heating cables. Provide sufficient slack conductor in expansion loop.
- D. The installer shall comply with the Roof & Gutter Deicing installation, operation & maintenance instructions – Chromalox document – PJ485-2.
- E. The installer shall layout heating cable per approved shop drawings.
- F. Grounding of the roof & Gutter Deicing System shall be in accordance with section 26 05 26 “Grounding & Bonding for Electrical Systems”

### **3.3 CONNECTIONS**

- A. Cable splices and repairs shall be made using a splice kit provided by the manufacturer and specifically designed for that purpose.
- B. Power connection and end seal junction box shall be mounted above grade. The junction box shall be installed in such a way so that water cannot enter it.

### **3.4 FIELD QUALITY CONTROL**

- A. Start-Up and testing of the Roof & Gutter Deicing System shall be performed by factory technician or factory representative per the owner's requirements.
- B. Field Testing & Inspections
  - 1. The system shall be commissioned in accordance to the Chromalox Installation, Operation & Maintenance manual for Roof & Gutter Deicing Systems – PJ-485.



2. The heating cable circuit integrity shall be tested using a 2500 Vdc megohmmeter at the following intervals below. Minimum acceptable insulation resistance shall be 1000 megohms or greater.
  - a. Before installing the heating cable
  - b. After heating cable has been installed onto the roof or gutter
  - c. After installing connection kits
  - d. Prior to initial start-up (commissioning)
  - e. As part of the regular system maintenance
3. The technician shall verify that the controller parameters are set properly for the roof & gutter deicing application requirements.
4. The technician shall verify that the temperature & moisture sensors are correctly connected to the controller.
5. The installer shall submit test results to owner after commissioning.

**END OF SECTION**

## SECTION 26 05 26 - GROUNDING AND BONDING

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. Equipment grounding system
- B. Bonding system
- C. Grounding electrode system

#### 1.2 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Testing agency as defined by OSHA in 29 CFR 1910.7 or a member company of the International Electrical Testing Association and that is acceptable to authorities having jurisdiction.
- B. Testing Agency's Field Supervisor: Person currently certified by the International Electrical Testing Association to supervise on-site testing specified in Part 3.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in Electrical Code, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- D. Comply with UL 467 Grounding and Bonding Equipment.
- E. Comply with Electrical Code; for overhead-line construction and medium-voltage underground construction, comply with IEEE/ANSI C2 National Electrical Safety Code (NESC).

#### 1.3 REFERENCES

- A. NFPA 70 - National Electrical Code (NEC)

#### 1.4 SUMMARY

- A. Section includes grounding of electrical systems and equipment. Grounding requirements specified may be supplemented by special requirements of systems described in other Sections.

### PART 2 - PRODUCTS

#### 2.1 GROUNDING CONDUCTORS

- A. For insulated conductors, comply with Division 26 Section 26 05 13 "Wire and Cable".
- B. Material: Copper.
- C. Equipment Grounding Conductors: Insulated. Refer to Section 26 05 53 for insulation color.
- D. Grounding Electrode Conductors: Stranded cable.
- E. Underground Conductors: Bare, tinned, stranded, unless otherwise indicated.
- F. Copper Bonding Conductors: As follows:
  - 1. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG copper conductor, 1/4 inch in

- diameter.
  - 2. Bonding Conductor: No. 4 or No. 6 AWG, stranded copper conductor.
  - 3. Bonding Jumper: Bare copper tape, braided bare copper conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
  - 4. Tinned Bonding Jumper: Tinned-copper tape, braided copper conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
- G. GB; Grounding Bar:
  - 1. Bare, annealed copper bars of rectangular cross section, with insulators. 1/4" x 2", length of technology or applicable room.
- H. IBT; Intersystem Bonding Termination:
  - 1. Copper bar, 1/4" x 2" x 24". Provide with wall mounting brackets, insulators and pre-tapped holes.
  - 2. Manufacturers:
    - a. Harger GBI Series.
    - b. Erico EGB Series.

## 2.2 CONNECTOR PRODUCTS

- A. Comply with UL 467; listed for use for specific types, sizes, and combinations of conductors and connected items.
- B. Connectors: Hydraulic compression type, in kit form, and selected per manufacturer instructions.
- C. Bolted Connectors: Bolted-pressure-type connectors.

## 2.3 GROUNDING ELECTRODES

- A. Ground Rods Copper-clad steel.
- B. Ground Rods: Sectional type; copper-clad steel.
  - 1. Size: 3/4" in diameter by 120 inches per section.
- C. Chemical Electrodes: Copper tube, straight or L-shaped, filled with nonhazardous chemical salts, terminated with a 4/0 bare conductor. Provide backfill material recommended by manufacturer.
- D. Concrete-Encased Grounding Electrode (Ufer): Fabricate according to Electrical Code, using a minimum of 20 feet of bare copper conductor not smaller than No. 4 AWG or 20 feet of 1/2" steel reinforcing bar.

## PART 3 - EXECUTION

### 3.1 CONNECTIONS

- A. General: Make connections so galvanic action or electrolysis possibility is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.
  - 1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer to order of galvanic series.
  - 2. Make connections with clean, bare metal at points of contact.

3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
  4. Make aluminum-to-galvanized steel connections with tin-plated copper jumpers and mechanical clamps.
  5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.
- B. Compression-Type Connections: Use hydraulic compression tools to provide correct circumferential pressure for compression connectors. Use tools and dies recommended by connector manufacturer. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on grounding conductor.
  - C. Equipment Grounding Conductor Terminations: For No. 8 AWG and larger, use pressure-type grounding lugs. No. 10 AWG and smaller grounding conductors may be terminated with winged pressure-type connectors.
  - D. Noncontact Metal Raceway Terminations: If metallic raceways terminate at metal housings without mechanical and electrical connection to housing, terminate each conduit with a grounding bushing. Connect grounding bushings with a bare grounding conductor to grounding bus or terminal in housing. Bond electrically non-continuous conduits at entrances and exits with grounding bushings and bare grounding conductors, unless otherwise indicated.
  - E. Structural Steel Connection: Exothermic-welded connections to structural steel. Coordinate with structure to provide physical protection.
  - F. Underground Connections: Hydraulic compression connection. Use for underground connections, except those at test wells.
  - G. Connections at Test Wells: Use compression-type connectors on conductors and make two bolted-and clamped-type connections between conductors and ground rods.
  - H. Connections at back boxes, junction boxes, pull boxes, and equipment terminations: The equipment grounding conductor(s) associated with all circuits in the box shall be connected together and to the box using a suitable grounding screw. The removal of the respective receptacle, luminaire, or other device served by the box shall not interrupt the grounding continuity. The connection to the non-metallic boxes shall be made to any metallic fitting or device requiring grounding.
  - I. Tighten screws and bolts for grounding and bonding connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
  - J. Moisture Protection: If insulated grounding conductors are connected to ground rods or grounding buses, insulate entire area of connection and seal against moisture penetration of insulation and cable.

### **3.2 INSTALLATION**

- A. Use only copper conductors for both insulated and bare grounding conductors in direct contact with earth, concrete, masonry, crushed stone, and similar materials.
- B. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage. Each grounding conductor that passes through a below grade wall must be provided with a waterstop.
- C. Grounding electrode conductor (GEC) shall be protected from physical damage by rigid polyvinyl chloride conduit (PVC) in exposed locations.

- D. Bonding Straps and Jumpers: Install so vibration by equipment mounted on vibration isolation hangers and supports is not transmitted to rigidly mounted equipment. Use exothermic-welded connectors for outdoor locations, unless a disconnect-type connection is required; then use a bolted clamp. Bond straps directly to the basic structure, taking care not to penetrate any adjacent parts. Install straps only in locations accessible for maintenance.
- E. In raceways, use insulated equipment grounding conductors.
- F. Underground Grounding Conductors: Use tinned copper conductor, No. 2/0 AWG minimum. Bury at least 24 inches below grade or bury 12 inches above duct bank when installed as part of the duct bank.
- G. Grounding Bus: Install in electrical and telephone equipment rooms, in rooms housing service equipment, below access floors, and elsewhere as indicated, with bolted connections to form a continuous ground path.

### **3.3 EQUIPMENT GROUNDING SYSTEM**

- A. Comply with Electrical Code, for types, sizes, and quantities of equipment grounding conductors, unless specific types, larger sizes, or more conductors than required by Electrical Code are indicated.
- B. Install equipment grounding conductors in all feeders and circuits. Terminate each end on a grounding lug or bus.
- C. Install insulated equipment grounding conductor with circuit conductors for the following items, in addition to those required by Electrical Code:
  1. Lighting and receptacle circuits. Terminate each end on a grounding lug or bus.
  2. Single-phase and three-phase motor and appliance branch circuits.
  3. Flexible raceway runs, including FMC and LFMC.
  4. Armored and metal-clad cable runs.
- D. Nonmetallic Raceways: Install an equipment grounding conductor in nonmetallic raceways unless they are designated for telephone or data cables.

### **3.4 BONDING SYSTEM**

- A. At building expansion joints, provide flexible bonding jumpers to connect to columns or beams on each side of the expansion joint.
- B. Exterior Metallic Pull and Junction Box Covers, Metallic Handrails: Bond to grounding system using flexible grounding conductors.
- C. Equipment Circuits: Install a bonding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, dampers, and heaters. Bond conductor to each unit and to air duct. Bond interior metal piping systems and metal air ducts to equipment grounding conductors of associated pumps, fans, blowers, electric heaters, and air cleaners. Use braided-type bonding straps or copper conductor sized equal to the equipment grounding conductor.
- D. Bond metal ducts of dust collectors, particulate conveying, fume hoods, and other hazardous materials to the equipment grounding conductors of associated pumps, fans, or blowers. Use braided-type bonding straps. Provide braided bare copper bonding conductor in nonmetallic dust collector ductwork to each equipment inlet location, and bond to equipment.
- E. Connect bonding conductors to metal water pipe using a suitable ground clamp. Make connections to flanged piping at street side of flange. Provide bonding jumper around water meter.

- F. Signal and Communication Systems: For telephone, alarm, voice and data, and other communication systems, provide No. 6 AWG minimum insulated bonding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location. Leave 10 feet of slack conductor at terminal board.
- G. Telecom Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-2-by-12-inch grounding bar.
- H. Equipment Ground Conductor Continuity: All spliced equipment grounding conductors in junction boxes, cabinets, and distribution equipment shall be connected together and bonded to the metal enclosure.
- I. Remote control, signaling, and fire alarm circuits shall be bonded in accordance with the most recent version of the National Electric Code.
- J. Metal Poles Supporting Outdoor Lighting Fixtures > 15 feet: Provide a grounding electrode in addition to installing a separate equipment grounding conductor with supply branch-circuit conductors.
- K. Medical Gas Piping: Bond to pipe with grounding clamp connectors. Bonding conductor shall be a #6 AWG minimum and may be connected to panelboard ground bar serving the area.

### **3.5 GROUNDING ELECTRODE SYSTEM**

- A. Supplementary Grounding Electrode: Use driven ground rod on exterior of building.
- B. Provide bonding at the owners pad mounted transformer.
- C. Ground Rods: Install at least two rods spaced at least 20 feet from each other and located at least the same distance from other grounding electrodes.
  - 1. Drive ground rods until tops are 12 inches below finished floor or final grade, unless otherwise indicated.
  - 2. Interconnect ground rods with grounding electrode conductors. Use irreversible mechanical connections. Make connections without exposing steel or damaging copper coating.
- D. Metal Water Service Pipe: Provide insulated copper grounding conductors, in conduit, from building main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes by grounding clamp connectors. Where a dielectric main water fitting is installed, connect grounding conductor to street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
- E. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters, filtering devices, and similar equipment. Connect to pipe with grounding clamp connectors.
- F. Natural Gas Service Piping: Bond to natural gas main service with grounding clamp connectors. Bonding conductor shall be connected to the main service ground bar. Provide grounding jumpers around all breaks in metallic continuity.
- G. Natural Gas Equipment Piping: Bond each aboveground portion of natural gas metallic piping system at each equipment location with grounding clamp connectors. Bonding shall be performed after any flexible attachment nearest the equipment. The equipment grounding conductors may serve as the bonding means.
- H. Install one test well for each service at the ground rod electrically closest to the service entrance. Set top of well flush with finished grade or floor.

- I. Concrete-Encased Grounding Electrode (Ufer): Install concrete-encased grounding electrode encased in at least 2 inches of concrete horizontally within the foundation that is in contact with the earth. If concrete foundation is less than 20 feet long, coil excess conductor within the base of the foundation. Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building grounding grid or to a grounding electrode external to concrete.

### **3.6 UNDERGROUND DISTRIBUTION SYSTEM GROUNDING**

- A. Pad-Mounted Transformers and Switches: Install two ground rods and counterpoise circling pad. Ground pad-mounted equipment and noncurrent-carrying metal items associated with substations by connecting them to underground cable and grounding electrodes. Use tinned-copper conductor not less than No. 2 AWG for counterpoise and for taps to equipment ground pad. Bury counterpoise not less than 18 inches below grade and 6 inches from the foundation. The pad rebar shall be attached to the counterpoise conductor at the four corners.

### **3.7 FIELD QUALITY CONTROL**

- A. Inspect grounding and bonding system conductors and connections for tightness and proper installation.
  - 1. Measure ground resistance from system neutral connection at service entrance to convenient ground reference points using suitable ground testing equipment. Resistance shall not exceed 5 ohms.
  - 2. Testing: Owner will engage a qualified testing agency to perform the following field quality-control testing:
  - 3. Testing: Engage a qualified testing agency to perform the following field quality-control testing:

### **3.8 GRADING AND PLANTING**

- A. Restore surface features, including vegetation, at areas disturbed by Work of this Section. Reestablish original grades, unless otherwise indicated. If sod has been removed, replace it as soon as possible after backfilling is completed. Restore areas disturbed by trenching, storing of dirt, cable laying, and other activities to their original condition. Include application of topsoil, fertilizer, lime, seed, sod, sprig, and mulch. Comply with Division 2. Maintain restored surfaces. Restore disturbed paving.

**END OF SECTION**

## SECTION 26 05 27 - SUPPORTING DEVICES

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. Conduit and Equipment Supports
- B. Fastening Hardware
- C. Concrete Housekeeping Pads
- D. Foundation and Underground Sleeves and Seals

#### 1.2 QUALITY ASSURANCE

- A. Support systems shall be adequate for weight of equipment and conduit, including wiring, which they carry.

#### 1.3 COORDINATION

- A. Coordinate size, shape and location of concrete pads with section on Cast-in-Place Concrete or Concrete Topping.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Allied Support Systems
- B. Cooper B-Line
- C. Erico, Inc.
- D. Hilti
- E. Power Fasteners
- F. Orbit Industries

#### 2.2 MATERIAL

- A. Support Channel: Hot-dip galvanized; painted steel for interior/dry locations. All field cut ends shall be touched up with matching finish to inhibit rusting.
- B. Hardware: Corrosion resistant.
- C. Anchorage and Structural Attachment Components:
  - 1. Strength: Defined in reports by ICBO Evaluation Service or another agency acceptable to Authorities Having Jurisdiction.
    - a. Structural Safety Factor: Strength in tension and shear of components used shall be at least two times the maximum seismic forces to which they will be subjected.
  - 2. Through Bolts: Structural type, hex head, high strength. Comply with ASTM A 325.



3. Welding Lugs: Comply with MSS-SP-69, Type 57.
4. Beam clamps for Steel Beams and Joists: Double sided or concentric open web joist hangers. Single-sided type is not acceptable.
5. Bushings for Floor-Mounted Equipment Anchors: Neoprene units designed for seismically rated rigid equipment mountings, and matched to the type and size of anchor bolts and studs used.
6. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for seismically rated rigid equipment mountings, and matched to the type and size of attachment devices used.
7. Concrete Anchors: Fasten to concrete using cast-in or post-installed anchors designed per the requirements of Appendix D of ACI 318-05. Post-installed anchors shall be qualified for use in cracked concrete by ACI-355.2.
8. Masonry Anchors: Fasten to concrete masonry units with expansion anchors or self-tapping masonry screws. For expansion anchors into hollow concrete block, use sleeve-type anchors designed for the specific application. Do not fasten in masonry joints. Do not use powder actuated fasteners, wooden plugs, or plastic inserts.

D. Conduit Sleeves and Lintels:

1. Each Contractor shall provide, to the General Contractor for installation, lintels for all openings required for the Contractor's work in masonry walls and conduit sleeves for floors, unless specifically shown as being by others.
2. Refer to Structural General Notes for lintel requirements in masonry construction.
3. Refer to Structural plans and specifications for lintel requirements and sizes.
4. Fabricate all lintels from structural steel shapes or as indicated on the drawings. All lintels and grouped wall openings shall be approved by the Architect or Structural Engineer.
5. Fabricate all sleeves from standard weight black steel pipe. Provide continuous sleeve. Cut or split sleeves are not acceptable. Sleeves through concrete walls may be high density polyethylene pipe penetration sleeve with a water stop collar, suitable for use with Link-Seal mechanical seals. Century-Line Model CS.
6. Sleeves through the floors on exposed risers shall be flush with the ceiling, with planed squared ends extending 1" above the floor in unfinished areas, and flush with the floor in finished areas, to accept spring closing floor plates.
7. Sleeves shall not penetrate structural members without approval from the Structural Engineer.
8. Openings through unexcavated floors and/or foundation walls below the floor shall have a smooth finish with sufficient annular space around material passing through opening so slight settling will not place stress on the material or building structure.
9. Install all sleeves concentric with conduits. Secure sleeves in concrete to wood forms. This Contractor is responsible for sleeves dislodged or moved when pouring concrete.
10. Where conduits rise through concrete floors that are on earthen grade, provide 3/4" resilient expansion joint material (asphalt and cork) wrapped around the pipe, the full depth of concrete, at the point of penetration. Secure to prevent shifting during concrete placement and finishing.
11. Size sleeves large enough to allow expansion and contraction movement.

E. Concrete Housekeeping Pads:

1. Concrete bases for all floor mounted equipment and wall mounted equipment which is surface mounted and extends to within 6" of the finished floor, unless shown otherwise on the drawings, shall be 3-1/2" thick concrete.
2. Bases shall extend 3" on all sides of the equipment (6" larger than factory base).
3. Where the base is less than 12" from a wall, the base shall be carried to the wall to prevent a "dirt-trap".
4. Concrete materials and workmanship required for the Contractor's work shall be provided by the Contractor. Materials and workmanship shall conform to the applicable standards of the Portland Cement Association. Reinforce with 6" x 6", W1.4-W1.4 welded wire fabric. Concrete shall withstand 3,000 pounds compression per square inch at twenty-

eight days.

## 2.3 FOUNDATION - UNDERGROUND SLEEVES AND SEALS

### A. Wall Seals ("Link-Seals"):

1. Where raceways passing through foundation walls to an underground condition shall have their annular space (sleeve or drilled hole "" not tapered hole made with knockout plug) sealed by properly sized sealing element consisting of a synthetic rubber material compounded to resist aging, ozone, sunlight, water and chemical action.
2. Sleeves, if used, shall be standard weight steel with primed finish and waterstop/anchor continuously welded to sleeve.
3. Sleeves shall be at least 2 trade sizes larger than the penetrating raceway.
4. Pressure shall be maintained by stainless steel bolts and accessories. Pressure plates may be of composite materials for Models S and OS.
5. Sealing Elements shall be as follows:

Model	Service	Element Material	Temperature Range
S	Standard (Stainless)	EPDM	-40°F to 250°F
T	Fire Seals (1 hour)	Silicone	-67°F to 400°F
FS	Fire Seals (3 hours)	Silicone	-67°F to 400°F
OS	Oil Resistant / Stainless	Nitrile	-40°F to 210°F

6. Approved Manufacturers:
  - a. Thunderline Corporation "Link-Seals"
  - b. O-Z/Gedney Company
  - c. Calpico, Inc
  - d. Innerlynx

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Fasten hanger rods, conduit clamps, and outlet and junction boxes to building structure using expansion anchors in concrete and beam clamps on structural steel.
- B. Trapeze support installation: Cut hanger rods back at trapeze supports so they do not extend more than 3/4" below bottom face of lowest fastener and blunt any sharp edges.
- C. Use toggle bolts or hollow wall fasteners in hollow masonry, plaster, or gypsum board partitions and walls; expansion anchors or preset inserts in solid masonry walls; self-drilling anchors or expansion anchor on concrete surfaces; sheet metal screws in sheet metal studs; and wood screws in wood construction.
- D. Do not fasten supports to ceiling systems, piping, ductwork, mechanical equipment, or conduit, unless otherwise noted.
- E. Do not use powder-actuated anchors without specific permission.
- F. Do not drill structural steel members.
- G. Fabricate supports from structural steel or steel channel, rigidly welded or bolted to present a neat appearance. Use hexagon head bolts with spring lock washers under all nuts.
- H. In wet locations and on all building floors below exterior earth grade install free-standing electrical equipment on concrete pads.

- I. Install cabinets and panelboards with minimum of four anchors. Provide horizontal backing/support framing in stud walls for rigid mounting. Provide steel channel supports to stand surface-mounted panelboard or cabinet one inch off wall.
- J. Bridge studs top and bottom with channels to support flush-mounted cabinets and panelboards in stud walls.
- K. Do not exceed 25 lbs. per hanger and a minimum spacing of 2'-0" on center when attaching to metal roof decking (excludes concrete on metal deck). This 25 lbs. load and 2'-0" spacing include adjacent electrical and mechanical items hanging from deck. If the hanger restrictions cannot be achieved, supplemental framing off steel framing will need to be added.
- L. Refer to Section 26 05 33 for special conduit supporting requirements.

### **3.2 FINISH**

- A. Prime coat exposed steel hangers and supports. Hangers and supports in crawl spaces, pipe shafts, and above suspended ceiling spaces are not considered exposed.
- B. Trim all ends of exposed field fabricated steel hangers, slotted channel and threaded rod to within 1" of support or fastener to eliminate potential injury to personnel unless shown otherwise on the drawings. Smooth ends and install elastomeric insulation with two coats of latex paint if exposed steel is within 6'-6" of finish floor and presents potential injury to personnel.

**END OF SECTION**

## SECTION 26 05 33 - CONDUIT AND BOXES

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. Rigid metallic conduit and fittings (RMC)
- B. Intermediate metallic conduit and fittings (IMC)
- C. Electrical metallic tubing and fittings (EMT)
- D. Flexible metallic conduit and fittings (FMC)
- E. Liquidtight flexible metallic conduit and fittings (LFMC)
- F. Rigid polyvinyl chloride conduit and fittings (PVC)
- G. High density polyethylene conduit and fittings (HDPE)
- H. Wall and ceiling outlet boxes
- I. Electrical connection
- J. Pull and junction boxes
- K. Rough-ins
- L. Handholes
- M. Accessories

#### 1.2 RELATED WORK

- A. Section 26 05 53 - Electrical Identification: Refer to electrical identification for color and identification labeling requirements.

#### 1.3 REFERENCES

- A. American National Standards Institute (ANSI):
  - 1. ANSI C80.1 - Rigid Steel Conduit, Zinc-Coated
  - 2. ANSI C80.3 - Electrical Metallic Tubing, Zinc-Coated and Fittings
  - 3. ANSI C80.4 - Fittings for Rigid Metal Conduit and Electrical Metallic Tubing
  - 4. ANSI C80.6 - Intermediate Metal Conduit, Zinc Coated
  - 5. ANSI/NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers and Box Supports
  - 6. ANSI/NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports
- B. Federal Specifications (FS):
  - 1. A-A-50553A - Fittings for Conduit, Metal, Rigid, (Thick-Wall and Thin-Wall (EMT) Type
  - 2. A-A-55810 - Specification for Flexible Metal Conduit
- C. NECA "Standards of Installation"
- D. National Electrical Manufacturers Association (NEMA):

1. ANSI/NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing and Cable
  2. RN 1 - Polyvinyl chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit, Rigid Aluminum Conduit, and Intermediate Metal Conduit
  3. TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit
  4. TC 9 - Fittings for PVC Plastic Utilities Duct for Underground Installation
- E. NFPA 70 - National Electrical Code (NEC)
- F. Underwriters Laboratories (UL): Applicable Listings
1. UL 1 - Flexible Metal Conduit
  2. UL 6 - Rigid Metal Conduit
  3. UL 360 - Liquid Tight Flexible Steel Conduit
  4. UL514-B - Conduit Tubing and Cable Fittings
  5. UL651-A - Type EB and a PVC Conduit and HDPE Conduit
  6. UL651-B - Continuous Length HDPE Conduit
  7. UL746A - Standard for Polymeric Materials - Short Term Property Evaluations
  8. UL797 - Electrical Metal Tubing
  9. UL1242 - Intermediate Metal Conduit
- G. American Standard of Testing and Materials (ASTM):
1. ASTM D 570 - Standard Test Method for Water Absorption of Plastics
  2. ASTM D 638 - Standard Test Method for Tensile Properties of Plastics
  3. ASTM D 648 - Standard Test Method for Deflection Temperature of Plastics under Flexural Load in the Edge Wise Position
  4. ASTM D 2412 - Standard Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading
  5. ASTM D 2447 - Standard Specification for Polyethylene (PE) Plastic Pipe, Schedules 40 and 80, Based on Outside Diameter
  6. ASTM D 3350 - Standard Specification for Polyethylene Plastic Pipe and Fittings Material
- H. Definitions:
1. Fittings: Conduit connection or coupling.
  2. Body: Enlarged fittings with opening allowing access to the conductors for pulling purposes only.
  3. Mechanical Spaces: Enclosed areas, usually kept separated from the general public, where the primary use is to house service equipment and to route services. These spaces generally have exposed structures, bare concrete and non-architecturally emphasized finishes.
  4. Finished Spaces: Enclosed areas where the primary use is to house personnel and the general public. These spaces generally have architecturally emphasized finishes, ceilings and/or floors.
  5. Concealed: Not visible by the general public. Often indicates a location either above the ceiling, in the walls, in or beneath the floor slab, in column coverings, or in the ceiling construction.
  6. Above Grade: Not directly in contact with the earth. For example, an interior wall located at an elevation below the finished grade shall be considered above grade but a wall retaining earth shall be considered below grade.
  7. Slab: Horizontal pour of concrete used for a floor or sub-floor.

## PART 2 - PRODUCTS

### 2.1 RIGID METALLIC CONDUIT (RMC) AND FITTINGS

#### A. Manufacturers:

1. Allied
2. LTV
3. Steelduct
4. Calbond Calpipe
5. Wheatland Tube Co
6. O-Z Gedney
7. or approved equal.

#### B. Manufacturers of RMC Conduit Fittings:

1. Appleton Electric
2. O-Z/Gedney Co.
3. Electroline
4. Raco
5. Bridgeport
6. Midwest
7. Regal
8. Thomas & Betts
9. Crouse-Hinds
10. Killark
11. Orbit Industries
12. or approved equal.

#### C. Minimum Size Galvanized Steel: 3/4 inch, unless otherwise noted.

#### D. Fittings and Conduit Bodies:

1. End Bell Fittings: Malleable iron, hot dip galvanized, threaded flare type with provisions for mounting to form.
2. Expansion Joints: Malleable iron and hot dip galvanized providing a minimum of 4 inches of movement. Fitting shall be watertight with an insulating bushing and a bonding jumper.
3. Expansion Joint for Concrete Encased Conduit: Neoprene sleeve with bronze end coupling, stainless steel bands and tinned copper braid bonding jumper. Fittings shall be watertight and concrete-tight.
4. Conduit End Bushings: Malleable iron type with molded-on high impact phenolic thermosetting insulation. Where required elsewhere in the contract documents, bushing shall be complete with ground conductor saddle and clamp. High impact phenolic threaded type bushings are not acceptable.
5. All other fittings and conduit bodies shall be of malleable iron construction and hot dip galvanized.

#### E. PVC Externally Coated Conduit: Compliant with UL 6, ANSI C80.1 and NEMA RN 1; rigid galvanized steel conduit with external 40 mil PVC coating and internal 2 mil urethane coating surface. All fittings and conduit bodies shall be complete with coating. Threads shall be hot galvanized and coated with a clear coat of urethane. The PVC coated system shall include necessary PVC coated fittings, boxes and covers to form a complete encapsulated system.

1. Acceptable Manufacturers:
  - a. Calbond Calpipe
  - b. Robroy
  - c. T&B Ocal

- d. or approved equal.

## **2.2 STAINLESS STEEL CONDUIT (316SS) AND FITTINGS**

- A. Manufacturers:
  - 1. Gibson Stainless & Specialty
  - 2. Calbond Calpipe
  - 3. Calbrite
  - 4. Eaton/Crouse-Hinds
  - 5. Thomas & Betts
  - 6. or approved equal.
- B. All material shall be Type 316 stainless steel, meet ASTM A-321 and SA-312 standards, and be UL 6A approved.
- C. All conduit shall be heavy wall Schedule 40 with standard NPT threads.
- D. Minimum Size Stainless Steel: 3/4 inch, unless otherwise noted.
- E. Fittings, conduit bodies, couplings, nipples, bushings, connectors, supports, clamps, and all accessory hardware shall be made of Type 316 stainless steel.

## **2.3 INTERMEDIATE METALLIC CONDUIT (IMC) AND FITTINGS**

- A. Minimum Size Galvanized Steel: 3/4 inch, unless otherwise noted.
- B. Manufacturers:
  - 1. Allied
  - 2. LTV
  - 3. Steelduct
  - 4. Wheatland Tube Co
  - 5. O-Z Gedney
  - 6. or approved equal.
- C. Fittings and Conduit Bodies:
  - 1. End Bell Fittings: Malleable iron, hot dip galvanized, threaded flare type with provisions for mounting to form.
  - 2. Expansion Joints: Malleable iron and hot dip galvanized providing a minimum of 4 inches of movement. Fitting shall be watertight with an insulating bushing and a bonding jumper.
  - 3. Expansion Joint for Concrete Encased Conduit: Neoprene sleeve with bronze end coupling, stainless steel bands and tinned copper braid bonding jumper. Fittings shall be watertight and concrete-tight.
  - 4. Conduit End Bushings: Malleable iron type with molded-on high impact phenolic thermosetting insulation. Where required elsewhere in the contract documents, bushing shall be complete with ground conductor saddle and clamp. High impact phenolic threaded type bushings are not acceptable.
  - 5. All other fittings and conduit bodies shall be of malleable iron construction and hot dip galvanized.

## **2.4 ELECTRICAL METALLIC TUBING (EMT) AND FITTINGS**

- A. Minimum Size Electrical Metallic Tubing: 3/4 inch, unless otherwise noted.
- B. Manufacturers of EMT Conduit:

1. Allied
2. Calbond Calpipe
3. LTV
4. Steelduct
5. Wheatland Tube Co
6. or approved equal.

C. Fittings and Conduit Bodies:

1. 2" Diameter or Smaller: Compression type of steel designed for their specific application.
2. 1/2" and 3/4" Conduit: Push-on connectors and couplers with locking ring and washer of zinc plated steel, listed for use in dry locations.
3. Larger than 2": Compression or steel set screw type of steel designed for their specific application.
4. Manufacturers of EMT Conduit Fittings:
  - a. Appleton Electric
  - b. O-Z/Gedney Co.
  - c. Electroline
  - d. Raco
  - e. Bridgeport
  - f. Midwest
  - g. Regal
  - h. Thomas & Betts
  - i. Orbit Industries
  - j. or approved equal.

## 2.5 FLEXIBLE METALLIC CONDUIT (FMC) AND FITTINGS

- A. Minimum Size Galvanized Steel: 3/4 inch, unless otherwise noted. Lighting branch circuit wiring to an individual luminaire may be a manufactured, UL listed 3/8" flexible metal conduit and fittings with #14 AWG THHN conductors and an insulated ground wire. Maximum length of 3/8" FMC shall be six (6) feet.
- B. Manufacturers:
  1. American Flex
  2. Alflex
  3. Electri-Flex Co
  4. or approved equal.
- C. Construction: Flexible steel, approved for conduit ground, zinc coated, threadless type formed from a continuous length of spirally wound, interlocked zinc coated strip steel. Provide a separate equipment grounding conductor when used for equipment where flexibility is required.
- D. Fittings and Conduit Bodies:
  1. Threadless hinged clamp type, galvanized zinc coated cadmium plated malleable cast iron or screw-in type, die-cast zinc.
  2. Fittings and conduit bodies shall include plastic or cast metal inserts supplied by the manufacturer to protect conductors from sharp edges.
  3. Manufacturers:
    - a. O-Z/Gedney Co.
    - b. Thomas & Betts
    - c. Appleton Electric
    - d. Electroline
    - e. Bridgeport



- f. Midwest
- g. Regal
- h. Orbit Industries
- i. or approved equal.

## **2.6 LIQUIDTIGHT FLEXIBLE METALLIC CONDUIT (LFMC) AND FITTINGS**

### **A. Manufacturers:**

- 1. Anaconda Type UA
- 2. Electri-Flex Type LA
- 3. Alflex
- 4. Carlon (Lamson & Sessions)
- 5. or approved equal.

### **B. Construction: Flexible steel, approved for conduit ground, zinc coated, threadless type formed from a continuous length of spirally wound, interlocked zinc coated strip steel and an extruded PVC cover.**

### **C. Fittings and Conduit Bodies:**

- 1. Watertight, compression type, galvanized zinc coated cadmium plated malleable cast iron, UL listed.
- 2. Fittings and conduit bodies shall include plastic or cast metal inserts supplied by the manufacturer to protect conductors from sharp edges.
- 3. Manufacturers:
  - a. Appleton Electric
  - b. O-Z/Gedney Co.
  - c. Electroline
  - d. Bridgeport
  - e. Thomas & Betts
  - f. Midwest
  - g. Regal
  - h. Carlon (Lamson & Sessions)
  - i. Orbit Industries
  - j. or approved equal.

## **2.7 RIGID NON-METALLIC CONDUIT (PVC) AND FITTINGS**

### **A. Minimum Size Rigid Smooth-Wall Nonmetallic Conduit: 3/4 inch, unless otherwise noted.**

### **B. Acceptable Manufacturers:**

- 1. Carlon (Lamson & Sessions) Type 40
- 2. Cantex, J.M. Mfg.
- 3. or approved equal.

### **C. Construction: Schedule 40 and Schedule 80 rigid polyvinyl chloride (PVC), UL labeled for 90°C.**

### **D. Fittings and Conduit Bodies: NEMA TC 3; sleeve type suitable for and manufactured especially for use with the conduit by the conduit manufacturer.**

### **E. Plastic cement for joining conduit and fittings shall be provided as recommended by the manufacturer.**

## 2.8 HIGH DENSITY POLYETHYLENE (HDPE)

- A. Minimum Size: 2 inch, unless noted otherwise.
- B. Acceptable Manufacturers:
1. Carlon
  2. Chevron Phillips Chemical Company
  3. or approved equal.
- C. Materials used for the manufacture of polyethylene pipe and fittings shall be extra high molecular weight, high-density polyethylene resin. The material shall be listed by PPI (Plastic Pipe Institute) and shall meet the following resin properties:

ASTM Test	Description	Values HDPE
D-1505	Density g/CM 3	less than 0.941
D-1238	Melt Index, g/10 min Condition E	greater than 0.55 grams/10 min.
D-638	Tensile Strength at yield (psi)	3000 min.
D-1693	Environmental Stress Crack Resistance Condition B, F 20	96 hrs.
D-790	Flexural Modulus, MPa (psi)	less than 80,000
D-746	Brittleness Temperature	-75°C Max

- D. The pipe shall contain no recycled compound except that generated in the manufacturer's own plant from resin of the same raw material, including both the base resin and coextruded resin. The pipe shall be homogeneous throughout and free of visible cracks, holes, voids, foreign inclusions, or other defects that may affect the wall integrity.
- E. Fitting and Conduit Bodies:
1. Directional Bore and Plow Type Installation: Electrofusion or Universal Aluminum threaded couplings. Tensile strength of coupled pipe must be greater than 2,000 lbs.
  2. For all other type of installation: Coupler must provide a water tight connection. The tensile strength of coupled pipe must be greater than 1,000 lbs.
  3. E-loc type couplings are not acceptable in any situations.
  4. Acceptable Manufacturers:
    - a. ARCON
    - b. Carlon
    - c. or approved equal.

## 2.9 REINFORCED THERMOSETTING RESIN CONDUIT (RTRC) AND FITTINGS

- A. Minimum Size: 1 inch.
- B. Acceptable Manufacturers:
1. Champion Fiberglass
  2. Atkore - FRE Composites
  3. or approved equal.
- C. Conduit shall be fiberglass-reinforced epoxy using a filament winding process. Conduit, elbows and fittings shall be manufactured from same resin/hardener/glass system and same filament wound system. Resin systems shall be epoxy with no fillers. Glass used shall be E-type.
- D. Fitting and Conduit Bodies:
1. Expansion fittings for RTRC shall be provided in accordance with Electrical Code.

2. Joints in wet locations and underground locations shall be watertight.

## **2.10 PHENOLIC REINFORCED THERMOSETTING RESIN CONDUIT & FITTINGS (PHENOLIC RTRC)**

- A. Minimum Size: 1 inch.
- B. Manufacturers:
  1. Champion Fiberglass Flameshield XW
  2. Atkore - FRE Composites BreathSaver
  3. or approved equal.
- C. Conduit shall be low smoke, no flame, low toxicity. Conduit shall be fiberglass reinforced phenolic using a filament winding process. Conduit, elbows, conduit bodies, and fittings shall be manufactured from the same resin/hardener/glass system and the same filament wound system. Resin systems shall be phenol with no fillers. Fiberglass used shall be E-type.
- D. Fitting and Conduit Bodies:
  1. Expansion fittings shall be provided in accordance with Electrical Code.
  2. Joints in wet locations and underground locations shall be watertight.

## **2.11 OUTLET BOXES**

- A. Sheet Metal Outlet Boxes: ANSI/NEMA OS 1; galvanized steel, 16 gauge (approximately 0.0625 inches), with 1/2-inch male fixture studs where required.
- B. Nonmetallic Outlet Boxes: ANSI/NEMA OS 2.
- C. Cast Boxes: Nema FB1, Type FD, Aluminum, cast fer alloy, or stainless steel deep type, gasketed cover, threaded hubs.
- D. Outlet boxes for luminaires to be not less than 1-1/2" deep, deeper if required by the number of wires or construction. The box shall be coordinated with surface luminaires to conceal the box from view or provide a finished trim plate.
- E. Switch outlet boxes for local light control switches, dimmers and occupancy sensors shall be 4 inches square by 2-1/8 inches deep, with raised cover to fit flush with finish wall line. Multiple gang switch outlets shall consist of required number of gang boxes appropriate to the quantity of switches comprising the gang. Where walls are plastered, provide a plaster raised cover. Where switch outlet boxes occur in exposed concrete block walls, boxes shall be installed in block cavity with a raised square edge tile cover of sufficient depth to extend out to face of block or masonry boxes.
- F. Outlet boxes for telephone substations in walls and columns shall be 4 inches square and 2-1/8 inches deep with single gang raised cover to fit flush with finished wall line equipped with flush telephone plate.
- G. Wall or column receptacle outlet boxes shall be 4 inches square with raised cover to fit flush with finished wall line. Boxes in concrete block walls shall be installed the same as for switch boxes in block walls.

## **2.12 ECONN; ELECTRICAL CONNECTION**

- A. Electrical connection to equipment and motors, sized per Electrical Code. Coordinate requirements with contractor furnishing equipment or motor. Refer to specifications and general installation notes for terminations to motors.

### 2.13 JB; PULL AND JUNCTION BOXES

- A. Sheet Metal Boxes: ANSI/NEMA OS 1; galvanized steel.
- B. Sheet metal boxes larger than 12 inches in any dimension that contain terminations or components: Continuous hinged enclosure with 1/4 turn latch and white back panel for mounting terminal blocks and electrical components.
- C. Cast Metal Boxes for Outdoor and Wet Location Installations: NEMA 250; Type 4 and Type 6, flat-flanged, surface-mounted junction box, UL listed as raintight. Galvanized cast iron box and cover with ground flange, neoprene gasket, and stainless steel cover screws.
- D. Cast Metal Boxes for Underground Installations: NEMA 250; Type 4, inside flanged, recessed cover box for flush mounting, UL listed as raintight. Galvanized cast iron box and plain cover with neoprene gasket and stainless steel cover screws.
- E. Flanged type boxes shall be used where installed flush in wall.

### 2.14 ROUGH-IN

- A. Provide with one (1) flush mount double gang box with single gang plaster ring and appropriate cover plate,
- B. Conduit stubbed to above the lay-in ceiling.
- C. RI-TECH; Technology Rough-in:
  - 1. Rough-in shall have one (1) 1" conduit.
- D. RI-TECH-W; Technology Rough-in - Wall Phone:
  - 1. Mount on wall +54" or as noted in plans. Rough-in shall have one (1) 1" conduit.
- E. RI-TECH-C; Technology Rough-in - Ceiling Flush Mounted:
  - 1. Mount flush in finished ceiling or as noted in plans. Rough-in shall have one (1) 1" conduit.
- F. RI-TV; Television Antenna Outlet Box Rough-in:
  - 1. Rough-in shall have one (1) 3/4" conduit.

### 2.15 HANDHOLES

- A. HH-#; Handhole, composite polymer concrete body and cover. Stainless steel hardware. Bolted non-skid cover rated for 10,000 pounds. Design load occasional non-deliberate vehicular traffic. Stack units to achieve depth shown on plans. Units in landscaped areas shall be green in color. 11"W, 18"L, 18"D or dimensions as shown on plans.
  - 1. Manufacturers:
    - a. Hubbell/Quazite PG####BB18, PG####HA00
    - b. Carson Industries H Series
    - c. Armorcast
    - d. Highline Products
    - e. Synertech
- B. HH-<#>; Handhole, cast iron, hot dipped galvanized with checkered cover sidewalk weatherproof box, flat neoprene cover gasket. Stainless steel screw hardware. Mounted flush

in concrete. [12"W, 18"L, 12"D or dimensions as shown on plans.]

1. Manufacturers:

- a. Appleton Electric WYT Series, WYT 181212
- b. OZ Gedney YT Series
- c. Crouse Hinds WJBF Series

- C. HH-<#>; Handhole, concrete traffic box and galvanized steel checkered cover. Stainless steel hardware. Bolted cover and box rated for H/20 vehicular traffic. Reinforced concrete slab for bottom. [11"W, 18"L, 24"D or dimensions as shown on plans.]

1. Manufacturer:

- a. Oldcastle Precast B1017 Box

## 2.16 ACCESSORIES

- A. Fire Rated Moldable Pads: UL #9700, moldable sheet putty at required thickness on all five sides of back boxes. Kinetics Noise Control - IsoBacker Pad, SpecSeal - SSP Putty and Pads, 3M #MPP-4S or equal.
- B. Sound Barrier Insulation Pads: Mastic, non-hardening, sheet material, minimum 1/8" thickness applied to all five sides of back boxes. Kinetics Noise Control - SealTight Backer Pad, L.H. DOTTIE Co., #68 or equal.

## PART 3 - EXECUTION

### 3.1 INSTALLATION TRAINING

- A. PVC coated rigid metal conduit, phenolic reinforced thermosetting resin conduit (phenolic RTRC), & reinforced thermosetting resin conduit (RTRC) manufacturers shall provide Contractor installation training for field cutting, joint preparation, joint assembly, field bending, and field cut sealing.

### 3.2 CONDUIT INSTALLATION SCHEDULE AND SIZING

- A. In the event the location of conduit installation represents conflicting installation requirements as specified in the following schedule, a clarification shall be obtained from Architect/Engineer. If Contractor is unable to obtain a clarification as outlined above, concealed rigid galvanized steel conduit installed per these specifications and the Electrical Code shall be required.
- B. Installation Schedule: Refer to drawings.
- C. Fire Rated Assemblies:
  1. Listed Fire Rated Assemblies: Phenolic RTRC
- D. Size conduit as shown on drawings and specifications. Where not indicated in contract documents, conduit size shall be according to the Electrical Code. Conduit and conductor sizing shall be coordinated to limit conductor fill to less than 40%, maintain conductor ampere capacity as required by Electrical Code (to include enlarged conductors due to temperature and quantity derating values) and to prevent excessive voltage drop and pulling tension due to long conduit/conductor lengths.
- E. Minimum Conduit Size (Unless Noted Otherwise):
  1. Above Grade: 3/4 inch. (Use of 1/2 inch would be allowed for installation conduit to individual

- light switches, individual receptacles and individual fixture whips from junction box.)
2. Below Grade 5' or less from Building Foundation: 1 inch.
  3. Below Grade More than 5' from Building Foundation: 1 inch.
  4. Telecommunication Conduit: 1 inch.
  5. Controls Conduit: 1/2 inch.

- F. Conduit sizes shall change only at the entrance or exit to a junction box, unless specifically noted on the drawings.

### **3.3 CONDUIT ARRANGEMENT**

- A. In general, conduit shall be installed concealed in walls, in finished spaces and where possible or practical, or as noted otherwise. Conduit shall be installed parallel or perpendicular to walls, ceilings, and exposed structural members. In unfinished spaces, mechanical and utility areas, conduit may run either concealed or exposed as conditions dictate and as practical unless noted otherwise on drawings. Installation shall maintain headroom in exposed vicinities of pedestrian or vehicular traffic.
- B. Exposed conduit on exterior walls or above roof will not be allowed without prior written approval of Architect/Engineer. A drawing of the proposed routing and a photo of the location shall be submitted 14 days prior to start of conduit rough-in. Routing shall be shown on coordination drawings.
- C. Conduit arrangement in elevated slabs (restricted to applications specifically noted or shown on drawings):
1. Conduit size shall not exceed one-third of the structural slab thickness. Place conduit between the top and bottom reinforcing with a minimum of 3" concrete cover.
  2. Parallel conduits shall be spaced at least 8 inches apart. Exception: Within 18 inches of commonly served floor boxes, junction boxes, or similar floor devices. Arrange conduits parallel or perpendicular to building lines and walls.
- D. Conduit shall not share the same cell as structural reinforcement in masonry walls.
- E. Conduit runs shall be routed as shown on large scale drawings. Conduit routing on drawings scaled 1/4"=1'-0" or less shall be considered diagrammatic, unless noted otherwise. The correct routing, when shown diagrammatically shall be chosen by the Contractor based on information in the contract documents, in accordance with manufacturer's written instructions, applicable codes, the NECA's "Standard of Installation", in accordance with recognized industry standards, and coordinated with other contractors.
- F. Contractor shall adapt Contractor's work to the job conditions and make such changes as required and permitted by the Architect/Engineer, such as moving to clear beams and joists, adjusting at columns, avoiding interference with windows, etc., to permit the proper installation of other mechanical and/or electrical equipment.
- G. Contractor shall cooperate with all contractors on the project. Contractor shall obtain details of other contractor's work to ensure fit and avoid conflict. Any expense due to the failure of This Contractor to do so shall be paid for in full by Contractor. The other trades involved as directed by the Architect/Engineer shall perform the repair of work damaged as a result of neglect or error by This Contractor. The resultant costs shall be borne by This Contractor.

### **3.4 CONDUIT SUPPORT**

- A. Conduit runs installed above a suspended ceiling shall be properly supported. In no case shall conduit rest on the suspended ceiling construction, nor utilize ceiling support system for conduit support.

1. Support wire used to independently support raceway and wiring systems above suspending ceilings shall be supported on both ends, minimum 12 gauge suspended ceiling support wire, and distinguishable from ceiling support systems by color (field paint), tagging, or equivalent means.
- B. Conduit shall not be supported from ductwork, water, sprinkler piping, or other non-structural members, unless approved by the Architect/Engineer. All supports shall be from structural slabs, walls, structural members, and bar joists, and coordinated with all other applicable contractors, unless noted otherwise.
- C. Conduit shall be held in place by the correct size of galvanized one-hole conduit clamps, two-hole conduit straps, patented support devices, clamp back conduit hangers, or by other means if called for on the drawings.
- D. Support individual horizontal raceways with separate, malleable-iron pipe hangers or clamps.
- E. Spring-steel conduit clips specifically designed for supporting single conduits or tubing may be used in lieu of malleable-iron hangers for 1" and smaller raceways serving lighting and receptacle branch circuits above accessible ceilings and for securing raceways to slotted channel and angle supports.
- F. Group conduits in parallel runs where practical and use conduit racks or trapeze hangers constructed of steel channel, suspended with threaded solid rods or wall mounted from metal channels with conduit straps or clamps. Provide space in each rack or trapeze for 25% additional conduits.
- G. Do not exceed 25 lbs. per hanger and a minimum spacing of 2'-0" on center when attaching to metal roof decking (excludes concrete on metal deck). This 25 lbs. load and 2'-0" spacing include adjacent electrical and mechanical items hanging from deck. If the hanger restrictions cannot be achieved, supplemental framing off steel framing will need to be added.
- H. Arrange supports in vertical runs so the weight of raceways and enclosed conductors is carried entirely by raceway supports, with no weight load on raceway terminals.
- I. Supports for metallic conduit shall be no greater than 10 feet. A smaller interval may be used if necessitated by building construction, but in no event shall support spans exceed the Electrical Code requirements. Conduit shall be securely fastened within 3 feet of each outlet box, junction box, device box, cabinet, or fitting.
- J. Supports of flexible conduit shall be within 12 inches of each outlet box, junction box, device box, cabinet, or fitting and at intervals not to exceed 4.5 feet.
- K. Supports for non-metallic conduit shall be at sufficiently close intervals to eliminate any sag in the conduit. The manufacturer's recommendations shall be followed, but in no event shall support spans exceed the Electrical Code requirements.
- L. Where conduit is to be installed in poured concrete floors or walls, provide concrete-tight conduit inserts securely fastened to forms to prevent conduit misplacement.
- M. Finish:
  1. Prime coat exposed steel hangers and supports. Hangers and supports in crawl spaces, pipe shafts, and above suspended ceiling spaces are not considered exposed.
  2. Trim all ends of exposed field fabricated steel hangers, slotted channel and threaded rod to within 1" of support or fastener to eliminate potential injury to personnel unless shown otherwise on the drawings. Smooth ends and install elastomeric insulation with two coats of latex paint if exposed steel is within 6'-6" of finish floor and presents potential injury to personnel.

### 3.5 CONDUIT INSTALLATION

#### A. Conduit Connections:

1. Shorter than standard conduit lengths shall be cut square using industry standards. The ends of all conduits cut shall be reamed or otherwise finished to remove all rough edges.
2. Metallic conduit connections in slab on grade installation shall be sealed and one coat of rust inhibitor primer applied after the connection is made.
3. Where conduits with tapered threads cannot be coupled with standard couplings, then approved split or Erickson couplings shall be used. Running threads will not be permitted.
4. Install expansion/deflection joints where conduit crosses structure expansion/seismic joints.

#### B. Conduit terminations for all low voltage wiring shall have nylon bushings installed on each end of every conduit run.

#### C. Conduit Bends:

1. Use a hydraulic one-shot conduit bender or factory elbows for bends in conduit 2" in size or larger. All steel conduit bending shall be done cold; no heating of steel conduit shall be permitted.
2. All bends of rigid polyvinyl chloride conduit (PVC) shall be made with the manufacturer's approved bending equipment. The use of spot heating devices will not be permitted (i.e. blow torches).
3. A run of conduit shall not contain more than the equivalent of four (4) quarter bends (360°), including those bends located immediately at the outlet or body.
4. Telecommunications conduits shall have no more than two (2) 90-degree bends between pull points and contain no continuous sections longer than 100 feet. Insert pull points or pull boxes for conduits exceeding 100 feet in length.
  - a. A third bend is acceptable if:
    - 1) The total run is not longer than (33) feet.
    - 2) The conduit size is increased to the next trade size.
5. Telecommunications pull boxes shall not be used in lieu of a bend. Align conduits that enter the pull box from opposite ends with each other. Pull box size shall be twelve (12) times the diameter of the largest conduit. Slip sleeves or gutters can be used in place of a pull box.
6. Telecommunications Conduit(s): Maintain appropriate conduit bend radius at all times. For conduits with an internal diameter of less than 2", maintain a bend radius of at least 6 times the internal diameter. For conduits with an internal diameter 2" or greater, maintain a bend radius of at least 10 times the internal diameter.
7. Rigid polyvinyl chloride conduit (PVC) runs longer than 100 feet or runs which have more than two 90° equivalent bends (regardless of length) shall use rigid metal or RTRC factory elbows for bends.
8. Use conduit bodies to make sharp changes in direction (i.e. around beams).

#### D. Conduit Placement:

1. Conduit shall be mechanically continuous from source of current to all outlets. Conduit shall be electrically continuous from source of current to all outlets, unless a properly sized grounding conductor is routed within the conduit. All metallic conduits shall be bonded per the Electrical Code.
2. Route exposed conduit and conduit above suspended ceilings (accessible or not) parallel/perpendicular to the building structural lines, and as close to building structure as possible. Wherever possible, route horizontal conduit runs above water and steam piping.
3. Route conduit through roof openings provided for piping and ductwork where possible. If



- not provided or routing through provided openings is not possible, route through roof jack with pitch pocket. Coordinate roof penetrations with other trades.
4. Conduits, raceway, and boxes shall not be installed in concealed locations in metal deck roofing or less than 1.5" below bottom of roof decking.
  5. Avoid moisture traps where possible. Where unavoidable, provide a junction box with drain fitting at conduit low point.
  6. All conduits through walls shall be grouted or sealed into openings. Where conduit penetrates firewalls and floors, seal with a UL listed sealant. ; refer to Section 26 05 03 for through penetration firestopping requirements.
  7. CONTRACTOR SHALL BE RESPONSIBLE FOR ALL OPENINGS REQUIRED IN MASONRY OR EXTERIOR WALLS UNDER THIS DIVISION. A QUALIFIED MASON AT THE EXPENSE OF THIS CONTRACTOR SHALL REPAIR ALL OPENINGS TO MATCH EXISTING CONDITIONS.
  8. Seal interior of conduit at exterior entries, air handling units, coolers/freezers, etc., and where the temperature differential can potentially be greater than 20°F, to prevent moisture penetration. Seal shall be placed where conduit enters warm space. Conduit seal fitting shall be a drain/seal, with sealing compound, identified for use with cable and raceway system, equal to O-Z/Gedney type EYD.
  9. Horizontal conduit routing through slabs above grade
    - a. Conduits, if run in concrete structure, shall be in middle one-third of slab thickness, and leave at least 3" min. concrete cover. Conduits shall run parallel to each other and spaced at least 8" apart centerline to centerline. Secure raceways to reinforcing rods to prevent sagging or shifting during concrete placement. Maximum conduit outside diameter 1".
    - b. No conduits are allowed in concrete on metal deck unless expressly approved in writing by the Structural Engineer.
    - c. No conduits are allowed to be routed horizontally through slabs above grade.
  10. Do not route conduits across each other in slabs on grade.
  11. Rigid polyvinyl chloride conduit (PVC) shall be installed when material surface temperatures and ambient temperature are greater than 40°F.
  12. Where rigid polyvinyl chloride conduit (PVC) is used below grade, in a slab, below a slab, etc., a transition to rigid galvanized steel or PVC-coated steel conduit shall be installed before conduit exits earth. The metallic conduit shall extend a minimum of 6" into the surface concealing the non-metallic conduit.
  13. Contractor shall provide suitable mechanical protection around all conduits stubbed out from floors, walls or ceilings during construction to prevent bending or damaging of stubs due to carelessness with construction equipment.
  14. Contractor shall provide a polypropylene pull cord with 2000 lbs. tensile strength in each empty conduit (indoor and outdoor), except in sleeves and nipples.
  15. Telecommunications conduits that protrude through the structural floor shall be installed 1 to 3" above finished floor (AFF).
  16. Telecommunications conduits that enter into Telecommunications rooms below the finished ceiling shall terminate a minimum of 4" below ceiling and as close to the wall as possible.
  17. Telecommunications conduits that are below grade and enter into a building shall terminate a minimum of 4" above finished floor (AFF) and as close to the wall as possible.

### **3.6 CONDUIT TERMINATIONS**

- A. Where conduit bonding is indicated or required in the contract documents, the bushings shall be a grounding type sized for the conduit and ground bonding conductor as manufactured by O-Z/Gedney, Appleton, Thomas & Betts, Burndy, Regal, Orbit Industries or approved equal.
- B. Conduits with termination fittings shall be threaded for one (1) lock nut on the outside and one (1) lock nut and bushing on the inside of each box.

- C. Where conduits terminate in boxes with knockouts, they shall be secured to the boxes with lock nuts and provided with approved screw type tinned iron bushings or fittings with plastic inserts.
- D. Where conduits terminate in boxes, fittings, or bodies with threaded openings, they shall be tightly screwed against the shoulder portion of the threaded openings.
- E. Conduit terminations to all motors shall be made with flexible metallic conduit (FMC), unless noted otherwise. Final connections to roof exhaust fans, or other exterior motors and motors in damp or wet locations shall be made with liquidtight flexible metallic conduit (LFMC). Motors in hazardous areas, as defined in the Electrical Code, shall be connected using flexible conduit rated for the environment. Flexible conduit shall not exceed 6' in length. Route equipment ground conductors from circuit ground to motor ground terminal through flexible conduit.
- F. Rigid polyvinyl chloride conduit (PVC) shall be terminated using fittings and bodies produced by the manufacturer of the conduit, unless noted otherwise. Prepare conduit as per manufacturer's recommendations before joining. All joints shall be solvent welded by applying full even coat of plastic cement to the entire areas that will be joined. Turn the conduit at least a quarter to one half turn in the fitting and let the joint cure for 1-hour minimum or as per the manufacturer's recommendations.
- G. All conduit ends shall be sealed with plastic immediately after installation to prevent the entrance of any foreign matter during construction. The seals shall be removed and the conduits blown clear of all foreign matter prior to any wires or pull cords being installed.

### **3.7 RIGID POLYVINYL CHLORIDE CONDUIT (PVC) OVERHEAD CONDUIT INSTALLATION**

- A. Conduit shall be installed away from high temperature piping and equipment.
- B. Conduit shall be installed to prevent exposure to ultraviolet radiation.
- C. Proper allowances shall be made for expansion and/or contraction of the conduit during installation.
- D. Expansion fittings shall be installed in any 100' continuous run of conduit and at each 100' thereafter.
- E. Supports shall be made from non-corroding materials and spacing shall not be greater than the listing in the Electrical Code, but also shall not exceed the manufacturer's recommendations depending on the expected surface temperature.

### **3.8 UNDERGROUND CONDUIT INSTALLATION**

- A. Conduit Connections:
  - 1. Conduit joints in a multiple conduit run shall be staggered at least one foot apart.
- B. Conduit Bends (Lateral):
  - 1. Conduits shall have long sweep radius elbows instead of standard elbows wherever special bends are indicated and noted on the drawings, or as required by the manufacturer of the equipment or system being served.
  - 2. Telecommunications conduit bend radius shall be six times the diameter for conduits under 2" and ten times the diameter for conduits over 2". Where long cable runs are involved, sidewall pressures may require larger radius bends. Coordinate with Architect/Engineer prior to conduit installation to determine bend radius.
- C. Conduit Elbows (vertical):

1. Minimum metal or RTRC elbow radiuses shall be 30 inches for primary conduits (greater than 600V) and 18 inches for secondary conduits (less than 600V). Increase radius, as required, based on pulling tension calculation requirements.
- D. Expansion Fittings at Finished Grade: Provide underground raceways with an expansion fitting after emerging from finished grade and exterior equipment pads. Field locate the expansion fitting above and within 24 inches of finished grade. Raceways extending less than 12 inches above finished grade, transitioning to LFMC within 12 inches of finished grade, and interior concrete building slabs do not require an expansion fitting unless required by code.
- E. Conduit Placement:
1. Conduit runs shall be pitched a minimum of 4" per 100 feet to drain toward the terminations. Duct runs shall be installed deeper than the minimum wherever required to avoid any conflicts with existing or new piping, tunnels, etc.
  2. For parallel runs, use suitable separators and chairs installed not greater than 4' on centers. Band conduit together with suitable banding devices. Securely anchor conduit to prevent movement during concrete placement or backfilling.
  3. Where concrete is required, the materials for concreting shall be thoroughly mixed to a minimum  $f'c = 2500$  and immediately placed in the trench around the conduits. No concrete that has been allowed to partially set shall be used.
  4. Before the Contractor pulls any cables into the conduit, Contractor shall have a mandrel 1/4" smaller than the conduit inside diameter pulled through each conduit and if any concrete or obstructions are found, the Contractor shall remove them and clear the conduit. Spare conduit shall also be cleared of all obstructions.
  5. Conduit terminations in manholes, masonry pull boxes, or masonry walls shall be with malleable iron end bell fittings.
  6. All spare conduits not terminated in a covered enclosure shall have its terminations plugged as described above.
  7. Ductbanks and conduit shall be installed a minimum of 24" below finished grade, unless otherwise noted on the drawings or elsewhere in these specifications.
  8. All non-metallic conduit installed underground outside of a slab shall be rigid.
- F. Horizontal Directional Drilling:
1. Entire drill path shall be accurately surveyed, with entry and exit stakes placed and coordinated with other contractors. If using a magnetic guidance system, entire drill path shall be surveyed for any surface geomagnetic variations or anomalies.
  2. Any utility locates within 20 feet of the bore path shall have the exact location physically verified by hand digging or vacuum excavation. Restore inspection holes to original condition after verification.
- G. Raceway Seal:
1. Where a raceway enters a building or structure, it shall be sealed with a sealing bushing or duct seal to prevent the entry of liquids or gases. Seal must be compatible with conductors and raceway system. Spare or unused raceway shall also be sealed.
  2. All telecommunications conduits and innerducts, including those containing cables, shall be plugged at the building and vault with "JackMoon" or equivalent duct seal, capable of withstanding a 10-foot head of water (5 PSI).
  3. Duct Seal Alternative Option: Inflatable duct seal system. Capable of withstanding a 10-foot head of water (5 PSEI).
    - a. Manufacturers:
      - 1) Raychem Rayplate Duct Sealing Systems RDSS
      - 2) Approved equal

### **3.9 BOX INSTALLATION SCHEDULE**

- A. Galvanized steel boxes may be used in:
  - 1. Concealed interior locations above ceilings and in hollow studded partitions.
  - 2. Exposed interior locations in mechanical rooms and in rooms without ceilings; higher than 8' above the highest platform level.
  - 3. Direct contact with concrete except slab on grade.
  - 4. Recessed in stud wall of kitchens and laundries.
  
- B. Cast boxes shall be used in:
  - 1. Exterior locations.
  - 2. Hazardous locations.
  - 3. Exposed interior locations within 8' of the highest platform level.
  - 4. Direct contact with earth.
  - 5. Direct contact with concrete in slab on grade.
  - 6. Wet locations.
  - 7. Kitchens and laundries when exposed on wall surface.

### **3.10 COORDINATION OF BOX LOCATIONS**

- A. Provide electrical boxes as shown on the drawings, and as required for splices, taps, wire pulling, equipment connections, and code compliance.
  
- B. Electrical box locations shown on the Contract Drawings are approximate, unless dimensioned. Verify location of floor boxes and outlets in offices and work areas prior to rough-in.
  
- C. Locate and install boxes to allow access. Avoid interferences with ductwork, piping, structure, equipment, etc. Recessed luminaires shall not be used as access to outlet, pull, and junction boxes. Where installation is inaccessible, provide access doors. Coordinate locations and sizes of required access doors with the Architect/Engineer and General Contractor.
  
- D. Locate and install to maintain headroom and to present a neat appearance.
  
- E. Coordinate locations with Heating Contractor to avoid baseboard radiation cabinets.

### **3.11 OUTLET BOX INSTALLATION**

- A. Do not install boxes back-to-back in walls.
  - 1. Provide a minimum horizontal separation of 6 inches between boxes installed on opposite sides of non-rated stud walls. When the minimum separation cannot be maintained, install sound insulation pads on all five sides of the back box in accordance with the manufacturer's instructions.
  - 2. Provide a minimum horizontal separation of 24 inches between boxes installed on opposite sides of fire-rated walls. When the minimum separation cannot be maintained, the box is greater than 16 square inches or the total box area (all trades) per 100 square feet is greater than or equal to 100 square inches, install fire-rated moldable pads to all five sides of the back box to maintain the fire rating of the wall. Install moldable pads in accordance with UL listing for the specific product. Sound insulation pads are not acceptable for use in fire-rated wall applications unless the product carries the necessary fire rating.
  
- B. Install sound insulation pads on all five sides of the back of all boxes in sound-rated wall assemblies. Sound-rated wall assemblies are defined as partition types carrying a Sound Transmission Class (STC) rating.

- C. The Contractor shall anchor switch and outlet box to wall construction so that it is flush with the finished masonry, paneling, drywall, plaster, etc. The Contractor shall check the boxes as the finish wall surface is being installed to assure that the box is flush. (Provide plaster rings as necessary.)
- D. Mount at heights shown or noted on the drawings or as generally accepted if not specifically noted.
- E. Locate boxes in masonry walls to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat openings for boxes.
- F. Provide knockout closures for unused openings.
- G. Support boxes independently of conduit.
- H. Use multiple-gang boxes where more than one device is mounted together; do not use sectional boxes. Provide barriers to separate wiring of different voltage systems.
- I. Install boxes in walls without damaging wall insulation.
- J. Coordinate mounting heights and locations of outlets mounted above counters, benches, backsplashes, and below baseboard radiation.
- K. Position outlets to locate luminaires as shown on reflected ceiling drawings.
- L. Provide recessed outlet boxes in finished areas; secure boxes to interior wall and partition studs, accurately positioned to allow for surface finish thickness. Use stamped steel stud bridges for flush outlets in hollow stud wall, and adjustable steel channel fasteners for flush ceiling outlet boxes.
- M. Align wall-mounted outlet boxes for switches, thermostats, and similar devices.
- N. Provide cast outlet boxes in exterior locations and wet locations, and where exposed rigid or intermediate conduit is used.

### **3.12 PULL AND JUNCTION BOX INSTALLATION**

- A. Locate pull boxes and junction boxes above accessible ceilings or in unfinished areas.
- B. Support pull and junction boxes independent of conduit.
- C. Do not install boxes back-to-back in walls.
  - 1. Provide a minimum horizontal separation of 6 inches between boxes installed on opposite sides of non-rated stud walls. When the minimum separation cannot be maintained, install sound insulation pads on all five sides of the back box in accordance with the manufacturer's instructions.
  - 2. Provide a minimum horizontal separation of 24 inches between boxes installed on opposite sides of fire-rated walls. When the minimum separation cannot be maintained, the box is greater than 16 square inches or the total box area (all trades) per 100 square feet is greater than or equal to 100 square inches, install fire-rated moldable pads to all five sides of the back box to maintain the fire rating of the wall. Install moldable pads in accordance with UL listing for the specific product. Sound insulation pads are not acceptable for use in fire-rated wall applications unless the product carries the necessary fire rating.
- D. Install sound insulation pads on all five sides of the back of all boxes in sound-rated wall assemblies. Sound-rated wall assemblies are defined as partition types carrying a Sound

Transmission Class (STC) rating.

**3.13 EXPOSED BOX INSTALLATION**

- A. Boxes shall be secured to the building structure with proper size screws, bolts, hanger rods, or structural steel elements.
- B. On brick, block and concrete walls or ceilings, exposed boxes shall be supported with no less than two (2) Ackerman-Johnson, Paine, Phillips, or approved equal screw anchors or expansion shields and round head machine screws. Cast boxes shall not be drilled.
- C. On steel structures, exposed boxes shall be supported to the steel member by drilling and tapping the member and fastening the boxes by means of round head machine screws.
- D. Boxes may be supported on steel members by APPROVED beam clamps if conduit is supported by beam clamps.
- E. Boxes shall be fastened to wood structures by means of a minimum of two (2) wood screws adequately large and long to properly support. (Quantity depends on size of box.)
- F. Wood, plastic, or fiber plugs shall not be used for fastenings.
- G. Explosive devices shall not be used unless specifically allowed.

**END OF SECTION**

## SECTION 26 05 53 - ELECTRICAL IDENTIFICATION

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. Adhesive Markings and Field Labels
- B. Nameplates and Signs
- C. Product Colors

#### 1.2 REFERENCES

- A. NFPA 70E - National Electrical Safety Code
- B. NFPA 70 - National Electrical Code (NEC)
- C. ANSI A13.1 - Standard for Pipe Identification
- D. ANSI Z535.4 - Standard for Product Safety Signs and Labels

#### 1.3 QUALITY ASSURANCE

- A. Electrical identification products shall be suitable for the environment installed. Identification labels damaged by the environment due to ultraviolet light fading, damp or wet conditions, physical damage, corrosion, or other conditions shall be replaced with labels suitable for the environment.

#### 1.4 SUBMITTALS

- A. General: Submit the following in accordance with Division 1 Specification Sections and under provisions of Section 26 05 00.
  - 1. Product Data for each type of product specified.
  - 2. Schedule of nomenclature to be used for identification signs and labels for each piece of equipment including, but not limited to, the following equipment types as specified in Division 26.
  - 3. Samples of each color, lettering style and other graphic representation required for identification materials including samples of labels and signs.
  - 4. Identification required in this section shall apply to equipment furnished in Division 26 and any other applicable Divisions including Division 21/22/23.

### PART 2 - PRODUCTS

#### 2.1 ADHESIVE MARKINGS AND FIELD LABELS

- A. Adhesive Marking Labels for Raceway: Pre-printed, flexible, self-adhesive vinyl labels with legend indicating voltage and service (Emergency, Lighting, Power, HVAC, Communications, Control, Fire).
  - 1. Label Size as follows:
    - a. Raceways: Kroy or Brother labels 1-inch high by 12-inches long (minimum).
  - 2. Color: As specified for various systems.

- B. Colored Adhesive Marking Tape for banding Raceways, Wires, and Cables: Self-adhesive vinyl tape not less than 3 mils thick by 1 inch to 2 inches in width.
- C. Pretensioned Flexible Wraparound Colored Plastic Sleeves for Cable Identification: flexible acrylic bands sized to suit the cable diameter and arranged to stay in place by pre-tensioned gripping action when coiled around the cable.
- D. Wire/Cable Designation Tape Markers: Vinyl or vinyl-cloth, self-adhesive, wraparound, cable/conductor markers with preprinted numbers and letter.
- E. Cable Ties: Fungus-inert, self-extinguishing, one-piece, self-locking nylon cable ties, 0.18-inch minimum width, 50-lb minimum tensile strength, and suitable for a temperature range from -40°F to 185°F (-40°C to 85°C), type 2/2S or type 21/21S based on application. Provide ties in specified colors when used for color coding. Cable ties shall be listed and identified for the application, securement, and support.
- F. Underground Plastic Markers: Bright colored continuously printed plastic ribbon tape of not less than 6 inches wide by 4 mil thick, printed legend indicating type of underground line, manufactured for direct burial service. Tape shall contain a continuous metallic wire to allow location with a metal detector.
- G. Aluminum, Wraparound Marker Bands: 1-inch width, 0.014 (5mm) inch thick aluminum bands with stamped or embossed legend, and fitted with slots or ears for permanently securing around wire or cable jacket or around groups of conductors.
- H. Brass or Aluminum Tags: 2" (50mm) by 2" (50mm) by .05-inch metal tags with stamped legend, punched for fastener.
- I. Indoor/Outdoor Number and Letters: Outdoor grade vinyl label with acrylic adhesive designed for permanent application in severe indoor and outdoor environments.
- J. Text Sizes:
  - 1. The following information shall be used for text heights, fonts, and size, unless otherwise noted.
    - a. Font: Normal 721 Swiss Bold
    - b. Adhesive Labels: 3/16 inch minimum text height
    - c. Vinyl / Plastic Laminate Labels: 3/4" inch minimum text height

## 2.2 NAMEPLATES AND SIGNS

- A. Engraved, Plastic-Laminated Labels, Signs and Instruction Plates: Engraving stock melamine plastic laminate, 1/16-inch minimum thick for signs up to 20 square inches, or 8 inches in length; 1/8 inch thick for larger sizes. Labels shall be punched for mechanical fasteners.
- B. Text Sizes:
  - 1. The following information shall be used for text heights, fonts, and size, unless otherwise noted.
    - a. Text Height: 3/8 inch minimum
- C. Baked-Enamel Signs for interior Use: Preprinted aluminum signs, punched, or drilled for fasteners, with colors, legend, and size required for application. Mounting 1/4" grommets in corners.
- D. Exterior, Metal-Backed, Butyrate Signs: Weather-resistant, nonfading, preprinted, cellulose-



acetate butyrate signs with 0.0396 inch galvanized-steel backing: and with colors, legend, and size required for application. Mounting 1/4" grommets in corners.

- E. Safety Signs: Comply with 29 CFR, Chapter XVII, Part 1910.145.
- F. Fasteners for Plastic-Laminated Signs; Self-tapping stainless steel screws or number 10/32 stainless steel machine screws with nuts and flat and lock washers.

## **2.3 PRODUCT COLORS**

- A. Adhesive Markings and Field Labels:
  - 1. All Labels: Black letters on white face
  - 2. Normal Power and General Labels: Black letters on white face
  - 3. Control Labels: Refer to division 27
  - 4. Medium Voltage (greater than 1,000 volts): Match existing on campus.
  - 5. Fire Alarm: Red letters on white face
- B. Nameplates and Signs:
  - 1. NORMAL POWER: Black letters on white face
  - 2. Control Labels: Black letters on white face
  - 3. EMERGENCY: White letters on red face
  - 4. GROUNDING: White letters on green face.
  - 5. CAUTION or UPS: Black letters on yellow face
- C. Raceways and Conduit:
  - 1. Provide color coded conduit as indicated below. Conduit shall be colored by the manufacturer:
    - a. Normal Power and General Distribution: Silver
    - b. Fire Alarm System: Red
- D. Box Covers:
  - 1. Box covers shall be painted to correspond with system type as follows:
    - a. Normal Power and General: Silver
    - b. Fire Alarm System: Red
    - c. Temperature Controls: Refer to mechanical cover sheet for color
  - 2. Box cover colors shall match conduit colors listed above.
- E. Conductor Color Identification: Refer to Part 3 for additional information.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Lettering and Graphics: Coordinate names, abbreviations, colors, and other designations used in electrical identification work with corresponding designations specified or indicated. Install numbers, lettering, and colors as approved in submittals and as required by code.
- B. Exposed Ceilings and Finished Spaces: The project includes exposed ceilings in finished spaces. The installation of colored raceways and labeling may not be aesthetically desirable in finished spaces. The contractor shall coordinate identification requirements in exposed ceilings

of finished spaces with the A/E prior to installation and ordering of materials.

- C. Electrical System Color Chart: This Contractor shall furnish and install framed 8" x 12" charts of the color-coded identification scheme used for the electrical system in all electrical rooms and next to the main fire alarm panel.
- D. Install identification devices in accordance with manufacturer's written instruction and requirements of Electrical Code.
- E. Sequence of Work: Where identification is to be applied to surfaces that require finish, install identification after completion of finish work. All mounting surfaces shall be cleaned and degreased prior to identification installation.
- F. Circuit Identification: Tag or label conductors as follows:
  - 1. Multiple Power or Lighting Circuits in Same Enclosure: Where multiple branch circuits are terminated or spliced in a box or enclosure, label each conductor with source and circuit number.
  - 2. Multiple Control Wiring and Communication/Signal Circuits in Same Enclosure: For control and communications/signal wiring, use wire/cable marking tape at terminations in wiring boxes, troughs, and control cabinets. Use consistent letter/number conductor designations throughout on wire/cable marking tape.
  - 3. Match identification markings with designations used in panelboards shop drawings, Contract Documents, and similar previously established identification schemes for the facility's electrical installations.
- G. Apply Danger, Warning, Caution and instruction signs as follows:
  - 1. Install Danger, Warning, Caution or instruction signs where required by Electrical Code, where indicated, or where reasonably required to assure safe operation and maintenance of electrical systems and of the items to which they connect. Install engraved plastic-laminated instruction signs with approved legend where instructions or explanations are needed for system or equipment operation. Install metal-backed butyrate signs for outdoor items.
  - 2. 'Danger' indicates a hazardous situation which, if not avoided, will result in death or serious injury. ANSI standard red background, white letters.
  - 3. 'Warning' indicates a hazardous situation which, if not avoided, could result in death or serious injury. ANSI standard orange background, black letters.
  - 4. 'Caution' indicates a hazardous situation which, if not avoided, may result in minor or moderate injury. ANSI standard yellow background, black letters.
  - 5. Emergency Operating Signs: Install, where required by Electrical Code, where indicated, or where reasonably required to assure safe operation and maintenance of electrical systems and of the items to which they connect, engraved laminate signs with white legend on red background with minimum 3/8-inch high lettering for emergency instructions on power transfer, load shedding, or other emergency operations.
- H. Apply circuit/control/item designation labels of engraved plastic laminate for pushbuttons, pilot lights, alarm/signal components, and similar items, except where labeling is specified elsewhere.
- I. Install labels parallel to equipment lines at locations as required and at locations for best convenience of viewing without interference with operation and maintenance of equipment.
- J. Install ARC FLASH WARNING signs on all power distribution equipment per Section 26 05 73.
- K. Install ARC FLASH WARNING signs on all switchboards, switchgear, distribution panels, branch panelboards, industrial control panels, and motor control centers.

1. Sample Label:  
! WARNING  
ARC FLASH AND SHOCK HAZARD  
APPROPRIATE PPE REQUIRED  
FAILURE TO COMPLY CAN RESULT IN DEATH OR INJURY  
REFER TO NFPA 70E
- L. Circuits with more than 600V: Identify raceway and cable with "DANGER-HIGH VOLTAGE" in black letters 2 (50mm) inches high on orange background at 10'-0 foot intervals.
  1. Entire floor area directly above conduits running beneath and within 12 inches of a basement or ground floor that is in contact with earth or is framed above unexcavated space.
  2. Wall surfaces directly external to conduits concealed within wall.
  3. All accessible surfaces of concrete envelope around conduits in vertical shafts, exposed in building, or concealed above suspended ceilings.
- M. Selective Coordination Label: Install caution signs on all switchboards, distribution panels, panelboards, disconnects, and other equipment with selectively coordinated overcurrent protection devices. Sign at a minimum shall contain:
  1. CAUTION: OVERCURRENT DEVICES IN ENCLOSURE ARE SELECTIVELY COORDINATED. EQUIVALENT REPLACEMENTS & TRIP SETTINGS ARE REQUIRED.
- N. Underground Electrical Lines: For exterior underground power, control, signal, and communication lines, install continuous underground plastic line marker located directly above line at 6 (150mm) to 8 (205mm) inches below grade. A single plastic line marker is permitted when the width of the common trench does not exceed 16 inches; provide a second plastic line marker to mark each edge of the trench when 16 inches of width is exceeded. Install line marker for underground wiring, both direct-buried cables and cables in raceway.

### **3.2 FEEDER AND BRANCH CIRCUIT DIRECTORIES**

- A. Product:
  1. Adhesive labels and field markings
  2. Nameplates and signs
- B. Feeder Directories Branch: Provide each feeder, branch circuit, feeder modification, and branch circuit modification with a typed circuit directory label. Refer to technical equipment specification sections for additional requirements. Include the following with each label:
  1. Load Description: Lighting, receptacles, specific equipment, spare, space, or similar description.
  2. Location: Room name, number, location.
- C. Provide a factory or custom clear plastic sleeve for each branch panel directory and secure to inside panel cover.

### **3.3 LIGHTING CONTROL AND RECEPTACLE COVER PLATES**

- A. Product:
  1. Adhesive labels and field markings
  2. Nameplates and signs
- B. Identification material to be a clear, 3/8-inch Kroy tape or Brother self-laminating vinyl label with black letters. Embossed Dymo-Tape labels are not acceptable. Permanently affix identification

label to cover plates, centered above the receptacle openings.

- C. Identification material to be engraved plastic-laminated labels, 1/16-inch minimum thickness with white letters on a red face. Letter and number size to 1/8-inch high.
- D. Identification to be engraved directly on the stainless steel coverplates. Letter and number size to 1/8-inch high.
- E. Provide identification on all switch and receptacle cover plates. Identification shall indicate source and circuit number serving the device (e.g. "C1A #24"). Identification for switch cover plates shall be installed on the inside cover.

### **3.4 CONDUIT AND EXPOSED CABLE LABELING**

- A. Product:
  - 1. Adhesive labels and field markings
- B. Conduit Identification: Pre-printed, flexible, self-adhesive vinyl labels with legend at 20 foot intervals to identify all conduits run exposed or located above accessible ceilings. Conduits located above non-accessible ceiling or in floors and walls shall be labeled within 3 feet of becoming accessible, or separated by enclosures, walls, partitions, ceilings, and floors. Labels for multiple conduits shall be aligned. Refer to color requirements in Part 2 when applicable in addition to the following:
  - 1. Medium Voltage (greater than 1,000 volt): Indicate feeder identification and voltage.
  - 2. 1000 Volt or less Normal/Emergency Power: Indicate feeder identification and voltage.
  - 3. Essential Electrical System EES: When applicable the label shall include "Essential Electrical System EES". Maximum interval between label intervals shall be 25 feet or as required by code.
  - 4. Fire Alarm: Indicate "FIRE ALARM".
  - 5. Grounding: Indicate "GROUND" and equipment and designation.
  - 6. Security System: Indicate "Security".
  - 7. Telephone System: Indicate "Telephone".
- C. Blank conduit ends or outlet boxes for future extension of system shall have permanent identification marker indicating purpose of conduit or box and where the raceway originated.

### **3.5 CONDUIT & RACEWAY COLOR BANDING FOR EXISTING CONDITIONS & REMODELING**

- A. Existing Conduit and Raceways: Identify existing conduits and raceways within the limits of the project boundary with color banding.
  - 1. Existing conduit and raceways to be color banded: 3/4 inch and larger.
  - 2. The Contractor shall perform a review of the existing conduit, raceway, and system type prior to submitting a bid. The Contractor's review shall include a review of areas with non-finished ceilings and areas with accessible finished ceilings.
- B. New Conduit and Raceways: Identify new conduits and raceways with color banding. The following products and materials shall be identified with color banding when required by Part 1 of this specification.
  - 1. Rigid metallic conduit and fittings (RMC)
  - 2. Intermediate metallic conduit and fittings (IMC)
  - 3. Wire and cable installed with or without raceways:
    - a. Fire-rated cable and assemblies (including but not limited to MI, fire-rated MC)
    - b. Metal-clad cable (MC)

c. Low voltage cabling

C. Instructions:

1. Band exposed or accessible raceways, cables, and bare conductors of the. Bands shall be pretensioned, snap-around colored plastic sleeves, colored adhesive marking tape, or a combination of the two. Make each color band 2 inches wide, completely encircling conduit, and place adjacent bands of two-color markings in contact, side by side. Refer to Part 1 of this specification for specific systems and colors requiring banding.
2. Install bands at changes within 36 inches of direction changes, all wall/floor penetrations, at each junction box, and at 10-foot maximum intervals in straight runs.

### 3.6 BOX LABELING

A. Products:

1. Adhesive labels and field markings

B. Identify Junction, Pull and Connection Boxes: Labeling shall be 3/8-inch Kroy tape OR Brother self-laminating vinyl label, letters/numbers. In rooms that are painted out, provide labeling on inside of cover.

C. All junction, pull, and connection boxes shall be identified as follows:

1. For power and lighting circuits, indicate system voltage and identity of contained circuits ("120V, 1LA1-3,5,7").
2. Essential Electrical System EES: When applicable the label shall include "Essential Electrical System EES". Maximum interval between label intervals shall be 25 feet or as required by code.
3. For other wiring, indicate system type and description of wiring ("FIRE ALARM NAC #1").

### 3.7 CONDUCTOR COLOR CODING

A. Products:

1. All wire and cables shall be color coded by the manufacturer.
2. All wires and cables, 6 AWG or larger, used in motor circuits, main feeders, sub-main feeders, and branch circuits shall be coded by the application of plastic tape. The tape shall be 3-M, Plymouth or Permacel in colors specified below. The tape shall be applied at each conductor termination with two 1-inch tape bands at 6-inch centers. Contractor option to use colored cabling in lieu of the tape at each end for conductor 6 AWG to 500 KCM. Wire and cables smaller than 6 AWG shall be color coded by the manufacturer.

B. Color coding shall be applied at all panels, switches, junction boxes, pull boxes, vaults, manholes etc., where the wires and cables are visible and terminations are made. The same color coding shall be used throughout the entire electrical system, therefore maintaining proper phasing throughout the entire project.

C. Colored cable ties shall be applied in groups of three ties of specified color to each conductor at each terminal or splice point starting 3 inches from the termination and spaced at 3- inches centers. Tighten to a snug fit, and cut off excess length.

D. Where more than one nominal voltage system exists in a building or facility, each ungrounded conductor of a multi-wire branch circuit, where accessible, shall be identified by phase and system.

E. Conductors shall be color coded as follows:

1. 208Y/120 Volt, 4-Wire:
  - a. A-Phase - Black
  - b. B-Phase - Red
  - c. C-Phase - Blue
  - d. Neutral - White
  - e. Ground Bond - Green
  
2. 480Y/277 Volt, 4-Wire:
  - a. A-Phase - Brown
  - b. B-Phase - Orange
  - c. C-Phase - Yellow
  - d. Neutral - Gray
  - e. Ground Bond - Green
  
3. Grounding Conductors:
  - a. Equipment grounding conductors, main/system/supply-side bonding jumpers: Green.
  - b. Isolated Equipment Ground Conductors: Green with colored distinctive yellow stripe along the entire length of the conductor. Isolated ground for feeders, use colored tape with alternating bands of green and yellow to provide a minimum of three bands of green and two bands of yellow.
  
4. Cabling for Remote Control, Signal, and Power Limited Circuits:
  - a. Fire Alarm: Red.
  - b. Low Voltage Switching: Per manufacturer recommendations and code requirements.
  - c. Building Automation Systems and Control: Refer to the Temperature Control Contactor notes located on the mechanical cover sheet.
  - d. Nurse Call: Refer to Division 27.
  - e. Electronic Control: Per manufacturer recommendations and code requirements.
  - f. Audio/Visual Systems: Refer to Division 27.
  - g. Structured Cabling: Refer to Division 27.

### **3.8 CONTROL EQUIPMENT IDENTIFICATION**

- A. Products:
  1. Nameplates and signs
  
- B. Provide identification on the front of all control equipment such as combination starters, starters, VFDs, contactors, motor control centers, etc.
  
- C. Identification shall be provided for all connections to equipment furnished by this Contractor, other contractors, or the Owner.
  
- D. Labeling shall include:
  1. Equipment type and contract documents designation of equipment being served.
  2. Location of equipment being served if it is not located within sight.
  3. Voltage and phase of circuit(s).
  4. Panel and circuit number(s) serving the equipment.
  5. Method of automatic control, if included ("AUTO CONTROL BY FMCS").
  6. Available fault current; refer to one-line diagram or panel schedule of panel serving equipment.
  7. Date of fault current study, refer to one-line diagram

8. Sample Label:  
EXHAUST FAN EF-1 ("LOCATED ON ROOF")  
480V, 3-PHASE  
FED FROM "1HA1-1"  
AUTO CONTROL BY FMCS  
22,000 AMPS AVAILABLE FAULT CURRENT  
DATE OF STUDY: 1 JAN 2017

### **3.9 EQUIPMENT CONNECTION IDENTIFICATION**

- A. Products:
  1. Nameplates and signs
- B. Provide identification for hard wired electrical connections to equipment such as disconnects switches, starters, etc. Plug and cord type connections do not require this specific label.
- C. Labeling shall include:
  1. Equipment type and contract documents designation of equipment being served
  2. Location of equipment being served if it is not located within sight.
  3. Voltage and rating of the equipment.
  4. Panel and circuit numbers(s) serving the equipment
  5. Available fault current; refer to one-line diagram or panel schedule of panel serving equipment.
  6. Date of fault current study; refer to one-line diagram
  7. Sample Label:  
UNIT HEATER UH-1 ("LOCATED IN STORAGE ROOM 200")  
480V: 3-PHASE  
FED FROM "1HA1-1"  
22,000 AMPS AVAILABLE FAULT CURRENT  
DATE OF STUDY: 1 JAN 2017

### **3.10 POWER DISTRIBUTION EQUIPMENT IDENTIFICATION**

- A. Products:
  1. Nameplates and signs
- B. Provide identification on the front of all power distribution equipment such as panelboards, switchboards, switchgear, motor control centers, generators, UPS, storage battery disconnects, transfer switches, etc. Labels shall be visible on the exterior of the gear, correspond to the one-line diagram nomenclature, and identify each cubicle of multi-section gear.
  1. Interior Equipment: The identification material shall be engraved plastic-laminated labels.
  2. Exterior Equipment: The identification material shall be engraved vinyl labels.
  3. Labeling shall include:
    - a. Essential Electrical System EES: When applicable the label shall include "Essential Electrical System EES". Applicable equipment includes components of the life safety and critical branch for healthcare facilities (generators, transfer switches, switchboards, distribution panels, panelboards, etc.).
    - b. Equipment type and contract documents designation of equipment.
    - c. Voltage of the equipment.
    - d. Name of the upstream equipment and location of the upstream equipment if it is not located within sight.
    - e. Rating and type of the overcurrent protection device serving the equipment if it is not located within sight ("FED BY 400A/3P BREAKER").

- f. Sample Label:  
DISTRIBUTION PANEL DP-H1  
480Y/277V  
FED FROM SWITCHBOARD "SB-1" (LOCATED IN MAIN ELEC ROOM)

4. Provide the following on a separate label, installed below the label above:

- a. Available fault current; refer to one-line diagram or panel schedules
- b. Date of fault current study; refer to one-line diagram
- c. Sample Label:  
22,000 AMPS AVAILABLE FAULT CURRENT  
DATE OF STUDY: 1 JAN 2017

C. Service Equipment Label: A separate nameplate for the service entrance equipment and include:

- 1. Nominal system voltage, service wire size, quantity, material, distance
- 2. Maximum available fault current; refer to one-line diagram for values
- 3. Clearing time of overcurrent protection devices based on available fault current. Refer to calculations and report from Section 26 05 73 for value.
- 4. Date of fault current study; refer to one-line diagram
- 5. Date of label
- 6. Sample Label:  
480Y/277V, 6 SETS 4#750KCM CU, 75FT  
39,800 AMPS AVAILABLE FAULT CURRENT  
0.07 SECOND CLEARING TIME  
DATE OF STUDY: 1 JAN 2017  
DATE OF LABEL: 4 JUL 2017

D. Arc Energy Reduction Label:

- 1. Provide a separate engraved plastic laminate label centered at the top of each vertical section of the electrical gear indicating the following when applicable.
  - a. Label: "This equipment is designed with a [system listed below]".
  - b. Applicable Systems:
    - 1) Zone-selective interlocking system for selective coordination and arc energy reduction
    - 2) Differential relaying system for selective coordination and arc energy reduction
    - 3) Arc energy reducing maintenance switch
    - 4) Energy reducing active arc flash mitigation system

E. Adjustable-Trip Over Current Protection Label:

- 1. Provide a separate engraved plastic laminate label adjacent to each overcurrent projection device with adjustable trip settings. Provide label separate from load identification label.
  - a. Label:
    - 1) Long-time delay:
    - 2) Long-time pickup:
    - 3) Short-time delay:
    - 4) Short-time pickup:
    - 5) Instantaneous:
    - 6) Ground fault delay:
    - 7) Ground fault:



- b. Sample Label:
  - Long-time delay: 10.0
  - Long-time pickup: 1.0
  - Short-time delay: 0.15
  - Short-time pickup: 5.0
  - Instantaneous: 2.0
  - Ground fault delay: 0.25
  - Ground fault: 50.0

F. Nominal System Voltage Label:

- 1. Where more than one nominal voltage system exists in a building or facility, the identification of color coding used in the panelboard or equipment shall be permanently posted on the interior of the door or cover.

G. Distribution panelboards and switchboards shall have each overcurrent protection device identified with name and location of the load being served ("AHU-1 LOCATED IN PENTHOUSE 1"). Provide a separate engraved plastic laminate label adjacent to each overcurrent protection device with feeder wire size, feeder wire quantity, conductor material and distance in feet. Provide label separate from load identification label and adjustable trip settings label.

- 1. Sample Labels for Feeders:
  - 4#3/0 CU & 1#6 CU GND, 125FT
  - 4#250KCM AL & 1#6 GND CU, 125FT
  - 2 SETS 4#400KCM CU & 1#1 GND CU, 125FT

H. Branch panelboards shall be provided with typed panel schedules upon completion of the project. Existing panelboards shall have their existing panel schedules typed, with all circuit changes, additions or deletions also typed on the panel schedules. A copy of all panel schedules for the project shall be turned over as part of the O&M Manuals. Refer to Section 26 05 00 for other requirements.

**3.11 TRANSFORMER EQUIPMENT IDENTIFICATION**

A. Products:

- 1. Nameplates and signs

B. Provide identification on the front of all transformers. The identification nameplate shall be an engraved plastic-laminated label.

C. Labeling shall include:

- 1. Equipment type and contract documents designation of equipment
- 2. Name of the upstream equipment.
- 3. Voltage and rating of the equipment.
- 4. Location of the upstream equipment if it is not located within sight.
- 5. Sample Label:
  - TRANSFORMER TR-15
  - 480V: 208Y/120V 15KVA
  - FED FROM SWITCHBOARD "SB-1" (LOCATED IN ELEC 123)

**3.12 POLE IDENTIFICATION**

A. Product:

- 1. Adhesive labels and field markings
- 2. Nameplates and signs

- B. Lighting poles, bollards and overhead distribution poles shall be individually identified with a unique number, for maintenance purposes. Apply the vinyl label number above the hand hole cover or 24" (610mm) above grade. Bollards may be identified with a number applied inside the luminaire that is visible from the exterior.

**END OF SECTION**

## SECTION 26 05 73 - POWER SYSTEM STUDY

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. low voltage distribution system power study.
- B. Short-circuit analysis and report.
- C. Selective coordination analysis and report.
- D. Arc-flash hazard analysis and report.

#### 1.2 RELATED SECTIONS

- A. Section 26 05 00 - Basic Electrical Requirements
- B. Section 26 24 13 - Switchboards
- C. Section 26 24 16 - Panelboards

#### 1.3 QUALITY ASSURANCE

- A. Analyses shall be performed by an agent authorized by the manufacturer of equipment specified in the related specification sections.

#### 1.4 SUBMITTALS

- A. Documentation shall bear the seal/signature of the licensed Professional Engineer who performed the analysis.
- B. The input for the power system study shall be based on the contract documents, with estimated conductor lengths and field investigation of existing equipment types, sizes, ratings provided by the Electrical Contractor. IMEG will provide a preliminary Power Tools for Windows project file for information, if requested.
- C. Documentation of the analyses shall be submitted in a single bound electronic (PDF or equal) format and shall accompany the shop drawing submittals for equipment provided under the related work specification sections. The submittal of these related specification sections will not be reviewed without this documentation. Submit a sample arc-flash hazard label for Owner review and approval prior to printing.
- D. Power system study project model shall be submitted on electronic media for review and the Owner's operating and maintenance records.

#### 1.5 REFERENCES

- A. NFPA 70 - National Electrical Code (NEC)
- B. CEC California Electrical Code
- C. IEEE 1584 - IEEE Guide for Performing Arc-Flash Hazard Calculations, latest version
- D. ANSI Z535.4 - Products Safety Signs and Labels

## **1.6 SCOPE**

- A. Provide a power system study of the electrical system shown on the plans. The study shall include arc-fault analysis, selective coordination analysis and arc flash hazard analysis.
- B. Contractor is required to provide a fully coordinated system for the normal and emergency electrical system or emergency electrical system and the associated normal side of each transfer switch and all other locations indicated on the one line diagram. Contractor shall provide overcurrent protective devices with the appropriate models, frame sizes, trip units, etc. as required to provide a selectively coordinated system.

## **PART 2 - PRODUCTS**

### **2.1 POWER SYSTEM STUDY**

- A. Power systems study shall be completed in Power Tools for Windows (PTW) version 10 or later version or pre-approved equivalent program.
- B. Power system studies including, but not limited to short-circuit analysis, selective coordination, and arc-flash analysis are inherently iterative in nature. The initial and subsequent analysis commonly requires engineering evaluation, equipment modification, setting adjustments, and revised analysis report. The power system analysis scope shall not be considered complete until all outstanding engineering, equipment and device setting solutions have been resolved and documented by a final report. The power system study vendor shall provide inclusive bid provisions for the initial, subsequent, final analysis and associated reports.

## **PART 3 - EXECUTION**

### **3.1 SHORT-CIRCUIT ANALYSIS**

- A. Provide a complete short-circuit analysis from the utility service to and including the entire building distribution as shown on the drawings.
- B. Analysis shall include the entire distribution system from the point of connection to the utility power source to the distribution panels and branch circuit panelboards.
- C. Short-circuit analysis documentation shall be made in one-line diagram form showing the magnitude and location of each calculated fault. Fault current calculations shall be made at the main bus of each switchboard, distribution panel, and branch circuit panel. A summary of the fault currents available shall also be submitted and made available to the AHJ if requested.

### **3.2 SELECTIVE COORDINATION ANALYSIS**

- A. Provide a complete selective coordination analysis comparing time/current curves of the protective devices to be installed to assure coordination between main and downstream devices. Overcurrent protection devices shall be coordinated based on the maximum available fault current results of the short-circuit analysis report.
- B. Provide a complete selective coordination analysis, comparing time/current curves of protective devices to be installed to assure complete selectivity between main and downstream devices for code-required branches and branches identified on one-line drawings. Overcurrent protective devices serving the essential electrical system shall selectively coordinate for the period of time that a fault's duration extends beyond 0.1 second. Overcurrent protective devices serving the normal shall selectively coordinate for period of time a fault's duration extends beyond 0.1.
- C. Existing Distribution, Selective Coordination, and Analysis:

1. The scope of work includes modification, replacement, adjustments, or additions of the emergency distribution system. A complete analysis and evaluation of the existing Emergency and Legally required branches is required in addition to the evaluation and analysis of the new distribution system components.
  2. The contractor shall provide field investigation service to collect all pertinent information required for a complete analysis and evaluation including but not limited to:
    - a. Over Current Protection Device (OCPD): Manufacturer, model, ratings, and settings
    - b. Feeder and Branch Circuit Conductor: Wire gauge sizes, lengths, and material type
    - c. Transformers: Manufacturer, model, transformer KVA, impedance, phase, voltage, configuration
    - d. Transfer Switch: Manufacturer, model, transfer switch voltage, amp rating, 3 or 4 pole configurations, switch style, short circuit withstand current rating
    - e. Emergency Power Supply: Manufacturer, model, power source type, voltage, amperage, ratings, fault current contribution values
    - f. Existing Distribution System Documentation: One line or riser diagram relationship of all distribution equipment including switchboards, switchgear, distribution panels, branch panelboards, transformers, transfer switches, emergency power supply, all line side normal and emergency power systems serving the applicable branches from the main electrical service and emergency power supply to the final branch circuit over current protection device.
- D. Provide trip settings for all (selectively coordinated and non-selectively coordinated) adjustable trip over current protection devices including long time delay, long time pickup, short time delay, short time pickup, instantaneous and ground fault. Selectively coordinated branches shall be based on the selective coordination study results. Non-selective coordinated branches shall be based on the design trip ratings. Provide selective coordination between all ground fault trip settings.
- E. The analysis shall include primary protective device, secondary main switchboard/switchgear device(s), switchboard/switchgear branch feeder devices, generator breaker, distribution panel, panelboard main devices, and branch feeder devices.
- F. The analysis shall include all normal, overcurrent protection devices served by the same electrical bus and directly in parallel with the emergency branch requiring selective coordination.
- G. The coordination plots provided shall indicate graphically the coordination proposed for the system on full-size log forms and shall define the types of protective devices selected, together with proposed time dial and pickup settings required. The plots shall include titles, representative one-line diagrams, legend, complete parameters for transformer(s), and complete operating bands for circuit breaker trip devices, fuses, etc.
1. The long-time region of the coordination plots shall designate the pickups required for the circuit breakers.
  2. The short-time region shall indicate the magnetizing in-rush and ASA-withstand-transformer parameter, the circuit breaker, short-time and instantaneous trip devices, fuse-manufacturing tolerance bands, significant symmetrical fault currents, etc.
  3. Each primary protective device required for the transformer shall be selected so the characteristics or operating band is within the transformer parameters, which shall include a parameter equivalent to 58% of the withstand point to afford protection for secondary line-to-ground faults. The transformer damage curve shall be included for the transformer when the selected protective device is not within the associated parameters.
  4. Molded case circuit breakers shall be separated from each other and the associated primary protective device by a 16% current margin for coordination and protection in the event of secondary line-to-line faults.
  5. Include zone selective interlocking, differential relaying, and other selective coordination

- technology in the study when required by other specification sections.
6. The protective device characteristics or operating bands shall be suitably indicated to reflect the actual symmetrical fault currents sensed by the device.
  7. The drawings and specifications indicate the general requirements for motors, motor-starting equipment, and medium-voltage and low-voltage equipment, but additional specific requirements of equipment furnished shall be determined in accordance with the results of the coordination study.
    - a. The study shall include verification of equipment ratings and settings. The Contractor shall keep the study up-to-date with any project changes which affect the study and submit the revised study for review. A final electronic copy shall be submitted with the record drawings.
- H. Provide summary table of adjustable overcurrent protective devices settings for the operating and maintenance manual.

### **3.3 ARC FLASH HAZARD ANALYSIS**

- A. The arc flash hazard analysis shall be performed according to the IEEE 1584 equations that are presented in NFPA70E.
- B. The flash protection boundary and the incident energy shall be calculated at all significant locations in the electrical distribution system (switchboards, switchgear, unit substations, motor-control centers, panelboards, busway, and splitters) where work could be performed on energized parts.
- C. Safe working distances shall be based on the calculated arc flash boundary considering an incident energy of 1.2 cal/cm<sup>2</sup>.
- D. When appropriate, the short circuit calculations and the clearing times of the phase overcurrent devices will be retrieved from the short-circuit analysis and coordination study models. Ground overcurrent relays should not be taken into consideration when determining the clearing time when performing incident energy calculations.
- E. The short-circuit calculations and the corresponding incident energy calculations for multiple system scenarios must be compared, and the greatest incident energy must be uniquely reported for each equipment location. Calculations must be performed to represent the maximum and minimum contributions of fault current magnitude for all normal and emergency operating conditions. The minimum calculation will assume that the utility contribution is at a minimum and will assume a minimum motor contribution (all motors off). Conversely, the maximum calculation will assume a maximum contribution from the utility and will assume the maximum amount of motors to be operating. Calculations shall take into consideration the parallel operation of synchronous generators with the electric utility, where applicable.
- F. The incident energy calculations must consider the accumulation of energy over time when performing arc flash calculations on buses with multiple sources. Iterative calculations must take into account the changing current contributions, as the sources are interrupted or decremented with time. Fault contribution from motors and generators should be decremented as follows:
  1. Fault contribution from induction motors should not be considered beyond 3 to 5 cycles.
  2. Fault contribution from synchronous motors and generators should be decayed to match the actual decrement of each as closely as possible (e.g., contributions from permanent magnet generators will typically decay from 10 per unit to 3 per unit after 10 cycles).
- G. For each equipment location with a separately enclosed main device (where there is adequate separation between the line side terminals of the main protective device and the work location), calculations for incident energy and flash protection boundary shall include both the line and

load side of the main breaker.

- H. Include Arc Energy Reduction (AER) analysis in study when required by other sections.
- I. When performing incident energy calculations on the line side of a main breaker (as required per the above), the line side and load side contributions must be included in fault calculation.
- J. Miscoordination should be checked among all devices within the branch containing the immediate protective device upstream of the calculation location, and the calculation should utilize the fastest device to compute the incident energy for the corresponding location.
- K. Where it is not physically possible to move outside the flash protection boundary in less than 2 seconds during an arc flash event, a maximum clearing time based on the specific location shall be utilized.
- L. Create and install NFPA 70E compliant labels describing the arc flash hazard level at all switchboards, panelboards, and other locations in the electrical distribution system where work could be performed on energized parts.
- M. Labels shall be vinyl or laminated, with a self-adhesive backing, conform with ANSI Z535.4 Products Safety Signs and Labels standard, and include the following:
  - 1. Arc flash boundary
  - 2. Available incident energy calculated in the analysis and the corresponding working distance, or the arc flash personal protective equipment (PPE category) for the equipment, but not both.
- N. Examples showing the minimum required information follow:
- O. A list of all hazard categories and the corresponding PPE requirements shall be posted in the main electric room, engineering office, or other location. The list shall be plastic laminate or typewritten and housed in a plastic frame.

### **3.4 ADJUSTMENTS**

- A. Manufacturer authorized representative shall set all adjustable protective devices to values indicated in the approved coordination study. Apply settings prior to placing equipment into operation. When the scope of work or execution includes remodel or phases construction, the contractor shall adjust applicable settings as required prior to each system component placed in operation.
- B. Wherever the arc flash incident energy exceeds Arc Flash Category 2 (i.e. greater than  $8 \text{ cal/cm}^2$ ), provide options for adjusting breaker trip times, if possible, to reduce energies to Category 2 or below.

### **3.5 TRAINING**

- A. Provide four hours of Owner training to explain the implications of arc-flash requirements and work permit procedure.

**END OF SECTION**

## SECTION 26 09 33 - LIGHTING CONTROL SYSTEMS

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. Line and low voltage standalone lighting controls
- B. Automatic load control relay (ALCR20)
- C. Distributed lighting control

#### 1.2 RELATED SECTIONS

- A. The lighting system design includes a combination of luminaire sources, lighting control components, programming sequences, and supplementary components for building and energy code compliance. The design uses performance-based specifications for portions of the lighting system to account for the limitation of comparable product solutions available by competitive manufacturers. The Contractor shall reference related specification sections, plans, schedules, and details prior to submitting pricing, submittals, and installation. The Contractor shall coordinate system component compatibility among various manufacturers and suppliers for a turnkey lighting system. Referenced sections include, but are not limited to, the following:
  - 1. 26 51 19 LED Lighting
  - 2. 26 52 15 Emergency Lighting Inverter
  - 3. Electrical Drawings: Plans, luminaire schedules, lighting control sequence of operations, diagrams, and details.

#### 1.3 RELATED WORK

- A. Section 01 91 00 - Commissioning
- B. Section 23 09 00 - Facility Management Control System (FMCS)
- C. Section 26 51 00 - Lighting
- D. Section Insert - Motorized Shades
- E. Section 27 41 00 - Audio/Visual System

#### 1.4 QUALITY ASSURANCE

- A. Manufacturers shall be regularly engaged in the manufacture of lighting control equipment and ancillary equipment, of types and capacities required, whose products have been in satisfactory use in similar service for not less than five (5) years.
- B. All components and assemblies are to be factory pre-tested prior to delivery and installation.
- C. Comply with Electrical Code as applicable to electrical wiring work.
- D. Comply with applicable portions of NEMA standards pertaining to types of electrical equipment and enclosures.
- E. Panels and accessory devices are to be UL listed under UL 916 Energy Management Equipment. Panels and accessories used for control of life safety and critical branch circuits shall be listed under UL 924 Emergency Lighting and Power Equipment.



- F. All assemblies are to be in compliance with FCC emissions standards specified in Part 15 Subpart J for Class A applications.

## **1.5 REFERENCES**

- A. FCC Rules and Regulations, Part 15, Subpart J - Radio Frequency Interference
- B. FS W S 896 Switch, Toggle
- C. NEMA WD 1 - General Color Requirements for Wiring Devices
- D. NEMA WD 7 - Occupancy Motion Sensors
- E. NFPA 70 - National Electrical Code (NEC)
- F. UL Standard 916 Energy Management Equipment
- G. UL 924 - Emergency Lighting and Power Equipment
- H. UL 1472 - Solid-State Dimming Controls

## **1.6 SUBMITTALS**

- A. Submit product data under provisions of Section 26 05 00.
- B. Submit a comprehensive package including devices, hardware, software, product specification, finishes, dimensions, installation instructions, warranty, system software requirements, and roles and responsibilities of all persons and groups involved in installation, execution, and commissioning.
- C. Provide floor plan showing location, orientation, and coverage area of each control device, sensor, and controller/interface. For areas requiring multiple sensor devices for appropriate coverage, submit specific manufacturer-approved sensor layout as an overlay directly on the project drawings, either in print or approved electronic form.
- D. Submit a list of devices and equipment that will be installed for each sequence of operation.
- E. Submit project specific control wiring diagrams showing all equipment, line voltage, and control wiring requirements for all components including, but not limited to, dimmers, relays, low voltage switches, occupancy sensors, control stations, dimmer panels, relay panels, and communication interfaces and programming instructions for each sequence of operation. Include network cable specification and end-of-line termination details, if required.
- F. Project-specific network riser diagram including floor and building level details. Illustrate points of connection to integrated systems. Coordinate integration with mechanical &/or other trades.
- G. Verify acceptance of communications connection to building automation system. Submit BACnet IP parameters.

## **1.7 EXTRA STOCK**

- A. Provide extra stock under provisions of Section 26 05 00.
- B. Sensors, Controls, Power Supplies, and Relays: Five (5) percent of quantity installed. Minimum of two (2) of each configuration and type.
- C. Relays and Dimmer Modules: Five (5) percent of quantity installed. Minimum of two (2) of each

size and type.

- D. Control Stations: One (1) of each configuration and type, except for LCD touch screens requiring factory setup prior to installation.

## **1.8 PROJECT RECORD DOCUMENTS**

- A. Submit project record documents under provisions of Section 26 05 00.
- B. Accurately record location of all controls and devices. Include description of switching sequences and circuiting arrangements.

## **1.9 OPERATION AND MAINTENANCE DATA**

- A. Submit emergency, operation, and maintenance data under provisions of Section 26 05 00. Data shall also include the following:
  - 1. Schedule for routine maintenance, inspection, and calibration of all lighting control devices and system components. Recommended schedule for inspection and recalibration of sensors.
  - 2. Complete narrative describing intended operation and sequence for each control scenario and system component, updated to reflect all changes resulting from commissioning of systems. Narrative shall indicate recommended settings for devices where applicable.
  - 3. Replacement part numbers for all system components.
- B. Identify installed location & labeling for each luminaire controlled by automated lighting controls.
- C. Submit software operating and maintenance manuals, program software backup on compact disc or compatible media with data files, device address list, and a printout of software application and graphic screens, where applicable.

## **1.10 SYSTEM DESCRIPTION**

- A. Performance Statement: This specification section and the accompanying lighting design documents describe the minimum material quality, required features, and operational requirements of the lighting control system (LCS). These documents do not convey every wire that must be installed and every equipment connection that must be made. Based on the performance required of the system, as presented in these documents, the Contractor and system manufacturer/vendor are solely responsible for determining all equipment, wiring, and programming required for a complete and operational system.
- B. Provide an integrated lighting controls system consisting of panels, power supplies, controllers, sensors, relays, switches, devices, wiring, etc. necessary to perform the Lighting Control Sequence of Operation as defined on the plans and specifications. Contractor is responsible for confirming that all components and luminaires interoperate as a single system.
  - 1. Sequence of Operation: Describes the required operation and performance for lighting control in each space. Sequences of operation are indicated on the drawings.
  - 2. Drawings: The drawings include sequences of operation, locations of control interface devices, sensors, and control zones. Wiring and additional equipment to make a complete and functioning system has not been shown, but shall be submitted with the shop drawings.
- C. The following control types and features are acceptable. Acceptable control locations are shown on the drawings.

1. Line Voltage Control: Control equipment consists of traditional line voltage wiring devices and equipment such as switches, dimmers and combination occupancy/vacancy sensor switches, etc.
2. Distributed Control: Control equipment is in the space/zone being controlled; not reliant on centralized controllers.
  - a. All locations shall have the ability to be networked for remote control and monitoring, but network connections are not required.
  - b. SPECIFIER: Paragraph below is not typical for all projects. Edit to suit project.

## **1.11 COMMISSIONING**

- A. Commissioning of a system or systems specified in this section is part of the construction process. Documentation and testing of these systems, as well as training of Owner operation and maintenance personnel, is required in cooperation with Owner Representative and the Commissioning Agent. Project closeout is dependent on successful completion of all commissioning procedures, documentation, and issue closure. Refer to Division 1 for detailed commissioning requirements.
- B. Contractor shall provide all services necessary for compliance with the IECC Section C408 Commissioning. The commissioning shall include, but not be limited to, a commissioning plan, preliminary commissioning report, construction documents, manuals, final commissioning report, and lighting system functional testing.
- C. This project will have selected building systems commissioned. Contractor is responsible to execute commissioning. Commissioning process, equipment, & systems to be commissioned are defined in Division 1. A third-party Commissioning Agent will direct commissioning process.
- D. Contractor shall notify the Commissioning Agent, Architect/Engineer and Owner Representative ten (10) working days prior to scheduled commissioning date.
- E. Commissioning process requires meeting attendance. Refer to Division 1 for meeting requirements.
- F. System shall be functionally tested by a factory-authorized engineer and comply with Sequence of Operation. All loads shall be tested live for continuity and freedom from defects, and all control wiring shall be tested for continuity and connections prior to energizing the system.

## **1.12 WARRANTY**

- A. Manufacturer shall warrant products under normal use and service to be free from defects in materials and workmanship for a period of two (2) years from date of commissioning.
- B. Occupancy, vacancy, daylight sensors and controls shall have a five (5) year warranty from date of Substantial Completion.

## **PART 2 - PRODUCTS**

### **2.1 LIGHTING CONTROLS**

- A. All items of material having a similar function (e.g., switches, dimmers, sensors, contactors, relays, etc.) shall be of the same manufacturer, unless specifically stated otherwise on drawings or elsewhere in the specifications. Lighting control switches, systems, and components shall be listed.
- B. Color of lighting controls and sensors shall match receptacle wiring devices specified in space.

- C. The functions described in the lighting sequence of operation shall dictate the actual lighting control device required to accomplish the functions described for the space.

## **2.2 LIGHTING CONTROL STATION**

- A. The lighting control station shall contain the controls required by the lighting sequence of operation in a common coverplate. The controls may consist of switches, dimmers, occupancy sensors, pushbuttons, etc.
  - 1. In spaces where the wall control station is shown in multiple locations, the sequence of operation shall be the same at all locations, unless noted otherwise.
  - 2. The controls supplier shall prepare control station shop drawings showing arrangement of controls, dimensioned elevations, wiring diagram, and recommended backboxes. The shop drawing submittal should be identified with the lighting sequence that the station provides. Submit data sheets on the switches, dimmers, sensors, buttons, etc. contained in the control station.

## **2.3 DEVICE COLOR**

- A. All switch, lighting controls, and coverplate colors shall be the same as wiring devices, unless indicated otherwise.

## **2.4 COVERPLATES**

- A. All switches and lighting controls shall be complete with coverplates that match material and color of the wiring device coverplates in the space.
- B. Where several devices are ganged together, the coverplate shall be of the ganged style for the number of devices used.
- C. Install nameplate identification as indicated in Section 26 05 53.
- D. Plate-securing screws shall be metal with head color matching the wall plate finish.

## **2.5 WALL SWITCHES**

- A. SW-1P; Single Pole Switch:
  - 1. Single throw, 120/277-volt, 20-amp maintained contact. Toggle handle, side & back wired.

## **2.6 WALL DIMMERS**

- A. UL listed with integral air-gap switch for on/off control.
- B. Integral EMI/RFI suppression.
- C. Non-viewable heat sink.
- D. Dimmer compatibility and wiring with the load being controlled shall be verified by Contractor prior to purchase and installation.
- E. Dimmer to match device color.
- F. SW-OD; Wall 0-10V Dimmer / Occupancy sensor:
  - 1. Wall switch with manual on/auto off. 120VAC load rating of 0-800 W for electronic ballast, LED. 277VAC load rating of 0-1,800 W for electronic ballast, LED. adjustable OFF delay. 0-

10V dimming with up to 30ma sink. Automatic ON/OFF, manual ON/automatic OFF, or occupancy on to predetermined dimming level go to last dimming setting upon occupancy.

## 2.7 LOCAL DAYLIGHTING CONTROLS

### A. Standalone Interior Photo Sensors:

1. SW-LS; Daylight Level Sensor - On/Off Control - One Zone:
  - a. On/Off control. Range of 10-200 FC. Adjustable deadband prevents cycling. Adjustable time delay.
2. SW-LS-3Z; Daylight Level Sensor and Controller - On/Off Control - Three Zones:
  - a. On/off control of up to three 10-amp zones. Range of 10 to 200 FC. Adjustable deadband prevents cycling. Adjustable time delay.
3. SW-LS-D; Daylight Level Sensor and Controller - 0-10V Dimming - One Zone:
  - a. Dimming control of one 0-10V zone. Range of 10 to 200 FC. Adjustable deadband prevents cycling. Adjustable time delay. Coordinated with dimming ballast prior to submittal.
4. SW-LS-D-3Z; Daylight Level Sensor and Controller - Dimming - Three Zones:
  - a. Dimming control of up to three zones of 0-10V. Range of 10 to 200 FC. Adjustable deadband prevents cycling. Adjustable time delay. Coordinate with dimming ballasts prior to submittal.
5. SW-LS-M; Daylight Level Sensor and Controller - Multilevel/Bi-level On/Off Control - Dual Zones:
  - a. Multilevel/bi-level on/off control of up to two 10-amp zones. Range of 10 to 200 FC. Adjustable deadband prevents cycling. Adjustable time delay. [120/277 volt].
6. Sensor shall detect changes in ambient light level and provide triggering of lighting groups in area based on sequence of operation.
7. Sensor shall be configurable via DIP switches at device or via handheld wireless remote programming unit. Settings shall include:
  - a. Ambient sensitivity range between 1 and 1,000 foot-candles.
  - b. Time delay of 5 to 300 seconds.
  - c. Trigger setpoints with deadband adjustment.
8. Sensor shall provide on/off setpoints in quantity as specified on drawings and as shown in the sequence of operation.
9. Sensor shall be ceiling- or wall-mounted for range and viewing angle meeting application requirements as outlined in the sequence of operation.
10. Output signal from sensor shall be linear with light level.

### B. SW-LS-PC; Standalone Exterior Photo Sensors:

1. Sensor shall be within a weatherproof enclosure, with design operation in temperatures of -30°F to +130°F. Sensor shall have threaded stem for box mounting, with knuckle to permit aiming of receptor after installation. Sensor shall be mounted facing north.
2. Sensor shall contain an integral switching contactor rated for 277-volt operation, with loads of up to 1,800 VA. Contacts shall be configured for zero-crossing closure to provide

- 100,000 cycle minimum operation.
- 3. Sensor shall detect changes in daylight levels to provide triggering of exterior lighting equipment based on the sequence of operation.
- 4. Sensor shall be field configurable at the device or via handheld wireless remote controller. Configurable settings shall include:
  - a. Ambient sensitivity range of 5 to 1,500 foot-candles.
  - b. Adjustable setpoint.
  - c. Deadband adjustment by percentage of setpoint.
  - d. Time delay of up to five minutes.
- 5. Sensor shall be equipped with a lens cover that can be applied for system testing during daylight conditions.
- 6. Manufacturers:
  - a. Paragon
  - b. Tork
  - c. Intermatic

## 2.8 INDOOR OCCUPANCY AND VACANCY SENSORS

- A. General Description: Wall- or ceiling-mounting, solid-state units with a separate power supply/relay unit.
  - 1. Operation: Unless otherwise indicated, turn lights on when covered area is occupied and off when unoccupied, with a time delay for turning lights off, adjustable over a minimum range of 1 to 30 minutes. Vacancy sensors require a manual switch operation to turn lights on and off, with a time delay for turning lights off when unoccupied.
  - 2. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor shall be powered from the relay unit.
  - 3. Relay Unit: Dry contacts rated for 20 A ballast load at 120 and 277 VAC, for 13-amp tungsten at 120 VAC, and for 1 hp at 120 VAC. Power supply to sensor shall be 24 V dc, 150-mA, Class 2 power source as defined by Electrical Code.
  - 4. Mounting:
    - a. Sensor: Suitable for mounting in any position on a standard outlet box.
    - b. Relay: Externally mounted through a 1/2-inch knockout in a standard electrical enclosure. Mount relay above accessible ceiling near entry door to room or area.
    - c. Time Delay and Sensitivity Adjustments: Recessed and concealed.
  - 5. Indicator: LED to show when motion is being detected during testing and normal operation of the sensor.
  - 6. Bypass Switch: Override the on function in case of sensor failure.
  - 7. Power Supply and Child Packs: Provide as required for sensor quantity and switching scheme. Mount to standard 1/2" knockout on electrical box above accessible ceiling near entry door to room or area. Sensor power shall be from emergency circuit if emergency lighting is in the area.
  - 8. Detection Coverage (Room): Detect occupancy anywhere in an area based on hand motion.
  - 9. Detection Coverage (Corridor): Detect occupancy based on a half-step motion.
  - 10. Warranty: Five (5) year warranty.
- B. Dual-Technology Type: Detect occupancy by using a combination of PIR and ultrasonic detection methods in area of coverage. Particular technology or combination of technologies that controls on and off functions shall be selectable in the field by operating controls on unit.
  - 1. SW-VS-D or SW-OC-D; 360 Degree Coverage Pattern:
    - a. Frequency greater than 40 KHz. Dual sensing verifications (requires both technologies

to activate), either technology maintains on status. Integrated ambient light level sensor (2 to 200 FC range), adjustable sensitivity and time delay. Sensor shall control all circuits in area, unless noted otherwise. Initial settings: ambient sensor 40 FC.

2. SW-VS-D-W or SW-OC-D-W; Wall Mounted on Adjustable Swivel Mount:
    - a. Wall or ceiling sensor with adjustable settings to allow manual on/auto off or auto on/auto off. Integrated ambient light level sensor (2 to 100 FC range).
  3. SW-O; Wall Switch:
    - a. Wall switch with manual on/auto off. 120/277 VAC load rating of 0-800 W for ballast, LED or tungsten. 5-, 15-, 30-minute adjustable OFF delay. Coverage of minor motion in 12' x 15' pattern.
  4. SW-O2; Wall Switch:
    - a. Multi-relay wall switch with manual on/auto off for two separate loads. 120/277 VAC load relay rating of 0-800 W for ballast, LED or tungsten. 5-, 15-, 30-minute adjustable OFF delay. Coverage of minor motion in 12' x 15' pattern.
  5. Sensitivity Adjustment: Separate for each sensing technology.
  6. Detection Coverage:
    - a. Task Areas: Detect occupancy anywhere in an area based on hand motion.
    - b. Circulation Areas: Detect occupancy anywhere in an area based upon half-step walking motion.
- C. Mask sensors where necessary to prevent nuisance switching from adjacent areas.
- D. Ultrasonic Type: Ceiling mounting. Detect occupancy by sensing a change in pattern of reflected ultrasonic energy in area of coverage.
1. SW-OC-U; 360 Degree 20' x 20' Hand Motion Coverage Pattern:
    - a. Frequency greater than 32 KHz solid state, adjustable sensitivity and time delay, [integral isolated 1-amp relay contact], temperature and humidity resistant receivers. Sensor shall control all circuits in area, unless noted otherwise.
    - b. Manufacturers:
      - 1) Watt Stopper WT-1100 series
      - 2) Hubbell OMNI-US or ATU series
      - 3) Leviton OSC series
      - 4) Greengate ODC-U series
  2. SW-OC-U2; 35' x 30' Hand Motion Coverage Pattern:
    - a. Frequency greater than 32 KHz solid state, adjustable sensitivity and time delay, [integral isolated relay contact], temperature and humidity resistant receivers. Sensor shall control all circuits in area, unless noted otherwise.
    - b. Manufacturers:
      - 1) Watt Stopper WT-2200 series
      - 2) Hubbell OMNI-US or ATU series
      - 3) Leviton OSC series
      - 4) Greengate ODC-U series

3. SW-OC-U-A; 360 Degree Two-Sided Corridor Coverage Pattern:
  - a. Frequency greater than 32 KHz solid state, adjustable sensitivity and time delay, [integral isolated relay contact], temperature and humidity resistant receivers. Sensor shall control all circuits in area, unless noted otherwise.
  - b. Manufacturers:
    - 1) Watt Stopper WT-2250 Series
    - 2) Hubbell OMNI-US or ATU series
    - 3) Greengate ODC-U Series
4. SW-OC-U-W; Wall Mounted:
  - a. Wall switch with adjustable settings to allow manual on/auto off or auto on/auto off.
  - b. Manufacturers:
    - 1) Watt Stopper UW-100 Series
    - 2) Hubbell AU1277I,
5. Crystal controlled with circuitry causing no detection interference between adjacent sensors.

## 2.9 AUTOMATIC LOAD CONTROL RELAY (ALCR) (INDIVIDUAL LUMINAIRE-INTEGRAL)

- A. This section includes information related to factory and field installed ALCR devices intended for individual luminaires.
- B. ALCR3; Automatic Load Control Relay ALCR, 120/277 volt, dry/damp listed, 32°F to 113°F (0°C to 45°C) operating temperature, plenum NEMA 1 rated, test button with visual indicator, remote test and fire alarm control, listed for factory or field installation within luminaire, UL924 listed latest edition, Electrical Code Article 700 compliant.
  1. Rating: 3 Amp LED driver, ballast, or incandescent.
  2. Lighting Control Coordination: Provide ALCR device compatible with designated lighting zone controls. Example: Switched, 0-10 volt dimming, DALI control, 2 wire dimming, or DMX.
  3. Operation:
    - a. ALCR device shall allow same local lighting control devices to control both normal lights and emergency designated lighting. Devices that require separate local lighting controls for normal and designated emergency lighting are NOT allowed.
    - b. ALCR device shall monitor the normal power circuit and shunt/bypass the local lighting controls upon loss of power, remote test switch, or fire alarm override to provide full lumen output for designated emergency lighting.
    - c. ALCR device shall return designated emergency lighting to local lighting control after a 15-minute delay upon return of normal power or remote test/fire alarm override release.
    - d. Performance Equivalent by Other Components: A limitation of equivalent comparable products may require some of the required functions of ALCR device to be provided by an alternative component of the lighting control system. The following functions may be performed by alternative components of lighting control system when the device is listed for required function and compatible with lighting control system.
      - 1) Remote test switch / fire alarm override interface.
      - 2) The 15-minute time delay upon return of normal power or remote test/fire alarm override release.
    - e. Accessory - Remote Test Switch: Provide a remote button test switch for all [ALCR3] devices associated with the same lighting control zone. The test switch shall be a single gang type switch compatible with the ALCR device and allow the



remote fire alarm override to function.

- 1) Test Switch Mounting:
  - a) Finished Spaces (ceiling height 10 feet or less): Flush mount device in finished ceiling adjacent to one of the emergency lights.
  - b) Finished Spaces (ceiling height greater than 10 feet): Flush mounted in wall. Refer to Architect/Engineer for location.
  - c) Unfinished Spaces: Adjacent and aligned with local wall-mounted lighting controls.

4. Manufacturers:

- a. LVS Controls EPC-2-FM (switched)
- b. EPC-2-D-FM Series (0-10V dimming)
- c. EPC Series (alternative lighting control)
- d. Iota ETS-step (switched)
- e. ETC-DR (0-10V dimming)
- f. ETC Series (alternative lighting control)
- g. Lighting control manufacturer

## 2.10 AUTOMATIC LOAD CONTROL RELAY (ALCR)

- A. ALCR20; Automatic Load Control Relay ALCR, 120/277 volt, dry/damp listed, 32°F to 113°F (0°C to 45°C) operating temperature, plenum NEMA 1 rated, test button with visual indicator, remote test and fire alarm control, UL924 listed latest edition, Electrical Code Article 700 compliant.

1. Rating:

- a. 20 amp (16 A permitted) LED driver and ballast.
- b. 10 A (1,200 watt) incandescent.

2. Lighting Control Coordination: Provide ALCR device compatible with designated lighting zone controls. Example: switched, 0-10 volt dimming, DALI control, 2 wire dimming, or DMX.

3. Operation:

- a. ALCR device shall allow the same local lighting control devices to control both the normal lights and emergency designated lighting. Devices requiring separate local lighting controls for normal and designated emergency lighting are NOT allowed.
- b. ALCR device shall monitor the normal power circuit and shunt/bypass the local lighting controls upon loss of power, remote test switch, or fire alarm override to provide full lumen output for designated emergency lighting.
- c. ALCR device shall return designated emergency lighting to local lighting control after a 15-minute delay upon return of normal power or remote test/fire alarm override release.
- d. Equivalent Facilitation and Performance: A limitation of equivalent comparable products may require some of the required functions of the ALCR device to be provided by an alternative component of the lighting control system. The following functions may be performed by alternative components of the lighting control system when the device is listed for the required function and compatible with the lighting control system:
  - 1) Remote test switch / fire alarm override interface.
  - 2) The 15-minute time delay upon return of normal power or remote test/fire alarm override release.
- e. Accessory - Remote Test Switch: Provide a remote button test switch. The test switch shall be a single gang type switch compatible with the ALCR device and

allow the remote fire alarm override to function.

- 1) Test Switch Mounting:
  - a) Finished Spaces (ceiling height 10 feet or less): Flush mount device in finished ceiling adjacent to one of the emergency lights.
  - b) Finished Spaces (ceiling height greater than 10 feet): Flush mounted in wall. Refer to Architect/Engineer for location.
  - c) Unfinished Spaces: Adjacent and aligned with local wall-mounted lighting controls.
  - d) Option: ALCR device(s) with a test button, visual indicator, and flush mounting plate may be installed in the location of the remote test switch in lieu of providing a separate remote test switch.

4. Manufacturers:

- a. LVS Controls EPC-2 (switched)
- b. EPC-2-D Series (0-10V dimming)
- c. EPC-DMX (DMX) EPC Series (alternative lighting control)
- d. Iota ETS-20 (switched)
- e. ETC-20-DR (0-10V dimming)
- f. ETC Series (alternative lighting control)
- g. Myers Emergency Power Systems RLY-SW-2 (switched)
- h. RLY-DIM-2D (0-10V dimming)
- i. RLY Series (alternative lighting control)
- j. Nine24 Inc ELCR-R (switched)
- k. ELCR-Z10 (0-10V dimming)
- l. ELCR Series (alternative lighting control)
- m. Lighting control manufacturer

## 2.11 DISTRIBUTED LIGHTING CONTROL

- A. Manufacturers: as listed below meet the qualifications as outlined in this specification. Contractor is responsible for verifying that selected manufacturer is capable of furnishing the complete system as specified herein.
  1. Acuity Controls nLight Series
  2. Legrand Watt Stopper DLM Series
  3. Eaton Greengate RC3 Series (room-based system)
  4. Lutron
- B. System Description: The lighting control system shall be a network of remote modules System includes all associated wiring, relay modules, photocells, switches, dimmers, time clock, occupancy sensors. System shall utilize distributed relays modules, allowing these relay modules to be located above accessible ceilings in or adjacent to rooms they are controlling.
- C. Control Devices: All occupancy sensors (ultrasonic, IR and dual technology type), photocells, switches, and timers shall be provided with system and designed to operate on system network. Supplemental power packs shall be provided as required for multiple control devices. This equipment shall be identified in shop drawing submission.
- D. Relay Modules: Mounted in NEMA enclosure with physically separate 120/277-volt wiring compartment from low voltage control wiring. Provide low voltage digital communication to control devices as shown on drawings and schedules. Supplemental power packs shall be provided as required for multiple control devices. This equipment shall be identified in shop drawing submission. Dimmable relay modules shall be provided where indicated. Relay modules shall contain up to four (4) relays. Relay modules shall be labeled with room number that relays control lighting within.

- E. Single-Pole Relays: Mechanically held unless otherwise indicated; split-coil, momentary-pulsed type, rated 20 A, 125-volt AC for tungsten filaments and 20 A, 277-volt AC for electronic ballasts, 50,000 cycles at rated capacity.
- F. System shall include server / central station with operating software, data network, and BACnet IP communication with other systems as described. System communication protocol shall be compatible with the building automation system.
- G. System server / central station shall provide programmable operation of lights connected via system relays and controlled with system devices. System software shall provide control of relays and control devices, time and sequence scheduling, timed out and blink light operation, and monitoring and reporting of system events and components. Initial programming shall be as shown on plans and schedules.
- H. Server / Central Control Station: Lighting control system manufacturer shall be responsible to assure coordination between relay modules, network hubs, and control system server/ central station such that system performs as described. Server shall be provided with monitor, keyboard, and mouse, and plugged into a receptacle connected to an equipment emergency circuit as a minimum.
- I. Network Hub: Network Hub shall contain processor and astronomic time clock for control and monitoring of lighting. Network hub shall be fed from an equipment emergency circuit at a minimum.

## **2.12 CONDUCTORS AND CABLES**

- A. Control Wiring:
  - 1. Where installed with the line-voltage wiring, control wiring shall be copper conductors not smaller than No.16 AWG with insulation voltage rating and temperature rating equal to that of the line-voltage wiring, complying with Division 26 Section 26 05 13 "Wire & Cable."
  - 2. Tap conductors to switches or relays: Stranded copper conductors of 16 AWG or solid 16 or 18 AWG with insulation rating equal to that of the line-voltage wiring.
  - 3. Tap conductors to dimming ballasts: Solid copper conductors of 18 AWG with insulation voltage rating equal to that of the line-voltage wiring and insulation temperature rating not less than 90°C.
  - 4. Network cabling as required by manufacturer.
- B. Splices and Taps:
  - 1. Tapping or wire trap connectors shall be used to splice all Class 1 and Class 2 control wiring. Twist-on, wire-nut type connectors are not allowed.

## **PART 3 - EXECUTION**

### **3.1 PRE-CONSTRUCTION MEETING**

- A. Schedule a pre-construction meeting with the controls representative, installing contractor, Architect/Engineer, and Owner to explain the proposed lighting control and distributed systems.

### **3.2 EXAMINATION**

- A. Verify surfaces are ready to receive work.
- B. Verify field dimensions and coordinate physical size of all equipment with the architectural requirements of the spaces into which they are to be installed. Allow space for adequate

ventilation and circulation of air.

- C. Verify required utilities are available, in proper location, and ready for use.
- D. Beginning of installation means installer accepts existing conditions.

### 3.3 INSTALLATION

- A. Install in accordance with manufacturer instructions and approved shop drawings.
- B. All wiring shall be installed in conduit. **Class II low voltage control wiring may be open wiring and shall maintain 150 mm (6 inch) spacing from electronic ballast and other RFI/EMI sources.**
- C. All branch load circuits shall be live tested before connecting loads to the lighting control panel.

### 3.4 SUPPORT SERVICES

- A. System Startup:
  - 1. Manufacturer shall provide factory authorized technician to confirm proper installation and operation of all system components.
- B. Testing:
  - 1. System shall be completely functional tested by a factory-authorized technician. All loads shall be tested live for continuity and freedom from defects, and all control wiring shall be tested for continuity and connections prior to energizing the system components.
  - 2. Programming of initial zones, schedules, lighting levels, control station groups, and sensor settings shall be performed by a factory-authorized technician. Lighting Control Sequence of Operation shall serve as a basis for programming, However, all final decisions regarding groups and schedules shall be at the direction of the Owner. The following procedures shall be performed at a minimum:
    - a. Confirm occupancy sensor placement, sensitivity, and time delay settings to meet specified performance criteria.
    - b. Confirm daylight sensor placement, sensitivity, deadband, and delay settings to meet specified performance criteria.
    - c. Confirm that schedules and time controls are configured to meet specified performance criteria and Owner's operating requirements.
  - 3. Verify occupancy/vacancy and daylight sensor operation is correct after furniture and equipment is installed in each area. Make adjustments to sensor settings and time delays to allow proper operation.
  - 4. Verify occupancy/vacancy sensors are located to provide complete coverage for the area served with no nuisance switching.
    - a. Relocate sensors or provide additional sensors as necessary to provide adequate coverage.
    - b. Mask occupancy sensors where necessary to prevent nuisance switching from adjacent areas.
- C. Training:
  - 1. Manufacturer shall provide competent factory-authorized technician to train Owner personnel in the operation, maintenance and programming of the lighting control system. Submit training plan with notification seven (7) days prior to proposed training dates.
  - 2. Training duration shall be no less than three (3) days, with one (1) day being scheduled

at least two (2) weeks after initial training.

D. Documentation:

1. Manufacturer shall provide system documentation including:
  - a. System one-line showing all panels, number and type of control stations and sensors, communication line, and network or BMS/BAS interface unit.
  - b. Drawings for each panel showing hardware configuration and numbering.
  - c. Panel wiring schedules.
  - d. Typical diagrams for each component.

### 3.5 SYSTEM COMMISSIONING

- A. Contractors' tests shall be scheduled and documented in accordance with the commissioning requirements. Refer to Section 01 09 00, General Commissioning, for further details.
- B. System verification testing is part of the commissioning process. Verification testing shall be performed by the Contractor and witnessed and documented by the Commissioning Agent. Refer to Section 01 09 00, General Commissioning, for system verification tests and commissioning requirements.
- C. Training of the Owner operation and maintenance personnel is required in cooperation with the Owner's Representative. The instruction shall be scheduled in coordination with the Owner's Representative after submission and approval of formal training plans. Refer to Section 01 09 00, General Commissioning, for Contractor training requirements.

## PART 4 - NLIGHT CONTROLS SYSTEM

### 4.1 SUMMARY

- A. Section includes a networked lighting control system comprised of the following components.
- B. System software interfaces.
  1. Management Interface
- C. System Backbone and Integration Equipment
  1. System Controller
- D. Wired Network Devices
  1. Wall Stations
  2. {nLAiod} Auxillary Input/Output Devices
  3. Occupancy and Photocell Sensors
  4. Wall Switch Sensors
  5. Power Packs and Secondary Packs
  6. {nLCb} Communication Bridge
- E. Wireless Networked Devices
  1. Wireless Networked Outdoor Occupancy and Photosensors
  2. Wireless Networked Indoor Embedded Sensors
  3. Wireless Networked Luminaires
- F. The networked lighting control system shall meet all the characteristics and performance requirements specified herein.
- G. The contractor shall provide, install and verify proper operation of all equipment necessary for

proper operation of the system as specified herein and as shown on applicable drawings.

#### **4.2 SYSTEM PERFORMANCE REQUIREMENTS**

- A. System shall have an architecture that is based upon three main concepts: (1) networkable intelligent lighting control devices, (2) standalone lighting control zones using distributed intelligence, (3) optional system backbone for remote, time based and global operation.
- B. Intelligent lighting control devices shall have individually addressable network communication capability and consist of one or more basic lighting control components: occupancy sensor, photocell sensor, relay, dimming output, contact closure input, analog 0-10V input, and manual wall station capable of indicating switching, dimming, and/or scene control. Combining one or more of these components into a single device enclosure shall be permissible so as to minimize overall device count of system.
- C. System shall have an architecture that is based upon three main concepts: (1) networkable intelligent lighting control devices, (2) standalone lighting control zones using distributed intelligence, (3) optional system backbone for remote, time based and global operation.
- D. Networked luminaires and intelligent lighting control devices shall support individual (unique) configuration of device settings and properties, with such configuration residing within the networked luminaires and intelligent control devices.
- E. Lighting control zones consisting of one or more networked luminaires and intelligent lighting control devices and shall be capable of providing automatic control from sensors (occupancy and/or photocell) and manual control from local wall stations without requiring connection to a higher-level system backbone; this capability is referred to as "distributed intelligence."
- F. Lighting control zones (wired and wireless) of at least 128 devices per zone shall be supported.
- G. Networked luminaires and intelligent lighting control devices shall have distributed intelligence programming stored in non-volatile memory, such that following any loss of power the lighting control zones shall operate according to their defined default settings and sequence of operations.
- H. Lighting control zones shall be capable of being networked with a higher-level system backbone to provide time-based control, remote control from inputs and/or systems external to the control zone, and remote configuration and monitoring through a software interface.
- I. System may include one or more system controllers that provide time-based control. System controller also provides a means of connecting the lighting control system to a system software interface and building management systems via BACnet/IP or BACnet MS/TP protocol.
- J. All system devices shall support firmware update, either remotely or from within the applications space, for purposes of upgrading functionality at a later date.

**END OF SECTION**

## **SECTION 26 20 00 - SERVICE ENTRANCE**

### **PART 1 - GENERAL**

#### **1.1 SECTION INCLUDES**

- A. Arrangement with Owner for permanent electric service for Graham Hall and Lincoln Hall.
- B. Underground service entrance
- C. 26 05 26 Grounding and Bonding

#### **1.2 RELATED SECTIONS AND WORK**

- A. Refer to the One-Line Diagram for additional information.

#### **1.3 SYSTEM DESCRIPTION**

- A. System Voltage: 208Y/120 volts, three-phase, four-wire, 60 Hertz.

### **PART 2 - EXECUTION**

#### **2.1 INSTALLATION**

- A. Make arrangements with the owner for all utility work.
- B. Primary campus conductors shall be furnished, installed, and terminated by the electrical contractor. Primary conduit shall be furnished and installed by the electrical Contractor, and as shown on the drawings, to Owner requirements.
- C. Underground - Graham Hall: Install service entrance conduits from existing connection cabinet, refer to plans. Contractor shall provide all lugging, any and all connections from existing service connection cabinet to provide Graham Hall power.
- D. Underground - Lincoln Hall: Contractor shall disconnect existing service transformer from Lincoln Hall and relocate as shown on plans. Utilize existing primary cabling as possible and make reconnection and grounding as required. Provide all new service lateral wiring and raceway for a complete system for Lincoln Hall. Refer to plans.

**END OF SECTION**

## SECTION 26 24 13 - SWITCHBOARDS

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. Main and distribution switchboards

#### 1.2 RELATED SECTIONS AND WORK

- A. Refer to the Electrical Distribution Diagram & Electrical Schedules for size, rating, & configuration.

#### 1.3 REFERENCES

- A. ANSI C12 - Code for Electricity Metering
- B. ANSI C39.1 - Requirements for Electrical Analog Indicating Instruments
- C. ANSI C57.13 - Requirements for Instrument Transformers
- D. NEMA AB 1 - Molded Case Circuit Breakers
- E. NEMA KS 1 - Enclosed Switches
- F. NEMA PB 2 - Dead Front Distribution Switchboards
- G. NEMA PB 2.1 - Instructions for Safe Handling, Installation, Operation and Maintenance of Deadfront Switchboards Rated 600 Volts or less

#### 1.4 SUBMITTALS

- A. Submit product data under provisions of Section 26 05 00.
- B. Include front and side views of enclosures with overall dimensions shown; conduit entrance locations and requirements; nameplate legends; size and number of bus bars per phase, neutral, and ground; switchboard instrument details; instructions for handling and installation of switchboard; and electrical characteristics including voltage, frame size and trip ratings, withstand ratings, and time-current curves of all equipment and components.
- C. Selective Coordination Study: Submit study to prove that all essential electrical systems, emergency systems and legally required standby system panelboards are selectively coordinated with all supply side overcurrent protective devices.
- D. Arc Energy Reduction Documentation: Submit documentation to demonstrate the arc energy reduction system is set to operate at a value below the available arcing current.
- E. Submit manufacturer's instructions under provisions of Section 26 05 00.

#### 1.5 SPARE PARTS

- A. Keys: Furnish four each to the Owner.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to the site under provisions of Section 26 05 00.
- B. Deliver in 48-inch maximum width shipping splits, unless approved otherwise by both the



Contractor and Architect/Engineer, individually wrapped for protection, and mounted on shipping skids.

- C. Store and protect products under provisions of Section 26 05 00.
- D. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- E. Handle in accordance with NEMA PB2.1 and manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to switchboard internal components, enclosure, and finish.

## **1.7 OPERATION AND MAINTENANCE DATA**

- A. Submit operation and maintenance data under provisions of Section 26 05 00.
- B. Include spare parts data listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.

## **PART 2 - PRODUCTS**

### **2.1 GENERAL**

- A. Approved Manufacturers:
  - 1. Square D Class 2700 QED-2, I-Line, Powerstyle
  - 2. ABB Spectra / Evolution
  - 3. Siemens
  - 4. Eaton

### **2.2 RATINGS**

- A. Definitions:
  - 1. Series rated equipment shall be defined as equipment that can achieve a required UL AIC rating with an upstream device such as a main breaker or a combination of devices to meet or exceed a required UL AIC rating. All series rated equipment shall have a permanently attached nameplate indicating that device rating must be maintained. Refer to Section 26 05 53 for additional requirements.
  - 2. Fully rated equipment shall be defined as equipment where all devices in that equipment shall carry a minimum of the AIC rating that is specified.
- B. The switchboards for this project shall be fully rated.

### **2.3 SWITCHBOARD CONSTRUCTION AND RATINGS**

- A. Factory-assembled, dead front, metal-enclosed, and self-supporting switchboard assembly conforming to NEMA PB2, and complete from incoming line terminals to load-side terminations.
- B. Switchboard electrical ratings and configurations as shown on the drawings.
- C. Line and Load Terminations: Accessible from the front only of the switchboard, suitable for the conductor materials used.
- D. Main Section Devices: Individually mounted and compartmented.

- E. Distribution Section Devices: Group mounted.
- F. Auxiliary Section Devices: Individually mounted and compartmented.
- G. Bus Material: Aluminum with tin plating, sized in accordance with NEMA PB 2.
- H. Bus Connections: Bolted, accessible from front only for maintenance. Plug-on connections may be utilized with Architect/Engineer's pre-approval by addenda.
- I. Bus bars shall be fully isolated, braced for minimum ampere rms symmetrical rating as indicated on drawings.
- J. Bus shall extend the full height of the distribution sections to provide space for future breakers.
- K. Provide a 1 X 1/4-inch copper ground bus through the length of the switchboard.
- L. Provide metering transformer compartment for Utility Company's use. Compartment size, bus spacing and drilling, door, and locking and sealing requirements shall be in accordance to Section 26 20 00 and Utility Company specifications.
- M. Enclosure shall be NEMA PB 2; Type 1 - General-Purpose. Sections shall align at front and rear. Provide removable panel access or hinged door with flush lock and all keyed alike. Door hardware shall provide swing clear operation (180-degree swing).
- N. Switchboard Height: NEMA PB 2; 92 inches, excluding floor sills, lifting members & pull boxes.
- O. Maximum Dimensions: <Insert> "L x <Insert> "W x <Insert> "H.
- P. Finish: Manufacturer standard light gray enamel over external surfaces. Coat internal surfaces with minimum one coat corrosion-resisting paint, or plate with cadmium or zinc.
- Q. Pull Box: Same construction as switchboard, size as shown on the drawings. Top and sides shall be removable. Insulating, fire-resistive bottom with separate openings for each circuit to pass into switchboard.
- R. Pull Section: Same construction as switchboard, size as shown on the drawings. Depth and height to match switchboard. Arrange as shown on the drawings.
- S. Future Provisions: In addition to the spare devices shown, provide a minimum of 15 inches of fully equipped space for future devices with bussing and bus connections, suitably insulated and braced for short circuit currents. Continuous current rating as indicated on the drawings.
- T. Suitable for use as service entrance equipment. Provide line side (service style) barriers.

## **2.4 SWITCHING, OVER-CURRENT PROTECTIVE DEVICES, & ARC ENERGY REDUCTION**

- A. Arc Energy Reduction:
  1. Provide an arc energy reduction system to reduce the clearing time of an arc flash event. The arc energy reduction system shall be provided for overcurrent protection devices rated 1,200 amps or larger.
  2. Energy-Reducing Maintenance Switch: Provide an energy-reducing maintenance switch visual status indication when engaged. Install the maintenance switch at the entrance to the electrical room.
  3. The following selective coordination & arc energy reduction system options are acceptable:
    - a. Zone-selective interlocking with permanent arc energy reduction

- b. Differential relaying with permanent arc energy reduction
- c. Listed energy-reducing active arch flash mitigating system

## **2.5 INSTRUMENTS AND SENSORS**

- A. [DPM]; Digital AC Power Monitor: Capable of measuring, calculating and directly displaying; Volts (L-L, L-N), Amps, KW, KWH. Monitor shall be true RMS measurement with programmable set-up parameters. All set-up parameters data shall be stored in non-volatile memory to protect from power outages.

## **2.6 ACCESSORIES**

- A. Provide REQUIRED accessories as described below. Provide SCHEDULED accessories when listed with plan schedules. Refer to plan schedules for additional requirements.
- B. Barriers: Provide finger safe barriers for lineside uninsulated and ungrounded terminations and components which remain energized when main disconnecting device is 'OPEN'. REQUIRED
- C. Barriers (Service Equipment): Provide solid barriers for lineside uninsulated and ungrounded terminations and components which remain energized when main disconnecting device is 'OPEN'. REQUIRED

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Install switchboard in locations shown on the drawings, in accordance with manufacturer written instructions and NEMA PB 2.1.
- B. Tighten accessible bus connections and mechanical fasteners after placing switchboard.
- C. Install fuses in each switch.

### **3.2 FIELD QUALITY CONTROL**

- A. Inspect completed installation for physical damage, proper alignment, anchorage, & grounding.
- B. Measure insulation resistance of each bus section phase to phase and phase to ground for one minute each. Test voltage shall be 1000 volts, and minimum acceptable value for insulation resistance is 2 megohms.
- C. Check tightness of accessible bolted bus joints using a calibrated torque wrench. Tightness shall be in accordance with manufacturer's recommended values.
- D. Physically test key interlock systems to ensure proper function.

### **3.3 ADJUSTING AND CLEANING**

- A. Adjust all operating mechanisms for free mechanical movement.
- B. Touch up scratched or marred surfaces to match original finish.
- C. Provide time/current trip curves for all adjustable protection devices that require setting. Also provide curves and equipment information for associated new and existing fixed devices that require coordination with new protection devices. Submit time/current curves in hard copy or electronic format.

- D. Adjust trip and time delay settings to values as scheduled, or as instructed by Architect/Engineer.
- E. Where two levels of ground fault are provided, test ground fault circuit breakers to prove selective coordination in accordance with manufacturer directions. Provide testing documentation with Operating & Maintenance Manual submittals.

**END OF SECTION**

## SECTION 26 24 16 - PANELBOARDS

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. Service and distribution panelboards:
- B. Lighting and appliance branch circuit panelboards:

#### 1.2 RELATED SECTIONS AND WORK

- A. Refer to the Electrical Distribution Diagram & Electrical Schedules for size, rating, & configuration.

#### 1.3 REFERENCES

- A. NEMA AB 1 - Molded Case Circuit Breakers
- B. NEMA FU 1 - Low voltage cartridge fuses
- C. NEMA KS 1 - Enclosed Switches
- D. NEMA PB 1 - Panelboards
- E. NEMA PB 1.1 - Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less
- F. NEMA PB 1.2 - Application Guide for Ground-fault Protective Devices for Equipment
- G. UL 67 - Panelboards

#### 1.4 SUBMITTALS

- A. Submit shop drawings for equipment & component devices under provisions of Section 26 05 00.
- B. Include outline and support point dimensions, voltage, main bus ampacity, integrated short circuit ampere rating, circuit breaker and fusible switch arrangement and sizes.
- C. Selective Coordination Study: Submit study to prove that all essential electrical systems, emergency systems and legally required standby system panelboards are selectively coordinated with all supply side overcurrent protective devices.
- D. Arc Energy Reduction Documentation: Submit documentation to demonstrate the arc energy reduction system is set to operate at a value below the available arcing current.
- E. Refurbished branch panel enclosure documentation for new branch panelboards installed in existing enclosures.
- F. Submit manufacturer's instructions under provisions of Section 26 05 00.

#### 1.5 SPARE PARTS

- A. Keys: Furnish four (4) each to the Owner.
- B. Fuses: Furnish 10% or a minimum of three (3) spare fuses of each type & rating installed to Owner.

## **PART 2 - PRODUCTS**

### **2.1 RATINGS**

- A. Definitions:
  - 1. Series rated equipment shall be defined as equipment that can achieve a required UL AIC rating with an upstream device such as a main breaker or a combination of devices to meet or exceed a required UL AIC rating. All series rated equipment shall have a permanently attached nameplate indicating that device rating must be maintained. See Section 26 05 53 for additional requirements.
  - 2. Fully rated equipment shall be defined as equipment where all devices in that equipment shall carry a minimum of the AIC rating that is specified.
- B. The panelboards for this project shall be fully rated unless otherwise specifically noted in the Drawings or Specifications.

### **2.2 MAIN AND DISTRIBUTION PANELBOARDS**

- A. General
  - 1. Manufacturers:
    - a. Square D QMB, I-Line
    - b. ABB ReliaGear Entelleon
    - c. Siemens F2, P4
    - d. Eaton PRL4, PRL5
- B. Panelboards: NEMA PB 1; type as shown on the drawings.
- C. Enclosure: NEMA PB 1; Type 1.
- D. Provide cabinet front with concealed trim clamps and hinged trim on door to allow access to wiring gutters without removal of trim and flush lock. Door hardware shall provide swing clear operation (180-degree swing). Finish in manufacturer's standard gray enamel.
- E. Provide panelboards with copper bus, ratings as scheduled on the drawings. Provide copper ground bus in all panelboards.
- F. All spaces shown on the one-line diagram shall be fully prepared spaces for future breakers.
- G. Minimum Integrated Short Circuit Rating: 100,000 amperes rms symmetrical for 240-volt panelboards; 50,000 amperes rms symmetrical for 480-volt panelboards, or as shown on drawings.
- H. Fuse Clips (Switches 600 Amperes and Smaller): Provide with Class 'R' rejection clips. Fuse Clips (601 Amperes and Larger): Designed to accommodate Class 'L' fuses.
- I. Molded Case Circuit Breakers: Provide circuit breakers with integral thermal and instantaneous magnetic trip in each pole.
- J. Molded Case Circuit Breakers with Current Limiters: Provide circuit breakers with replaceable current limiting elements, in addition to integral thermal & instantaneous magnetic trip in each pole.
- K. Current Limiting Molded Case Circuit Breakers: Provide circuit breakers with integral thermal and instantaneous magnetic trip in each pole, coordinated with automatically resetting current limiting elements in each pole. Interrupting rating 100,000 symmetrical amperes, let-through current and energy level less than permitted for same size Class RK-5 fuse.

- L. Solid State Molded Case Circuit Breakers: (All breakers identified on plans as solid-state with 1,200 ampere frame sizes and below.) Provide molded case switch with electronic sensing, timing, and tripping circuits for fully adjustable time current characteristic settings including ground fault trip, instantaneous trip, long time trip, long time delay, short time trip, and short time delay. Trip setting shall be field programmable with restricted access and a sealable clear cover.
- M. Arc Energy Reduction:
  - 1. Provide an arc energy reduction system to reduce the clearing time of an arc flash event. The arc energy reduction system shall be provided for overcurrent protection devices rated 1,200 amps or larger.
  - 2. Energy-Reducing Maintenance Switch: Provide an energy-reducing maintenance switch visual status indication when engaged. Install the maintenance switch at the entrance to the electrical room.
- N. Suitable for use as service entrance equipment. Provide line side (service style) barriers.
- O. Maximum Dimensions: <Insert> "L x <Insert> "W x <Insert> "H.

### **2.3 BRANCH CIRCUIT PANELBOARDS**

- A. General
  - 1. Manufacturers:
    - a. Square D NQ, NF
    - b. ABB A Series
    - c. Siemens P1
    - d. Eaton PRL1, PRL2
- B. Lighting and Appliance Branch Circuit Panelboards: NEMA PB 1; circuit breaker type.
- C. Enclosure: NEMA PB 1; Type 1.
- D. Provide cabinet front with door-in-door construction, concealed hinge, and flush lock all keyed alike. Door hardware shall provide swing clear operation (180-degree swing). Finish in manufacturer's standard gray enamel.
- E. Provide panelboards with copper bus, ratings as scheduled on the drawings. Provide copper ground bus in all panelboards.
- F. All unlabeled circuits shown on the panelboard schedule shall be fully prepared spaces for future breakers.
- G. All multiple-section panelboards shall have same dimensional back box and cabinet front size.
- H. Minimum Integrated Short Circuit Rating: As shown on the drawings.
- I. Provide handle lock-on devices for all breakers serving exit sign and lighting circuits with emergency battery units. Provide handle lock-on devices and red handles for breakers serving fire alarm panels.
- J. Molded Case Circuit Breakers: Bolt-on type thermal magnetic trip circuit breakers, with common trip handle for all poles. Provide circuit breakers UL listed as Type SWD for lighting circuits. Provide UL Class A ground fault interrupter circuit breakers where scheduled on the drawings. Do not use tandem circuit breakers.

- K. Current Limiting Molded Case Circuit Breakers: Provide circuit breakers with integral thermal and instantaneous magnetic trip in each pole, coordinated with automatically resetting current limiting elements in each pole. Interrupting rating 100,000 symmetrical amperes, let-through current and energy level less than permitted for same size Class RK-5 fuse.
- L. Suitable for use as service entrance equipment. Provide line side (service style) barriers.

## **2.4 ACCESSORIES**

- A. Barriers: Provide finger safe barriers for lineside uninsulated and ungrounded terminations and components which remain energized when main disconnecting device is 'open'. REQUIRED

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Height: 6 feet to handle of highest device.
- B. Provide filler plates for unused spaces in panelboards.
- C. Provide custom-typed circuit directory for each branch circuit panelboard. Provide updated custom-typed circuit directory for each existing branch circuit panelboard with new or revised circuits per the scope of work. Label shall include equipment name or final approved room name, room number, and load type for each circuit (examples: SUMP SP-1 or ROOM 101 RECEIPT). Revise directory to reflect circuit changes required to balance phase loads. Printed copies of the bid document panel schedules are not acceptable as circuit directories.
- D. Stub five (5) empty one-inch conduits to accessible location above ceiling out of each recessed panelboard.

### **3.2 FIELD QUALITY CONTROL**

- A. Measure steady-state load currents at each panelboard feeder. Should the difference at any panelboard between phases exceed 20 percent, rearrange circuits in the panelboard to balance the phase loads within 20 percent. Take care to maintain proper phasing for multi-wire branch circuits.
- B. Visual and Mechanical Inspection: Inspect for physical damage, proper alignment, anchorage, and grounding. Check proper installation and tightness of connections for circuit breakers, fusible switches, and fuses.

**END OF SECTION**



## SECTION 26 27 26 - WIRING DEVICES

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. Device plates and box covers
- B. Receptacles
- C. Countertop and furniture receptacle assemblies
- D. Floor boxes and floor box with service fitting
- E. Poke-through fittings

#### 1.2 QUALITY ASSURANCE

- A. Provide similar devices from a single manufacturer.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in Electrical Code, by a testing agency to Authorities Having Jurisdiction and marked for intended use.
- C. Comply with the Electrical Code.

#### 1.3 REFERENCES

- A. DSCC W-C-896F - General Specification for Electrical Power Connector
- B. FS W-C-596 - Electrical Power Connector, Plug, Receptacle, and Cable Outlet
- C. NEMA WD 1 - General Color Requirements for Wiring Devices
- D. NEMA WD 6 - Wiring Devices - Dimensional Requirements
- E. NFPA 70 - National Electrical Code (NEC)
- F. UL 498 - Standard for Attachment Plugs and Receptacles
- G. UL 943 - Standard for Ground Fault Circuit Interrupters

#### 1.4 SUBMITTALS

- A. Submit product data under provisions of Section 26 05 00.
- B. Provide product data showing configurations, finishes, dimensions, & manufacturer instructions.
- C. Provide a non-returnable sample of each countertop and furniture-mounted receptacle assembly as part of the submittal process.

#### 1.5 COORDINATION

- A. Receptacles for Owner Furnished Equipment: Match plug configurations.
- B. Cord and Plug Sets: Match equipment requirements.
- C. Coordinate installation of receptacle assemblies in countertops and furniture with Contractor

providing the countertop or furniture. Contractor shall coordinate penetrations and conduit routing in countertops and furniture with drawings and other obstacles below installation surface.

## **PART 2 - PRODUCTS**

### **2.1 DEVICE COLOR**

- A. All switch, receptacle, and outlet colors shall be verified with Architect, unless indicated otherwise.

### **2.2 COVERPLATES**

- A. All switches, receptacles, and outlets shall be complete with the following:
  - 1. Unbreakable thermoplastic/thermoset plastic and match device color coverplates in finished spaces where walls are finished.
  - 2. Decorator Grade - Public: Decorator thermoset plastic and match device color wallplates in public finished spaces where walls are finished.
    - a. Manufacturer:
      - 1) Leviton Decora
      - 2) Hubbell Decorator
      - 3) Cooper Decorator
      - 4) or approved equal
  - 3. Galvanized steel coverplates in unfinished spaces for surface mounted boxes.
- B. Where several devices are ganged together, the coverplate shall be of the ganged style for the number of devices used.
- C. Install nameplate identification as indicated in Section 26 05 53.
- D. Plate securing screws shall be metal with head color matching the wall plate finish.

### **2.3 RECEPTACLES**

- A. REC-DUP: NEMA 5-20R Duplex Receptacle:
  - 1. Spec Grade: 125-volt, 20 amp, 3-wire grounding type with impact resistant thermoplastic face and brass back strap.
    - a. Manufacturers:
      - 1) Hubbell 5352
      - 2) Leviton 5362-S
      - 3) Pass & Seymour 5362
      - 4) Cooper 5362
- B. REC-DUP-GFI: NEMA 5-20R Ground Fault Duplex Receptacle:
  - 1. Standard Grade: 125-volt, 20 amp, 3-wire grounding type with test and reset buttons in impact resistant thermoplastic face, listed.
    - a. Device shall perform self-test of GFCI circuitry in accordance with UL 943.
    - b. Manufacturers:

- 1) Hubbell GF20L
- 2) Leviton GFNT2
- 3) Pass & Seymour 2097
- 4) Cooper SGF20

C. REC-DUP-WP: NEMA 5-20R Weatherproof Ground Fault Duplex Receptacle:

1. 125-volt, 20 amp, 3-wire grounding type with test and reset buttons in impact resistant thermoplastic face, weather resistant WR listed. Provide extra-duty NEMA 3R rated while-in-use cast aluminum cover.
2. Device shall perform self-test of GFCI circuitry in accordance with UL 943.
  - a. Manufacturers:
    - 1) Hubbell:
      - a) GFTWRST20 with aluminum housing WP826
      - b) GFCI type devices are not allowed. Contractor may substitute an alternative manufacturer when Hubbell is the basis of submittal for all other wiring devices.
    - 2) Leviton GFWT2 with aluminum housing M5979
    - 3) Pass & Seymour 2097TRWR with aluminum housing WIUCAST1
    - 4) Cooper WRS GF20 with aluminum housing WIUMV-1

D. REC-USB: NEMA 5-20R Receptacle with USB Charger:

1. Hospital Grade: 125-volt, 20-amp, hospital grade tamper resistant, 3-wire grounding type with impact resistant thermoplastic face. USB charging rated at 5VDC 3.0A minimum. Mounted in double gang backbox. Device shall be compatible with all major cell phone and devices manufacturers.
  - a. Manufacturers:
    - 1) Hubbell USB8300
    - 2) Pass & Seymour TR8300USB
    - 3) Leviton T5832-HG

E. Back wired devices shall be complete with eight holes that are screw activated with metal clamps for connection to #12 or #10 copper conductors.

F. Ground fault circuit interrupter (GFCI) receptacles shall be listed and comply with UL 943 requiring increased surge immunity, improved corrosion resistance, improved resistance to false tripping and diagnostic indication for miswiring if the line and load conductors are reversed during installation.

## 2.4 FLOOR BOXES

- A. Cover Color and Style: Verify with Architect from manufacturer standard options.
- B. Refer to Technology drawings for voice/data, Audio/Video outlet, & coordination requirements.
- C. Refer to electrical drawing schedule.

## 2.5 POKE-THROUGH FITTINGS

- A. Cover Color and Style: Verify with Architect from manufacturer standard options.

- B. Refer to Technology drawings for voice/data, Audio/Video outlet, & coordination requirements.
- C. Refer to electrical schedule for types.
- D. UL listed as fire-rated poke-through device for 1, 2, 42-hour rated floors: include fire stops and smoke barriers in through-floor component. UL514A listed for scrub locations and approved for use in the City of Chicago.
- E. Terminate in 4-inch square by 2-1/2-inch-deep junction box.
- F. Suitable for installation with a floor thickness of 2-1/4 to 7 inches.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Install convenience receptacles at elevations indicated in the General Installation Notes on the contract drawings.
- B. Install specific-use receptacles at heights shown on the contract drawings. Install devices level, plumb, and square with building lines. Coordinate installation of adjacent devices of separate systems with common mounting heights, including lighting, power, systems, technology, and temperature control device rough-ins.
- C. Ground Fault Protection: Provide ground fault protection for all branch circuit breakers serving 120/208 receptacles & electrical outlets rated 50 amps or less single-phase and 100 amps or less three-phase in the following locations, as shown on drawings, or required by adopted code:
  - 1. Bathrooms, locker rooms, shower rooms
  - 2. Kitchens' all 120-volt through 250-volt receptacles
  - 3. Buffet, serving, food preparation areas; all 120-volt through 250-volt receptacles
  - 4. Rooftops
  - 5. Interior/Exterior locations subject to damp/wet conditions
  - 6. When located within 6 feet of sinks, bathtubs, and shower stalls
  - 7. Plug-&-cord receptacles when utilization appliance is located within 6 feet of a sink edge.
  - 8. Exterior dwelling outlets (disconnects, equipment connections, etc.) when required by code.
  - 9. Specific Appliances: Auto vacuum machines, water drink/bottle fill coolers, pressure staying machines, tire inflation machines, vending machines, sump pumps, dishwashers, electric ranges, ovens, clothes dryers, microwave ovens
  - 10. Future Provisions: Provide a conduit raceway and backbox for future addition of countertop pop-receptacle when receptacles are not installed in kitchen islands and peninsulas.
- D. Tamper Resistant Protection: Provide tamper-resistant protection for all 15 / 20-amp 120/208 straight blade wiring devices in the following locations, as shown on the drawings, or required by adopted code.
  - 1. Dwelling units and accessory dwelling unit structures
  - 2. Boathouses
  - 3. Dormitory units
  - 4. Guest rooms, guest suites, and common public areas
  - 5. Childcare, preschool, elementary, middle, high school, educational facilities
  - 6. Medical Business Office: Offices, corridors, waiting rooms, common areas
  - 7. Public Buildings: Corridors, waiting rooms, common areas
  - 8. Public Spaces involving: Transportation waiting, gymnasiums, fitness centers, auditoriums, public use venue common areas
  - 9. Nursing homes, assisted living, psychiatric spaces, substance abuse, foster care facilities
  - 10. Agricultural buildings common areas accessible to the public

- E. Drill opening for poke-through fitting installation in accordance with manufacturer's instructions. This Contractor is responsible for taking any measures required to ensure no conduits or other services are damaged. This may include X-ray or similar non-destructive means.
- F. Install receptacles vertically with ground slot up or where indicated on the drawings, horizontally with ground slot to the left.
- G. Install decorative plates on switch, receptacle, and blank outlets in finished areas, using jumbo size plates for outlets installed in masonry walls.
- H. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface-mounted outlets.
- I. Install devices and wall plates flush and level.
- J. Install nameplate identification to receptacle cover plates indicated. Identification shall identify panel name and circuit number. Refer to Specification Section 26 05 53 Electrical Identification.
- K. Test receptacles and modular wiring connectors for proper polarity, ground continuity and compliance with requirements.
- L. Floor Box Installation:
  - 1. Set boxes level and flush with finish flooring material.
  - 2. Use cast iron floor boxes for installations in slab on grade. Trim shall match floor covering to be used.
  - 3. Provide a minimum horizontal offset of 24 inches between boxes.
  - 4. Provide saw-cutting and patching of existing concrete floors as necessary for floor box installations within existing floors.

**END OF SECTION**

## **SECTION 26 27 74 - ELECTRIC HEATERS**

### **PART 1 - GENERAL**

#### **1.1 SCOPE**

- A. Work under this section includes the furnishing and installing of all electric heating equipment as indicated on drawings and specified herein. Provide all wiring and connections shown and control devices where indicated.

#### **1.2 RELATED SECTIONS**

- A. Section 26 05 00 - General Requirements
- B. Section 26 05 19 - Low Voltage Electrical Power Conductors and Cables (600 Volts and Below)
- C. Section 26 05 26 - Grounding and Bonding for Electrical Systems
- D. Section 26 05 33 - Raceway and Boxes for Electrical Systems

#### **1.3 SUBMITTALS**

- A. Shop Drawings
  - 1. Submit shop drawings and product data in accordance with Division 1.
  - 2. Submit shop drawings for all types of electric heaters specified including KW, voltage and phase ratings, dimensions, finishes and auxiliary and control devices.
  - 3. Submit factory drawings for heat cable system layout, with cut sheets, controllers and all auxiliary equipment.

### **PART 2 - PRODUCTS**

#### **2.1 ACCEPTABLE MANUFACTURERS**

- A. Hand Dryers - Excel
- B. Heaters - Qmark MWUH5004 or approved equal

#### **2.2 GENERAL**

- A. All electric heaters and equipment shall be UL listed and labeled.
- B. Electric ratings of heaters shall be as shown on drawings. Verify KW, voltage and phase ratings shown are proper for the voltage system and circuits shown.

#### **2.3 HAND DRYER**

- A. Dryers shall be flush or surface type and UL listed. Flush-mounted units shall include wall box.
- B. Construction of cover shall be one piece gray iron casting with acid-resistant porcelain enamel finish.
- C. Motor shall be universal type, 1/10 HP, 7500 rpm with resilient mounting and sealed lubricated ball bearings and fuse protected.

- D. Fan shall be double inlet centrifugal type and deliver 152 cfm at the outlet.
- E. Heating element shall be protected by an automatic resetting circuit breaker.
- F. Excel Dryer Corporation number is campus standard with no substitute.

	<u>Model</u> <u>No._____</u>	<u>Time</u> <u>Cycle</u>	<u>Volt</u>	<u>Amps</u>	<u>Watts</u>	<u>Surface</u>	<u>Nozzle</u>	<u>Color</u>
Hand Dryer	EXCEL XL-WV	14	208	8	900	YES*	Sur	WHITE
	*Must meet ADA							

**PART 3 - EXECUTION**

**3.1 GENERAL**

- A. Provide proper anchors and supports for heaters for a secure installation.
- B. Where remote low voltage thermostats are indicated, coordinate with requirements of Division 22 and verify relay voltage required.

**3.2 HAND DRYERS**

- A. Surface dryers shall be fastened to the wall with 4 long 1/4" toggle or expansion bolts.
- B. Verify mounting heights with Architect/Engineer for hand.

**END OF SECTION**

## SECTION 26 28 16 - DISCONNECT SWITCHES

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. Non-fusible switches
- B. Molded case circuit switches
- C. Molded case switches
- D. Motor disconnect switch
- E. Elevator Service Disconnect Switch
- F. Enclosures

#### 1.2 RELATED SECTIONS AND WORK

- A. Refer to the Disconnect and Starter Schedule for rating and configuration.

#### 1.3 REFERENCES

- A. NEMA KS 1 - Enclosed Switches

#### 1.4 SUBMITTALS

- A. Submit product data under provisions of Section 26 05 00.
- B. All disconnect switches shall be heavy-duty rated.
- C. Product Data: For each type of enclosed switch, circuit breakers, accessory and component indicated, include dimensions, weights, and manufacturer's technical data on features, performance, and ratings.
- D. Electrical Characteristics: For each type of enclosed switch, enclosure types, current and voltage ratings, short-circuit current ratings, UL listing for series rating of installed devices, features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

#### 1.5 COORDINATION

- A. Coordinate layout and installation of switches, circuit breakers, and components with other construction, including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

### PART 2 - PRODUCTS

#### 2.1 FUSIBLE AND NON-FUSIBLE SWITCHES

- A. Acceptable Manufacturers:
  - 1. Square D 3110 Series
  - 2. Eaton DH Series
  - 3. ABB TH Series



4. Siemens HNF / HF Series

- B. Non-fusible Switch Assemblies: NEMA KS 1; Type heavy duty, quick-make, quick-break, load interrupter enclosed knife switch with externally operable handle interlocked to prevent opening front cover with switch in ON position without a tool. Handle lockable in OFF position.
- C. Enclosures: Type as indicated on the disconnect schedule.
- D. Accessories: Provide the following accessories. Refer to Disconnect Schedule for additional requirements for each application.
  - 1. Lockable
  - 2. Provide finger safe barriers for exposed line-side terminations and energized components when the switch is in the open position.

## 2.2 MOLDED CASE CIRCUIT BREAKERS AND SWITCHES

- A. Acceptable Manufacturers:
  - 1. Square D
  - 2. Eaton
  - 3. ABB
  - 4. Siemens
- B. Molded Case Circuit Breaker: NEMA AB 1, with interrupting capacity to meet available fault currents.
  - 1. Thermal Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
  - 2. Adjustable Instantaneous Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip settings.
  - 3. Electronic Trip Unit Circuit Breakers: RMS sensing; field-replaceable rating plug; with the following field-adjustable settings:
    - a. Instantaneous trip.
    - b. Long- and short-time pickup levels.
    - c. Long- and short-time adjustments.
    - d. Ground-fault pickup level, time delay, and I2t responses.
- C. Molded Case Switches: Molded case circuit breaker with fixed, high-set instantaneous trip only, and short-circuit withstand rating equal to equivalent breaker frame size interrupting rating.
- D. Accessories: Provide the following accessories. Refer to Disconnect Schedule for additional requirements for each application.
  - 1. Lockable
  - 2. Provide finger safe barriers for exposed line-side terminations and energized components when the switch is in the open position.

## 2.3 MOTOR DISCONNECT SWITCH

- A. Acceptable Manufacturers:
  - 1. Square D 3110 Series
  - 2. Eaton r5 Series
  - 3. ABB ML Series
  - 4. Siemens LBR Series

- B. Rotary Switch Assemblies: Rated for making and breaking loads, rotary type enclosed switch with externally operable handle interlocked to prevent opening front cover with switch in ON position without a tool. Handle lockable in OFF position.
- C. Enclosures: Type as indicated on the Disconnect Schedule.
- D. Ground lug connection provided in enclosure.
- E. Accessories: Provide the following accessories. Refer to Disconnect Schedule for additional requirements for each application.
  - 1. Lockable
  - 2. Provide finger-safe barriers for exposed line-side terminations and energized components when the switch is in the open position.
- F. Listed UL 508 suitable for motor control.

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION**

- A. Install disconnect switches where indicated on the drawings.
- B. Field coordinate installation with other contractors and equipment to maintain code-required working space requirements.
- C. Provide adhesive label on inside door of each switch indicating UL fuse class and size for replacement.

#### **3.2 ADJUSTING**

- A. Set field-adjustable circuit breaker trip ranges.

**END OF SECTION**

## SECTION 26 43 00 - SURGE PROTECTION DEVICES

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. This section describes materials and installation requirements for factory and field wired low voltage surge protection devices (SPD) for the protection of all AC electrical circuits. SPD equipment to be installed at designated service entrance equipment, distribution panels, electronic equipment, elevators, and receptacle devices.

#### 1.2 QUALITY ASSURANCE

- A. The specified unit shall be designed, manufactured, tested and installed in compliance with the above references. The unit shall be "Listed by Underwriters Laboratories" to UL 1449.
- B. Each unit shall be designed and manufactured by a qualified manufacturer of power conditioning equipment. The qualified manufacturer must have been engaged in the design and manufacturer of such products for a minimum of five years.

#### 1.3 REFERENCES

- A. ANSI/IEEE C62.33 - IEEE Guide on Testing of MOV components
- B. ANSI/IEEE C62.35 - IEEE Guide on Testing of SAD components
- C. ANSI/IEEE C62.41 - IEEE Recommended Practice on Surge Voltage in Low Voltage AC Power Circuits
- D. ANSI/IEEE C62.45 - IEEE Guide on Surge Testing for Equipment Connected to Low Voltage AC Power Circuits
- E. ANSI/UL 1449 Latest Edition - UL Standard for Safety for Surge Protective Devices
- F. CBEMA - Computer Business Equipment Manufacturers Association
- G. IEC 664 - International Engineering Consortium, Standard for Clamping Voltage
- H. NFPA 70 - National Electrical Code (NEC)
- I. CEC California Electrical Code
- J. UL 67 - Listed for Internal Panelboard Transient Voltage Surge Suppressors
- K. UL 96A - Devices listed as approved for secondary surge arrestors (VZCA)
- L. UL 248-1 - Fusing
- M. UL 1283 - Electromagnetic Interference Filters, Fifth Edition

#### 1.4 SUBMITTALS

- A. Shop Drawings: Should include device dimensions, mounting requirements including wire size and over-current protection device rating, nameplate nomenclature, electrical ratings, short circuit current rating, and test results as indicated below under "Testing, Warranty and Life Expectancy" as provided by an independent test lab or a UL certified test lab for the category(ies) of suppression device(s) specified using the appropriate IEEE test wave. Product data sheets with installation instructions for each size and type of device are required. Shop

drawings submitted without the testing data as required by section this section will be rejected.

- B. Fuse information: Provide fuse information if required for operation. Include size, manufacturer, time-current chart responses to UL 1449 testing requirements, maximum surge protection capability per mode and phase as limited by the fuse, and verification of repetitive surge protection device operation without system degeneration greater than 10%.

## 1.5 SPARE PARTS

- A. Surge Protection Modules: Furnish 1 replacement module for each type installed.
- B. Fuses: Furnish to the Owner 3 spare fuses of each type and rating installed.

## 1.6 TESTING, WARRANTY AND LIFE EXPECTANCY

- A. Manufacturer must provide independent testing on repetitive capability and maximum surge current rating of service entrance suppressor units. This shall be performed at a nationally recognized lab not affiliated with the manufacturer.
  - 1. Single pulse surge current capacity: Single pulse surge current tested in a mode at rated surge currents.
  - 2. Single pulse surge current capacity test: An initial UL 1449 defined 1.2 x 50 $\mu$ s, 6000V open circuit voltage waveform and an 8 x 20 $\mu$ s, 500A and 3kA short circuit current waveform shall be applied to benchmark the unit's suppression voltage (VPR).
  - 3. A single 8 x 20 $\mu$ s waveform pulse of maximum rated surge current per mode shall then be applied. To complete the test, another UL 1449 surge shall be applied to verify the unit's survival. Survival is achieved if the suppression voltage measured from the two UL1449 surges does not vary by more than 10%.
- B. Minimum Repetitive Surge Current Capacity:
  - 1. Service entrance suppressor units should be tested repetitively at an independent lab to verify repetitive capacity.
  - 2. Minimum Repetitive Surge Current Capacity Test:
    - a. An initial UL 1449 surge defined as 1.2 x 50 $\mu$ s, 6000V open circuit voltage waveform and an 8 x 20 $\mu$ s, 500A and 3kA short circuit current waveform shall be applied to benchmark the unit's suppression voltage.
    - b. A repetitive number of ANSI/IEEE C62.41.2-2002 (Category C3) surges, defined as a 1.2 x 50 $\mu$ s 10kV or 20kV open circuit voltage waveform and an 8 x 20 $\mu$ s 10,000A short circuit current waveform, shall then be applied at one-minute intervals.
    - c. To complete the test, another UL 1449 surge shall be applied to verify the unit's survival.
  - 3. Survival is achieved if the suppression voltage (VPR) does not vary by more than 10%.
  - 4. Proof of such testing shall be the test log generated by the surge generator.
- C. Provide UL 1449 classification white sheet pages indicating the VPR (voltage protection rating) for each SPD unit submitted for this product using the 6kV/3kA combination wave surge.
- D. Warranty: Ten (10) years. Includes workmanship, installation and programming.
- E. No scheduled parts replacement or preventative maintenance shall be required.

## PART 2 - PRODUCTS

### 2.1 DESCRIPTION

- A. General: Unit shall provide transient voltage suppression, surge current diversion and high-frequency noise attenuation, when connected in parallel to facilities distribution system. Unit MCOV shall not be less than 115% of nominal system voltage. Operating frequency shall be for a 60 Hz system. Unit shall provide protection in all normal modes for "wye" & "delta" systems.
- B. Short Circuit Current Rating: Provide factory label for SCCR rating. Short circuit current rating shall be the larger of the listed value on drawings or as required by equipment protected.

### 2.2 RATINGS

- A. SPD-Insert #, Service Entrance Suppressors:
  - 1. For 120/208-volt, 3 phase, 4 wire, type 2, category C3 unit.
    - a. Surge current capacity: 80,000/160,000 amps per protection mode/phase
    - b. Nominal Discharge Current: 20 kA.
    - c. Mounting: Refer to the drawings.
    - d. Voltage Protection Rating: Refer to requirements below.
    - e. Components: Minimum component size of 20mm thermally protected metal oxide varistors (MOV).
    - f. Disconnect: Surge-rated disconnect with 200,000 SCCR.
  - 2. Manufacturers:
    - a. Square D Surgelogic EMA Series
    - b. Siemens TPS3 Series
    - c. Eaton SPD Series
    - d. Current Technology Current Guard Plus
    - e. ASCO Power Technologies 400 Series
    - f. LEA International LSS Series
- B. SPD-Insert # Secondary Distribution Suppressors:
  - 1. For 120/208-volt, 3 phase, 4 wire, type 2, category B3/C1 unit.
    - a. Surge current capacity: 60,000/120,000 amps per protection mode/phase
    - b. Nominal Discharge Current (IN): 20 kA.
    - c. Mounting: Refer to the drawings.
    - d. Voltage Protection Rating: Refer to requirements below.
    - e. Components: Minimum component size of 20mm metal thermally protected oxide varistors (MOV).
  - 2. Manufacturers:
    - a. Square D Surgelogic EMA Series
    - b. Siemens TPS3 Series
    - c. Eaton SPD Series
    - d. Current Technology Current Guard Plus
    - e. ASCO Power Technologies 400 Series
    - f. LEA International CFS Series
- C. Voltage Protection Rating:
  - 1. Protection modes and UL 1449 voltage protection rating for surge suppression units per

each mode (L-N, L-L, L-G, and N-G as appropriate).

D. EMI/RFI Noise Rejection or Filtering:

1. Each unit shall include a UL1283 first order, high-frequency filter for noise filtering between 10 KHz and 100 MHz.

E. Indication:

1. Each unit shall include solid-state indicators with externally mounted LED visual status indicators that indicate on-line status of each protection mode of the unit.
2. Each unit shall include a visual indicator that indicates the unit is functioning properly and providing protection.
3. Each unit shall include an audible alarm with silencing switch to indicate when protection has failed.
4. Provide each service entrance secondary distribution type unit(s) with a transient counter.
5. Each unit shall contain form "C" contacts for remote indication of an alarm status.

F. Fuses:

1. Use fuses recommended by the manufacturer to satisfy repetitive UL 1449 operation of the surge suppression unit.
2. Fuses shall be rated 200, 000 AIC minimum interrupting capacity.

### PART 3 - EXECUTION

#### 3.1 INSPECTION

- A. Examine equipment for size and type of surge protection device to be used to ensure physical compatibility.
- B. Inspect surge protection device for any signs of physical damage due to shipping or handling before installing surge protection device.

#### 3.2 INSTALLATION

A. Mounting Location:

1. The unit shall be installed as close as practical to the panel secondary lugs in accordance with applicable national/Local Electrical Codes and the manufacturer's recommended installation instructions. Connect the unit to the or switchboard or panel using a conduit nipple. Flush mount the unit in the front of the switchboard. Mount unit directly across from the breaker or disconnect serving it.
2. Integral surge protection devices mount between the main and branch circuit breakers.
3. If internal surge protection device is specified, device shall be installed in a barrier compartment isolated from other components.

B. Connections:

1. Conductors from the protected bus to the unit shall not be any longer than necessary avoiding unnecessary bends. Conductor leads shall be twisted together and as short as possible. Connection shall be with mechanical lugs for each phase, neutral, and ground if applicable. Contractor shall provide wire and circuit breakers sized per the approved manufacturer's requirements. Maximum lead length from protected bus to surge protection device shall be per manufacturer's requirements, but no greater than 5'-0".
2. The surge protection unit shall be isolatable from the electrical distribution system via 3 pole circuit breaker mounted in the switchboard/panelboard or be equipped with a factory

supplied integral fused switch or circuit breaker. Single phase 120-volt units shall be hardwired without a disconnecting means.

3. Neutral and ground shall not be bonded together at secondary panelboard locations.

C. Additional Locations: Critical Load Protection - Fixed Equipment (120 Vac):

1. Install an A3 plug-in surge protection device between each of the following equipment items and its power supply conductors.
  - a. Fire alarm master panel
  - b. Phone switch
  - c. Intercom master
  - d. Building management system master
  - e. Security system master
  - f. Telephone switch
  - g. TV head
  - h. Elevator control panel

D. General:

1. Check unit for proper operation of protection and indication under start-up.
2. Check unit to ensure all MOVs for each mode of protection are operational. Verify integral fuse links are operational and have not melted.
3. Surge suppression devices shall not be installed ahead of the main service disconnect(s).
4. Install fuses in all fuse holders and fused disconnects internal to the surge protection unit. Use fuses recommended by the manufacturer to satisfy repetitive UL 1449 operation of the surge suppression unit. External fusing of the surge protection device is not allowed.
5. Coordinate location of surge protection device to allow adequate clearances for maintenance.
6. Manufacturer service phone number shall be posted on front of surge protection device.

**END OF SECTION**

## SECTION 26 51 19 - LED LIGHTING

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. Interior luminaires and accessories
- B. Exterior luminaires and accessories
- C. LED emergency lighting units
- D. Emergency exit signs
- E. Lighting poles

#### 1.2 RELATED SECTIONS

- A. The lighting system design includes a combination of luminaire sources, lighting control components, programming sequences, and supplementary components for building and energy code compliance. The design uses performance-based specifications for portions of the lighting system to account for the limitation of comparable product solutions available by competitive manufacturers. The Contractor shall reference related specification sections, plans, schedules, and details prior to submitting pricing, submittals, and installation. The Contractor shall coordinate system component compatibility among various manufacturers and suppliers for a turnkey lighting system. Referenced sections include, but are not limited to, the following:
  - 1. 26 09 33 Lighting Control Systems
    - a. Automatic load control relay (ALCR) (individual luminaire - integral) (ALCR3)
  - 2. 26 52 15 Emergency Lighting Inverter
  - 3. Electrical drawings: Plans, luminaire schedules, lighting control sequence of operations, diagrams, and details.

#### 1.3 REFERENCES

- A. ANSI C78.377 - Specifications for the Chromaticity of Solid State Lighting Products
- B. ANSI C82.16 - Light-Emitting Diode Drivers - Method of Measurement
- C. ANSI C82.77 - Standard for Harmonic Emission Limits and Related Power Quality Requirements for Lighting Equipment
- D. NFPA 70E - National Electrical Safety Code
- E. NEMA SSL1 - Electronic Drivers for LED Devices, Arrays or System
- F. UL 8750 - Light Emitting Diode (LED) Equipment for use in Lighting Products
- G. LM-79 - Approved Method: Electrical & Photometric Measurements of Solid-State Lighting Products
- H. LM-80 - Measuring Luminous Flux and Color Maintenance of LED
- I. FS W-L-305 - Light Set, General Illumination (Emergency or Auxiliary)
- J. UL 924 - Standard for Emergency Lighting and Power Equipment



- K. Project site classification as defined in IESNA RP-33 LZ1.

#### **1.4 SUBMITTALS**

- A. Submit product data under provisions of Section 26 05 00.
- B. Basic Requirements of Submittal:
  - 1. Submit product data sheets for luminaires, LED light engines, drivers and poles. Include complete product model number with all options as specified. Submittal shall be arranged with luminaires listed in ascending order, and with each luminaire's, LED light engine, driver, or pole information following luminaire's product data. Failure to organize submittal in this manner will result in the submittal being rejected.
  - 2. Submit lens product data, dimensions and weights if not included in product data sheet submittal.
  - 3. Include outline drawings, support points, weights, and accessory information for each luminaire.
  - 4. Submit manufacturer origin of LED chipset and driver.
- C. LED Lighting - Performance Testing Submittal (when requested by Architect/Engineer):
  - 1. IESNA LM-79: Include photometric report for the latest generation system being furnished. Provide name of independent testing laboratory, report number, date of test, luminaire series/model number, input wattage, and light source specifications.
  - 2. IESNA LM-80: Measuring Lumen Maintenance of LED Light Sources.
- D. LED Lighting - Control Compatibility Submittal:
  - 1. Submit lighting control capability data for each LED luminaire. The submittal shall clearly identify device data proposed by the Contractor and approved by the luminaire manufacturer for dimming, switching, addressable, wireless, and similar control characteristics.
- E. Submit Design Lights Consortium (DLC) information for each luminaire type.
- F. Submit utility rebate forms where offered at project location. Submit completed rebate forms within 30 days of Substantial Completion.
- G. LEED Requirements:
  - 1. Light Pollution Reduction:
    - a. Exterior Luminaires: Submit manufacturer Backlight Uplight Glare (BUG) rating including data showing percentage of light lumens emitted at or above 90° from nadir for each luminaire type.
  - 2. Toxic Material Reduction:
    - a. Submit manufacturer published data for each lamp type being furnished, indicating mercury content in milligrams per lamp.

#### **1.5 EXTRA STOCK**

- A. Provide extra stock under provisions of Section 26 05 00.
- B. LED Light Engines or Modules: 2 percent of quantity installed, minimum one (1) of each size and type of field replaceable light engine or module. Provide field replacement installation instructions.

- C. Lenses: Three (3) percent of quantity installed, minimum one (1) of each size and type.
- D. LED Drivers: 1 percent of quantity installed, minimum one (1) of each size and type.
- E. Exit Signs: Provide 4 additional exit sign luminaires complete with labor, conduit, and wire. Additional exit luminaires shall be located per the Architect/Engineer or provided as attic stock when a location is not defined prior to Owner occupancy. When multiple exit signs are scheduled, the quantity listed above shall represent each type listed.

## **1.6 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver products to site. Store and protect under provisions of Section 26 05 00.
- B. Protect luminaire finishes, lenses, and trims from damage during storage and installation. Do not remove protective films until construction cleanup within each area is complete.
- C. Handle site lighting poles carefully to prevent breakage and damage to finish.

## **1.7 WARRANTY**

- A. The warranty period begins at the date of Substantial Completion.
- B. LED Light Engines and Drivers:
  - 1. LED Drivers and Dimming Drivers: Five (5) years
  - 2. Light Emitting Diode (LED) Light Engines: Five (5) years
- C. Emergency Lighting Units and Exit Signs:
  - 1. Emergency Lighting Units: Three (3) year, non-prorated
  - 2. Exit Signs: Three (3) year, non-prorated
  - 3. Emergency Unit and Exit Sign Battery: Sealed lead acid or lead calcium cell, requiring no maintenance or replacement for ten (10) years under normal conditions.
- D. Emergency Drivers:
  - 1. Emergency LED Driver: Three (3) years
- E. Automatic Load Control Relay (ALCR): Five (5) year
- F. Pole Finish: Three (3) year warranty of pole color and finish

## **1.8 REGULATORY REQUIREMENTS**

- A. Conform to NFPA 101 for installation requirements.

## **PART 2 - PRODUCTS**

### **2.1 INTERIOR LUMINAIRES AND ACCESSORIES - GENERAL**

- A. Lensed Troffers: Provide hinged frames with latches & 0.125-inch thick virgin acrylic lenses. Prismatic lenses shall have depth of no less than 0.080", KSH12 or equal. Other lenses as scheduled.
- B. Recessed Luminaires: Confirm ceiling and wall type and furnish trim and accessories necessary to permit proper installation in each system. Where fire-rated ceiling or wall assemblies are specified, furnish and install listed enclosures around luminaires that maintain the system rating.
- C. Luminaires: Louvers shall be anodized low iridescent specular aluminum with mitered corners

and interlocking construction.

- D. Suspended Luminaires: Coordinate power feed and suspension canopies with ceiling type and architectural RCP for proper fit and location. Ensure finished installations are plumb and level at elevations specified. Verify suspension length prior to submittal.
- E. Painted reflector surfaces shall have a minimum reflectance of 90%.
- F. All painted components shall be painted after fabrication.

## **2.2 EXTERIOR LUMINAIRES AND ACCESSORIES - GENERAL**

- A. Listed for wet or damp location as scheduled. Provide ingress protection (IP) rating when scheduled.
- B. Provide low-temperature LED drivers, with reliable starting to -20°F.
- C. In-grade luminaires shall have lamp/optic separation to prevent surface temperature from exceeding 115°F. Compartment separation of wire entry and control gear/lamp chamber.
- D. Exterior LED luminaires shall contain separate, easily accessible and replaceable Category C surge protection device.

## **2.3 LED EMERGENCY LIGHTING UNITS**

- A. Self-Powered Emergency Lighting Units: One-piece, self-contained unit with sealed, maintenance-free nickel cadmium battery, automatic charger and electronic circuitry. Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
- B. Battery: Maintenance free lead calcium type, with 90-minute capacity to supply the connected lamp load.
- C. Charger: Dual-rate solid state current charger, capable of maintaining the battery in a full-charge state during normal conditions, and capable of recharging discharged battery to full charged within 168 hours. Low voltage disconnect to prevent deep discharge of battery.
- D. LED Lamp Wattage: As scheduled on luminaire schedule.
- E. Remote Lamps: Match LED lamps on unit.
- F. Indicators: Provide lamps to indicate AC ON and RECHARGING.
- G. Provide test switch to transfer unit from normal supply to battery supply.
- H. Electrical Connection: Knockout for conduit connection.
- I. Unit Voltage: Refer to luminaire schedule volts, AC.
- J. Self-Diagnostics and Testing:
  - 1. Unit shall be self-diagnostic with continuous monitoring of charger performance and battery voltage. Any malfunction of battery, charger, transfer circuit, or emergency lamps shall be detected and visually indicated.
  - 2. Unit shall be programmed to exercise the battery and test emergency operation by performing a five-minute discharge/diagnostic cycle every six months. A manual test switch shall allow a five-minute discharge/diagnostic test at any time.

## **2.4 EMERGENCY EXIT SIGNS**

- A. Exit Signs: Stencil face, 6-inch high letters, directional arrows as indicated, universal mounting type as indicated on the drawings.
- B. Self-Powered Exit Signs: Stencil face, 6-inch high letters, directional arrows as indicated, universal mounting type as indicated on the drawings. One-piece, self-contained unit with sealed, maintenance-free nickel cadmium battery, test switch, AC ON pilot light, automatic charger, and electronic circuitry. Power failure relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
- C. Directional Indicators: The directional indicator for exit signage shall be of a chevron type meeting all requirements of NFPA 101.
- D. Self-Diagnostics and Testing:
  - 1. Unit shall be self-diagnostic with continuous monitoring of charger performance and battery voltage. Any malfunction of battery, charger, transfer circuit, or emergency lamps shall be detected and visually indicated.
  - 2. Unit shall be programmed to exercise the battery and test emergency operation by performing a five-minute discharge/diagnostic cycle every six months. A manual test switch shall allow a five minute discharge/diagnostic test at any time.

## **2.5 LIGHTING POLES**

- A. Manufacturers:
  - 1. Manufacturer of luminaire (metallic pole)
- B. Metal Poles: Round aluminum lighting pole with anchor base.
  - 1. Painted steel poles shall have electrostatic applied polyester powder coated paint finish thermally cured with UV protection. Interior of pole shall be coated with same coating for a minimum of 12" from base plate.
  - 2. Galvanized steel hot dipped finish to standard AASHTO M 111.
  - 3. Anodized aluminum finish to MIL-A-8625 Type II, minimum 0.8 mil thickness. Provide anodized color sample to Architect/Engineer prior to ordering.
- C. Hand Hole: 2 x 4 inches with removable weatherproof cover installed at manufacturer's standard location. Provide matching gasketed cover plate.
- D. Pole Top: Provide Insert inch diameter slipfitter.
- E. Anchor Bolts: As recommended by pole manufacturer. Provide template, flat washers, lock washers, and hex nuts for each pole. Grout between anchor plate and concrete base with non-shrink grout after pole is plumbed.
- F. Vibration Damper: Canister or snake type second mode vibration damper internal to the metal pole as recommended by pole manufacturer. Provide additional pole top damper for first mode vibration on single-head metal poles where recommended by manufacturer.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Securely fasten luminaires to the listed and labeled ceiling framing member by mechanical

means such as bolts, screws, rivets or listed clips identified for use with the type of ceiling framing members. The architectural ceiling framing system may be used in lieu of independent support with prior written approval by the ceiling system manufacturer and Authority Having Jurisdiction (AHJ). Luminaires and wiring installed in fire-rated ceiling assemblies shall be independently supported for all applications.

1. Install recessed flanged luminaires to permit removal from below. Use manufacturer-supplied plaster frames and swing gate supports. Provide independent support as follows:
  - a. Luminaires less than 56 lbs: Provide a minimum of two (2) #12 gauge suspended ceiling support wires located on diagonal corners of the luminaires.
  - b. Luminaires 56 lbs or greater: Provide a minimum of four (4) #12 gauge suspended ceiling support wires located on diagonal corners of the luminaires. Support luminaire independent of the ceiling system.
  - c. Luminaires larger than eight square feet (8 ft<sup>2</sup>): Support luminaire independent of the ceiling system.
- B. Do not fasten luminaire supports to piping, ductwork, mechanical equipment, or conduit, unless otherwise noted. Support wires shall be tightly wrapped (minimum of three turns within 3 inches of the connection) and sharply bend to prevent vertical movement.
- C. Support suspended or pendant mounted luminaires independent of ceiling grid with adjustable stainless steel aircraft cables or per luminaire schedule mounting requirements. Suspension assembly and anchors shall be capable of supporting 300 pounds dead load at each suspension point.
- D. Support wire used to independently support luminaires, raceways, and wiring systems shall be distinguishable from ceiling support systems by color (field paint), tagging or equivalent means.
- E. Provide seismic bracing of luminaires per IBC Chapter 16. Design pendant luminaires on a component seismic coefficient (C<sub>c</sub>) of 0.67. Design vertical supports with a factor of safety of 4.0. Contractor shall verify the Seismic Hazard Exposure Group & Performance Criteria Factor.
- F. Install lamps in lamp holders of luminaires.
- G. Adjust aimable luminaires to obtain lighting levels on objects and areas as directed to obtain desired lighting levels.
- H. Luminaire Pole Bases: Sized and constructed as indicated on the drawings. Project anchor bolts 2 inches minimum above base. Install poles plumb with double nuts for adjustment. Grout around pole anchor base.
- I. Use belt slings or non-chafing ropes to raise and set pre-finished luminaire poles.

### **3.2 CONSTRUCTION USE OF PROJECT LUMINAIRES**

- A. Contractor shall provide temporary construction lighting per the requirements of Division 1.
- B. The project luminaires shown on the construction documents shall not be used for temporary construction purposes without providing a plan for Owner approval that addresses energy and luminaire operating hours.

### **3.3 AUTOMATIC LOAD CONTROL RELAYS**

- A. Factory or field installation per manufacturer requirements.
- B. Remote Test Switch: Provide connection to remote test switch.

- C. Fire Alarm Override: Provide connection to addressable fire alarm relay.

### **3.4 EMERGENCY LIGHTING UNITS AND EXIT SIGNS**

- A. Install units plumb and level.
- B. Aim directional lamp heads as directed.
- C. Test emergency lighting equipment for 60 minutes to determine proper operation, prior to Substantial Completion. Provide electronic copy of periodic test log form to Owner's Representative. Explain and instruct Owner's Representative of requirements for testing and maintenance. Refer to latest adopted NFPA 101 for testing and logging requirements.

### **3.5 RELAMPING**

- A. Replace failed LED light engine modules or arrays at completion of work.

### **3.6 ADJUSTING AND CLEANING**

- A. Align luminaires and clean lenses and diffusers at completion of work. Clean paint splatters, dirt, and debris from installed luminaires.
- B. Touch up luminaire and pole finish at completion of work.

### **3.7 OWNER TRAINING**

- A. Test emergency lighting equipment for 60 minutes to determine proper operation, prior to Substantial Completion, with the Owner's Representative.
- B. Provide electronic copy of periodic test log form to Owner Representative. Explain and instruct Owner Representative of requirements for testing and maintenance. Refer to latest adopted NFPA 101 for testing and logging requirements.

### **3.8 LUMINAIRE SCHEDULE**

- A. As shown on the drawings.

**END OF SECTION**

## SECTION 26 52 15 - EMERGENCY LIGHTING INVERTER

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. Emergency lighting inverter INV

#### 1.2 REFERENCE AND REGULATORY

- A. UL924 - Standard Emergency Lighting and Power Equipment
- B. UL924A - Auxiliary Lighting
- C. NFPA 101 - Life Safety Code
- D. NFPA 111 - Standard on Stored Electrical Energy Emergency and Standby Power Systems
- E. ANSI C62.41 (IEEE 587)
- F. ANSI C62.42.45 (Cat A & B)
- G. OSHA - Occupational Safety and Health Administration

#### 1.3 RELATED SECTIONS

- A. The lighting system design includes a combination of luminaire sources, lighting control components, programming sequences, and supplementary components for building and energy code compliance. The design uses performance-based specifications for portions of the lighting system to account for the limitation of comparable product solutions available by competitive manufacturers. The Contractor shall reference related specification sections, plans, schedules, and details prior to submitting pricing, submittals, and installation. The Contractor shall coordinate system component compatibility among various manufacturers and suppliers for a turnkey lighting system. Referenced sections include, but are not limited to, the following:

1. 26 09 33 Lighting Controls
2. 26 51 19 LED Lighting
3. Electrical drawings: Plans, luminaire schedules, lighting control sequence of operations, diagrams, and details

#### 1.4 SUBMITTALS

- A. Submit product data under provisions of Section 26 05 00.
- B. Indicate unit ratings, dimensions, and finishes. Include performance data for batteries.
- C. Submit manufacturer's installation instructions under provisions of Section 26 05 00.
- D. Submit seismic bracing information.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site under provisions of Section 26 05 00.
- B. Store and protect products under provisions of Section 26 05 00.

## 1.6 SYSTEM DESCRIPTION

- A. System Configuration: Emergency lighting inverter, line interactive, solid-state power supply with cabinet enclosure.
- B. Operating Sequence: When utility power is available, it is supplied by the normal power source. When utility power fails, the load is transferred to the emergency battery. When utility is restored, load is retransferred and battery charger restores battery charge.

## 1.7 OPERATION AND MAINTENANCE DATA

- A. Submit data under provisions of Section 26 05 00.
- B. Include battery maintenance and unit testing procedures.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Myers Emergency Power System Illuminator Series
- B. Signify Chloride HC Series
- C. Acuity Lithonia Lighting Iota IIS Series
- D. Perfect Power Systems Power Ride Series

### 2.2 EMERGENCY LIGHTING INVERTER

- A. Emergency lighting inverter, line interactive, solid-state power supply with cabinet enclosure. The system shall be suitable LED, and fluorescent lamp sources without extinguishing the illumination arc upon load transfer. UL924 listed latest edition.
- B. Input Voltage: 208 volts, 60 Hertz, single phase
- C. Output Voltage: 120
- D. Output Power: 8 Kw at 1.0 power factor. The inverter shall have the ability to supply the rated Kw from a power factor of 0.7 lagging to 0.7 leading. Overload capability of 115% for 2 minutes.
- E. Battery Operating Time: 90 minutes at full load and within output voltage limits.
- F. Recharge Time: 24 hours maximum after full discharge.
- G. Transformer: Provide an isolation transformer on the output side. The bypass switch shall not bypass the isolation transformer when in the bypass position.
- H. Inverter Output:
  - 1. Voltage Stability: +/- 5%
  - 2. Frequency: +/- 1%
  - 3. Harmonic Distortion: 10% maximum at full load
  - 4. Crest Factor: 3 to 1
- I. Battery: Lead calcium, sealed maintenance-free type. Low voltage battery disconnect protects the battery from "deep discharge" during prolonged power outages.



- J. Charger: Designed to maintain battery in full-charge condition during normal conditions.
- K. Control and Interface: Provide operation monitoring and control with audible alarm, visual indicators, manual test switch, and alarm silence button. Systems exceeding 500VA shall have the following individual visual indicators with common audible annunciator and monitoring:
  - 1. Instrument display monitoring: Battery voltage, system output voltage and current per leg, system output frequency.
  - 2. Visual Indicators:
    - a. Load on normal power
    - b. Load on emergency power
    - c. Output circuit breaker open
    - d. Output overload/overcurrent
    - e. High temperature
    - f. ECE in bypass mode
    - g. Low battery
    - h. Major alarm
    - i. Minor alarm
- L. Self-Test and Self-Diagnostics: Provide unit with self-test and self-diagnostics capability. Include the following automatically programmed tests and diagnostics:
  - 1. Monthly Test and Diagnostics: NFPA compliant
  - 2. Yearly Test and Diagnostics: 90 minutes NFPA compliant
  - 3. History and Recording: History log shall maintain at least three (3) years of test, diagnostic, and alarm event data.
- M. Output Circuit Breakers:
  - 1. Provide supervised output circuit breakers: 12 single pole supervised circuit breakers.
  - 2. Circuit Breakers: 20 amp, single pole, voltage to match output voltage.
- N. Accessories:
  - 1. Maintenance Bypass: Internal maintenance bypass switch.
  - 2. Remote Monitor: Provide remote monitor display with user interface, alarm, and silence switch similar to display on the main unit. Refer to plans for installation location.
  - 3. Remote Communication: Provide provisions for remote monitoring via RS232 interface. Bi-directional communication shall allow system diagnostic, testing, and data retrieval.
  - 4. Form C Contacts: Provide with auxiliary Form C contacts for Insert.
  - 5. Seismic Bracing: Provide components and installation per seismic requirements.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Provide interconnection between cabinets.
- B. Branch Circuit: The manufacturer recommended input circuit breaker size may vary between manufacturers. Provide branch circuit breaker and wire size per manufacturer recommendations in lieu of the scheduled sizes when applicable.

### **3.2 MANUFACTURER FIELD SERVICES**

- A. Provide manufacturer's field services under provisions of Section 26 05 00.

- B. Include services of technician to supervise adjustments, final connections, and system start-up.

**END OF SECTION**

## SECTION 27 05 00 - BASIC COMMUNICATIONS SYSTEMS REQUIREMENTS

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. Basic Communications Systems Requirements specifically applicable to Division 27 sections, in addition to Division 1 - General Requirements.
- B. All materials and installation methods shall conform to the applicable standards, guidelines and codes referenced herein and within each specification section.

#### 1.2 SCOPE OF WORK

- A. This Specification and the associated drawings govern furnishing, installing, testing and placing into satisfactory operation the Communications Systems.
- B. The Contractor shall furnish and install all new materials as indicated on the drawings, and/or in these specifications, and all items required to make the portion of the Communications Work a finished and working system.
- C. Description of Systems include, but are not limited to, the following:
  - 1. Complete Structured Cabling System including, but not limited to:
    - a. Backbone cabling and terminations.
    - b. Horizontal cabling and terminations.
    - c. Information outlets (IOes) including faceplates, jacks and labeling.
    - d. Equipment racks, cable management, and equipment.
    - e. Telecommunication Room equipment including patch panels, optical distribution cabinets, and termination blocks.
    - f. Cabling pathways.
    - g. Grounding and Bonding
    - h. Testing
  - 2. Complete Data Communications Equipment Systems.
  - 3. Complete Voice Communications Equipment Systems.
  - 4. Complete Audio/Visual Systems.
  - 5. Complete Paging Systems.
  - 6. Complete Healthcare Communications Systems.
  - 7. Complete Clock Systems.
  - 8. Mounting and patching of wireless access points provided by others.
  - 9. Removal/demolition work and/or relocation and reuse of existing systems and equipment.
  - 10. Low Voltage Communications Wiring (less than +120VAC) as specified and required for proper system control and communications.
  - 11. All associated electrical backboxes, conduit, miscellaneous cabling, and power supplies required for proper system installation and operation as defined in the "Suggested Matrix of Scope Responsibility".
  - 12. Firestopping of penetrations as described in Section 27 05 03.
  - 13. Seismic requirements as described in Section 26 05 48 "Seismic Requirements for Equipment and Supports".

#### 1.3 OWNER FURNISHED PRODUCTS

- A. Insert

## 1.4 ALTERNATES

- A. <Insert>.

## 1.5 DIVISION OF WORK BETWEEN ELECTRICAL AND COMMUNICATIONS CONTRACTORS

- A. Division of work is the responsibility of the Prime Contractor. Any scope of work described in the contract document shall be sufficient for including said requirement in the project. The Prime Contractor shall be solely responsible for determining the appropriate subcontractor for the described scope. In no case shall the project be assessed an additional cost for scope that is described in the contract documents. The following division of responsibility is a guideline based on typical industry practice.
- B. Definitions:
1. "Electrical Contractor" as referred to herein refers to the Contractors listed in Division 26 of this Specification.
  2. "Electrical Contractor" shall also refer to the Contractor listed in Division 27 of this specification when the "Suggested Matrix of Scope Responsibility" indicates the work shall be provided by the EC. Refer to the Contract Documents for the "Suggested Matrix of Scope Responsibility".
  3. "Technology Contractor" as referred to herein refers to the Contractors listed in Division 27 of this Specification.
  4. Low Voltage Technology Wiring: The wiring (less than 120VAC) associated with the Technology Systems, used for analog and/or digital signals between equipment.
  5. Telecommunications/Technology Rough-in: Relates specifically to the backboxes, necessary plaster rings and other miscellaneous hardware required for the installation and mounting of the telecommunications/technology outlet. Rough-in shall include conduit from the information outlet backbox to above the lay-in ceiling. Where surface mounted backboxes are required, conduit shall be routed to above the lay-in ceiling.
- C. General:
1. The purpose of these specifications is to outline typical Electrical and Technology Contractor's work responsibilities as related to technology systems including telecommunications rough-in, audio/visual systems rough-in, conduit, cable tray, power wiring, and low voltage communications and technology wiring. The prime contractor is responsible for all divisions of work.
  2. The exact wiring requirements for much of the equipment cannot be determined until the systems have been purchased and submittals are approved. Therefore, only known wiring, conduits, raceways, and electrical power as related to such items, is shown on the technology drawings. Other wiring, conduits, raceways, junction boxes, and electrical power not shown on the technology drawings but required for the successful operation of the systems shall be the responsibility of the Technology Contractor and included in the Contractor's bid.
  3. Where the Electrical Contractor is required to install conduit, conduit sleeves and/or power connections in support of technology systems, the final installation shall not begin until a coordination meeting between the Electrical Contractor and the Technology Contractor has convened to determine the exact location and requirements of the installation.
  4. Where the Electrical Contractor is required to install cable tray that will contain low voltage technology wiring, the installation shall not begin until the Technology Contractor has completed a coordination review of the cable tray shop drawing.
  5. This Contractor shall establish electrical and technology utility elevations prior to fabrication and installation. The Technology Contractor shall cooperate with the Electrical Contractor and the determined elevations in accordance with the guidelines below. This Contractor shall coordinate utility elevations with other trades. When a conflict arises, priority shall be as follows:

- a. Lighting Fixtures
- b. Gravity Flow Piping, including Steam and Condensate
- c. Sheet Metal
- d. Electrical Busduct
- e. Cable Trays, including 12" access space
- f. Sprinkler Piping and other Piping
- g. Conduit and Wireway
- h. Open Cabling

D. Electrical Contractor Responsibility:

- 1. Assumes all responsibility for all required conduit and power connections when shown on the "Suggested Matrix of Scope Responsibility" to be provided by Electrical Contractor.
- 2. Assumes all responsibility for providing and installing cable tray.
- 3. Responsible for Communications Systems grounding and bonding.
- 4. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.

E. Technology Contractor Responsibility:

- 1. Assumes all responsibility for the low voltage technology wiring of all systems, including cable support where open cable is specified.
- 2. Assumes all responsibility for all required backboxes, conduit and power connections not specifically shown as being provided by the Electrical Contractor on the "Suggested Matrix of Scope Responsibility."
- 3. Assumes all responsibility for providing and installing all ladder rack and other cable management hardware (as defined herein).
- 4. Responsible for providing the Electrical Contractor with the required grounding lugs or other hardware for each piece of technology equipment which is required to be bonded to the technology bonding system.
- 5. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.

## 1.6 COORDINATION DRAWINGS

A. Definitions:

- 1. Coordination Drawings: A compilation of the pertinent layout and system drawings that show the sizes and locations, including elevations, of system components and required access areas to ensure that no two objects will occupy the same space.
  - a. Mechanical trades shall include, but are not limited to, mechanical equipment, ductwork, fire protection systems, plumbing piping, medical gas systems, hydronic piping, steam and steam condensate piping, and any item that may impact coordination with other disciplines.
  - b. Electrical trades shall include, but are not limited to, electrical equipment, conduit 1.5" and larger, conduit racks, cable trays, pull boxes, transformers, raceway, busway, lighting, ceiling-mounted devices, and any item that may impact coordination with other disciplines.
  - c. Technology trades shall include, but are not limited to, technology equipment, racks, conduit 1.5" and larger, conduit racks, cable trays, ladder rack, pull boxes, raceway, ceiling-mounted devices, and any item that may impact coordination with other disciplines.
  - d. Maintenance clearances and code-required dedicated space shall be included.
  - e. The coordination drawings shall include all underground, underfloor, in-floor, in chase, and vertical trade items.

2. Spaces with open/cloud ceiling architecture shall indicate the overhead utilities and locate equipment as required to maintain clearance above lights. The intent for the installation is to maintain a maximum allowable vertical clearance and an organized/clean manner in the horizontal. Notify Architect/Engineer of the maximum clearance which can be maintained. Failure to comply will result in modifications with no cost to Owner.
  - a. In cloud ceiling architecture, when open cabling/wire and/or cable tray crosses gaps between ceiling clouds and/or walls, cabling is to transition to conduits to span the gaps in order to conceal cabling from below.
3. The contractors shall use the coordination process to identify the proper sequence of installation of all utilities above ceilings and in other congested areas, to ensure an orderly and coordinated end result, and to provide adequate access for service and maintenance.

B. Participation:

1. Contractors and subcontractors responsible for work defined above shall participate in the coordination drawing process.
2. One contractor shall be designated as the Coordinating Contractor for purposes of preparing a complete set of composite electronic CAD coordination drawings that include all applicable trades, and for coordinating the activities related to this process. The Coordinating Contractor for this project shall be the Mechanical Contractor.
  - a. The Coordinating Contractor shall utilize personnel familiar with requirements of this project and skilled as draftspersons/CAD operators, competent to prepare the required coordination drawings.
3. Electronic CAD drawings shall be submitted to the Coordinating Contractor for addition of work by other trades. IMEG will provide electronic file copies of applicable drawings for contractor's use if the contractor signs and returns an "Electronic File Transfer" waiver provided by IMEG. IMEG will not consider blatant reproductions of original file copies an acceptable alternative for coordination drawings.

C. Drawing Requirements:

1. The file format and file naming convention shall be coordinated with and agreed to by all contractors participating in the coordination process and the Owner.
  - a. Scale of drawings:
    - 1) General plans: 1/4 Inch = 1'-0" (minimum).
    - 2) Mechanical, electrical, communication rooms, and including the surrounding areas within 10 feet: 1/2 Inch = 1'-0" (minimum).
    - 3) Shafts and risers: 1/2 Inch = 1'-0" (minimum).
    - 4) Sections of shafts and mechanical and electrical equipment rooms: 1/4 Inch = 1'-0" (minimum).
    - 5) Sections of congested areas: 1/2 Inch = 1'-0" (minimum).
2. Ductwork layout drawings shall be the baseline system for other components. Ductwork layout drawings shall be modified to accommodate other components as the coordination process progresses.
3. There may be more drawings required for risers, top and bottom levels of mechanical rooms, and shafts.
4. The minimum quantity of drawings will be established at the first coordination meeting and sent to the A/E for review. Additional drawings may be required if other areas of congestion are discovered during the coordination process.

D. General:

1. Coordination drawing files shall be made available to the A/E and Owner's Representative. The A/E will only review identified conflicts and give an opinion, but will not perform as a coordinator.
2. A plotted set of coordination drawings shall be available at the project site.
3. Coordination drawings are not shop drawings and shall not be submitted as such.
4. The contract drawings are schematic in nature and do not show every fitting and appurtenance for each utility. Each contractor is expected to have included in his/her bid sufficient fittings, material, and labor to allow for adjustments in routing of utilities made necessary by the coordination process and to provide a complete and functional system.
5. The contractors will not be allowed additional costs or time extensions due to participation in the coordination process.
6. The contractors will not be allowed additional costs or time extensions for additional fittings, reroutings or changes of duct size, that are essentially equivalent sizes to those shown on the drawings and determined necessary through the coordination process.
7. The A/E reserves the right to determine space priority of equipment in the event of spatial conflicts or interference between equipment, piping, conduit, ducts, and equipment provided by the trades.
8. Changes to the contract documents that are necessary for systems installation and coordination shall be brought to the attention of the A/E.
9. Access panels shall preferably occur only in gypsum board walls or plaster ceilings where indicated on the drawings.
  - a. Access to mechanical, electrical, technology, and other items located above the ceiling shall be through accessible lay-in ceiling tile areas.
  - b. Potential layout changes shall be made to avoid additional access panels.
  - c. Additional access panels shall not be allowed without written approval from the A/E at the coordination drawing stage.
  - d. Providing additional access panels shall be considered after other alternatives are reviewed and discarded by the A/E and the Owner's Representative.
  - e. When additional access panels are required, they shall be provided without additional cost to the Owner.
10. Complete the coordination drawing process and obtain signoff of the drawings by all contractors prior to installing any of the components.
11. Conflicts that result after the coordination drawings are signed off shall be the responsibility of the contractor or subcontractor who did not properly identify their work requirements, or installed their work without proper coordination.
12. Updated coordination drawings that reflect as-built conditions may be used as record documents.

## 1.7 QUALITY ASSURANCE

A. Telecommunications Structured Cabling System Standards:

1. All work and equipment shall conform to the most current ratified version of the following published standards unless otherwise indicated that draft standards are to be followed:
  - a. ANSI/NECA/BICSI 568 - Standard for Installing Commercial Building Telecommunications Cabling
  - b. ANSI/TIA-568-C.0 - Generic Telecommunications Cabling for Customer Premises
    - 1) C.1 - Commercial Building Telecommunications Standard
    - 2) C.2 - Balanced Twisted-Pair Telecommunications Cabling and Components Standard
    - 3) C.3 - Optical Fiber Cabling Components Standard
    - 4) C.4 - Broadband Coaxial Cabling and Components Standard

- c. ANSI/TIA-569-C - Telecommunications Pathways and Spaces
- d. ANSI/TIA-606-B - Administration Standard for Commercial Telecommunications Infrastructure
- e. ANSI/TIA-607-B - Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications
- f. ANSI/TIA-758-B - Customer-Owned Outside Plant Telecommunications Standard
- g. ANSI/TIA-862-A - Building Automation Systems Cabling Standard
- h. ANSI/TIA-942-A - Telecommunications Infrastructure Standard for Data Centers
- i. ANSI/TIA-1152 - Requirements for Field Test Instruments and Measurements for Balanced Twisted-Pair Cabling
- j. ANSI/TIA-1179 Healthcare Facility Telecommunications Standard
- k. ANSI/TIA/EIA-598-C - Optical Fiber Cable Color Coding
- l. NFPA 70 (NEC) - National Electrical Code (Current Edition)
- m. UL 444 - Standard for Safety for Communications Cable

B. Refer to individual sections for additional Quality Assurance requirements.

C. Qualifications:

1. Only products of reputable manufacturers as determined by Architect/Engineer will be acceptable.
2. The installing Contractor shall be certified by the manufacturer of the structured cabling system. Certification of Contractor shall have been in place for a minimum of one (1) year prior to bidding this project. Documentation of certification is required at the time of bid. Shop drawings will not be approved until proof of certification is submitted. Refer to the end of this specification section for certification documentation requirements.
3. Each Contractor and their subcontractors shall employ only workers who are skilled in their respective trades and fully trained. All workers involved in the termination of cabling shall be individually certified by the manufacturer.
4. The Contractor shall be experienced in all aspects of this work and shall be required to demonstrate direct experience on recent systems of similar type and size.
5. The Contractor shall own and maintain tools and equipment necessary for successful installation and testing of optical and copper structured cabling systems and have personnel adequately trained in the use of such tools and equipment.
6. The Contractor must have a BICSI RCDD (Registered Communications Distribution Designer) or CNet CNIDP (Certified Network Infrastructure Design Professional) on-staff serving as a project manager. Project shop drawings and test reports shall be stamped by the RCDD or CNIDP.
7. The Contractor shall obtain the services of a BICSI RCDD (Registered Communications Distribution Designer) or CNet CNIDP (Certified Network Infrastructure Design Professional) for the project. The RCDD or CNIDP shall perform the following tasks on the project:
  - a. Review contractor's submittals and stamp the submittals stating the submittals compliance with the contract documents.
  - b. Provide written and dated confirmation of an observation of the contractor's installation activities no less than every 2 weeks during the construction period.
  - c. Provide a final written and dated confirmation of a final construction review prior to testing.
  - d. Review final testing of system and indication that the documented results or transmittal of the results stating the test results compliance with the contract documents.
8. The Contractor shall have certified BICSI installation technicians or CNet CNIT (Certified Network Infrastructure Technician) on staff to perform the following tasks on the project:
  - a. Act as the field superintendent or job foreman with the responsibility of monitoring the daily work of each technician.
  - b. Oversee all testing and termination of cabling.



9. The Contractor shall have certified BICSI Installer 2 or CNet CNCI (Certified Network Cabling Installer) on staff to perform the following tasks:
  - a. Installation and termination of copper cable.
  - b. Installation and termination of optical fiber.
10. A resume of qualification shall be submitted with Contractor bid indicating the following:
  - a. Documentation of certification of This Contractor by the proposed structured cabling system manufacturer as required at the end of this specification section.
  - b. A list of recently completed projects of similar type and size with contact names and telephone numbers for each.
  - c. A list of test equipment proposed for use in verifying the installed integrity of copper and fiber optic systems on the project.
  - d. A technical resume of experience for the Contractor's project manager and on-site installation supervisor assigned to this project.
  - e. Resume and certification of the RCDD or CNIDP for the project as required by the form at the end of this specification section.
  - f. Resume and certification of the BICSI installation technician or CNet CNIT for the project.

D. Compliance with Codes, Laws, Ordinances:

1. Conform to all requirements of the State of South Dakota Codes, Laws, Ordinances and other regulations having jurisdiction.
2. Conform to all published standards of Northern State University.
3. In the event there are no local codes having jurisdiction over this job, the current issue of the National Electrical Code shall be followed.
4. If there is a discrepancy between the codes and regulations having jurisdiction over this installation, and these specifications, Architect/Engineer shall determine the method or equipment used.
5. If the Contractor notes, at the time of bidding, any parts of the drawings and specifications which are not in accordance with the applicable codes or regulations, he shall inform the Architect/Engineer in writing, requesting a clarification. If there is insufficient time to follow this procedure, he shall submit with the proposal, a separate price required to make the system shown on the drawings comply with the codes and regulations.
6. Verify the installation environment prior to purchasing or installing any cable. Cable installed in a plenum environment shall be appropriately rated. Bring all discrepancies between the contract documents and installation conditions to the attention of the Architect/Engineer prior to purchase or installation.
7. All changes to the system made after the letting of the contract, in order to comply with the applicable codes or the requirements of the Inspector, shall be made by the Contractor without cost to the Owner.

E. Permits, Fees, Taxes, Inspections:

1. Procure all applicable permits and licenses.
2. Abide by all applicable laws, regulations, ordinances, and other rules of the State or Political Subdivision wherein the work is done, or as required by any duly constituted public authority.
3. Pay all applicable charges for such permits or licenses that may be required.
4. Pay all applicable fees and taxes imposed by the State, Municipal and/or other regulatory bodies.
5. Pay all charges arising out of required inspections due to codes, permits, licenses or as otherwise may be required by an authorized body.
6. Pay all charges arising out of required contract document reviews associated with the project and as initiated by the Owner or authorized independent agency/consultant.

7. Pay any charges by the service provider related to service or change in service to project.
8. All equipment and materials shall be as approved or listed by the following (unless approval or listing is not applicable to an item by all acceptable manufacturers):

- a. Factory Mutual
- b. Underwriters' Laboratories, Inc.

F. Service Provider Requirements:

1. Secure from the telecommunications service provider all applicable requirements.
2. Comply with all service provider requirements.
3. The Owner shall make application for and pay for new telecommunications service equipment and installation. The Contractor shall coordinate schedule and requirements with the Owner and service provider.

G. Examination of Drawings:

1. The drawings for the technology systems work are diagrammatic, intended to convey the scope of the work and to indicate the general arrangements and locations of equipment etc., and the approximate sizes of equipment.
2. Contractor shall determine the exact locations of equipment and the exact routing of cabling to best fit the layout of the job. Scaling of the drawings will not be sufficient or accurate for determining this layout. Where a specific route is required, such route will be indicated on the drawings.
3. Where job conditions require reasonable changes in indicated arrangements and locations, such changes shall be made by the Contractor at no additional cost to the Owner.
4. If an item is either shown on drawings, called for in the specifications or required for proper operation of the system, it shall be considered sufficient for including same in contract.
5. The determination of quantities of material and equipment required shall be made by the Contractor from the drawings. Schedules on the drawings and in the specifications are completed as an aid to the Contractor but where discrepancies arise, the greater number shall govern.
6. Where words "provide", "install", or "furnish" are used on the drawings or in the specifications, it shall be taken to mean, to furnish, install and terminate completely ready for operation, the items mentioned.

H. Electronic Media/Files:

1. Construction drawings for this project have been prepared utilizing Revit.
2. Contractors and Subcontractors may request electronic media files of contract drawings and/or copies of the specifications. Specifications will be provided in PDF format.
3. Upon request for electronic media, the Contractor shall complete and return a signed "Electronic File Transmittal" form provided by IMEG. If the information requested includes floor plans prepared by others, the Contractor will be responsible for obtaining approval from the appropriate Design Professional for use of that part of the document.
4. Electronic contract documents can be used for preparation of shop drawings and as-built drawings only. The information may not be used in whole or in part for any other project.
5. The drawings prepared by IMEG for bidding purposes may not be used directly for ductwork layout drawings or coordination drawings.
6. The use of these CAD documents by the Contractor does not relieve them from their responsibility for coordination of work with other trades and verification of space available for the installation.
7. The information is provided to expedite the project and assist the Contractor with no guarantee by IMEG as to the accuracy or correctness of the information provided. IMEG accepts no responsibility or liability for the Contractor's use of these documents.

I. Field Measurements:

1. Before ordering any materials, this Contractor shall verify all pertinent dimensions at the job site and be responsible for their accuracy.
2. Field conditions that will result in telecommunications drops that exceed the length limitations identified in the contract documents shall be brought to the attention of the Architect/Engineer prior to installation. The cost of reworking cabling that is too long, that was not brought to the written attention of the Architect/Engineer will be borne entirely by the Contractor.
3. This Contractor shall provide the Architect/Engineer with written documentation of any cabling drops that will not be able to use the cable tray (where cable tray is available) due to the resulting cabling lengths. This documentation shall be submitted prior to installation and installation shall not commence until approved by the Architect/Engineer.

## 1.8 SUBMITTALS

- A. Submittals shall be required for the following items, and for additional items where required elsewhere in the specifications or on the drawings.

1. Submittals list:

Referenced Section	Submittal Item	Coordination Drawings
27 05 03	Through Penetration Firestopping	
27 05 26	Communications Bonding	
27 05 28	Interior Communications Pathways	Yes
27 05 43	Exterior Communications Pathways	Yes
27 05 53	Identification and Administration	
27 11 00	Communication Equipment Rooms	Yes
27 13 00	Backbone Cabling Requirements	
27 15 00	Horizontal Cabling Requirements	
27 17 10	Testing	
27 41 00	Professional Audio Video System	Yes
27 51 13	Paging Systems	Yes

- B. General Submittal Procedures: In addition to provisions of Division 1, the following are required:

1. Transmittal: Each transmittal shall include the following:

- a. Date
- b. Project title and number
- c. Contractor's name and address
- d. Description of items submitted and relevant specification number
- e. Notations of deviations from the contract documents
- f. Other pertinent data

2. Submittal Cover Sheet: Each submittal shall include a cover sheet containing:

- a. Date
- b. Project title and number
- c. Architect/Engineer
- d. Contractor and subcontractors' names and addresses
- e. Supplier and manufacturer's names and addresses
- f. Description of item submitted (using project nomenclature) and relevant specification number
- g. Notations of deviations from the contract documents
- h. Other pertinent data
- i. Provide space for Contractor's review stamps

3. Composition:

- a. Submittals shall be submitted using specification sections and the project

- nomenclature for each item.
- b. Individual submittal packages shall be prepared for items in each specification section. All items within a single specification section shall be packaged together where possible. An individual submittal may contain items from multiple specifications sections if the items are intimately linked (e.g., pumps and motors).
  - c. All sets shall contain an index of the items enclosed with a general topic description on the cover.
4. Content: Submittals shall include all fabrication, erection, layout, and setting drawings; manufacturers' standard drawings; schedules; descriptive literature, catalogs and brochures; performance and test data; wiring and control diagrams; dimensions; shipping and operating weights; shipping splits; service clearances; and all other drawings and descriptive data of materials of construction as may be required to show that the materials, equipment or systems and the location thereof conform to the requirements of the contract documents.
5. Contractor's Approval Stamp:
- a. Contractor shall thoroughly review and approve all shop drawings before submitting them to Architect/Engineer. The Contractor shall stamp, date and sign each submittal certifying it has been reviewed.
  - b. Unstamped submittals will be rejected.
  - c. Contractor shall provide proof of RCDD or CNIDP review on the submittal.
  - d. Contractor review shall include, but not be limited to, verification of the following:
    - 1) Only approved manufacturers are used.
    - 2) Addenda items have been incorporated.
    - 3) Catalog numbers and options match those specified.
    - 4) Performance data matches that specified.
    - 5) Electrical characteristics and loads match those specified.
    - 6) Equipment connection locations, sizes, capacities, etc. have been coordinated with other affected trades.
    - 7) Dimensions and service clearances are suitable for the intended location.
    - 8) Equipment dimensions are coordinated with support steel, housekeeping pads, openings, etc.
    - 9) Constructability issues are resolved (e.g., weights and dimensions are suitable for getting the item into the building and into place, sinks fit into countertops, etc.).
  - e. Contractor shall review, stamp and approve all subcontractors' submittals as described above.
  - f. Contractor approval stamp is required on all submittals. Approval will indicate Contractor review of all material and a complete understanding of exactly what is to be furnished. Contractor shall clearly mark all deviations from the contract documents on all submittals. If deviations are not marked by the Contractor, then the item shall be required to meet all drawing and specification requirements.
6. Submittal Identification and Markings:
- a. The Contractor shall clearly mark each item with the same nomenclature applied on the drawings or in the specifications.
  - b. The Contractor shall clearly indicate the size, finish, material, etc.
  - c. Where more than one model is shown on a manufacturer's sheet, the Contractor shall clearly indicate exactly which item and which data is intended.
  - d. All marks and identifications on the submittals shall be unambiguous.
7. Schedule submittals to expedite the project. Coordinate submission of related items.
8. Identify variations from the contract documents and product or system limitations that may be detrimental to the successful performance of the completed work.

9. Reproduction of contract documents alone is not acceptable for submittals.
10. Incomplete submittals will be rejected without review. Partial submittals will only be reviewed with prior approval from the Architect/Engineer.
11. Submittals not required by the contract documents may be returned without review.
12. The Architect/Engineer's responsibility shall be to review one set of shop drawing submittals for each product. If the first submittal is incomplete or does not comply with the drawings and/or specifications, the Contractor shall be responsible to bear the cost for the Architect/Engineer to recheck and handle the additional shop drawing submittals.
13. Submittals shall be reviewed and approved by the Architect/Engineer **before** releasing any equipment for manufacture or shipment.
14. Contractor responsibility for errors, omissions or deviation from the contract documents in submittals is not relieved by Architect/Engineer approval.
15. Schedule shall allow for adequate time to perform orderly and proper review of submittals, including time for consultants and Owner if required, and resubmittals by Contractor if necessary, and to cause no delay in Work or in activities of Owner or other contractors.
  - a. Allow at least two weeks for Architect/Engineer review and processing of each submittal.
16. Architect/Engineer reserves the right to withhold action on a submittal which, in the Architect/Engineer's opinion, requires coordination with other submittals until related submittals are received. The Architect/Engineer will notify the Contractor, in writing, when they exercise this right.

C. Electronic Submittal Procedures:

1. Distribution: Email submittals as attachments to all parties designated by the Architect/Engineer, unless a web-based submittal program is used.
2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.
3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.
4. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.
  - a. Submittal file name: 27 XX XX.description.YYYYMMDD
  - b. Transmittal file name: 27 XX XX.description.YYYYMMDD
5. File Size: Files shall be transmitted via a pre-approved method. Larger files may require an alternative transfer method, which shall also be pre-approved.

## 1.9 SCHEDULE OF VALUES

- A. The requirements herein are in addition to the provisions of Division 1.
- B. Format:
  1. Use AIA Document Continuation Sheets G703 or another similar form approved by the Owner and Architect/Engineer.
  2. Submit in Excel format.
  3. Support values given with substantiating data.
- C. Preparation:

1. Itemize work required by each specification section and list all providers. All work provided by subcontractors and major suppliers shall be listed on the Schedule of Values. List each subcontractor and supplier by company name.
  2. Break down all costs into:
    - a. Material: Delivered cost of product with taxes paid.
    - b. Labor: Labor cost, excluding overhead and profit.
  3. Itemize the cost for each of the following:
    - a. Overhead and profit.
    - b. Bonds.
    - c. Insurance.
    - d. General Requirements: Itemize all requirements.
  4. For each line item having an installed cost of more than \$5,000, break down costs to list major products or operations under each item. At a minimum, provide material and labor cost line items for the following:
    - a. Structured cabling
    - b. Overhead paging/intercom systems
    - c. Security systems
      - 1) Surveillance
      - 2) Access control
      - 3) Intrusion
      - 4) Infant abduction
    - d. Audio/video systems
    - e. Nurse call
- D. Update Schedule of Values when:
1. Indicated by Architect/Engineer.
  2. Change of Subcontractor or supplier occurs.
  3. Change of product or equipment occurs.

#### **1.10 CHANGE ORDERS**

- A. A detailed material and labor takeoff shall be prepared for each change order, along with labor rates and markup percentages. Change orders shall be broken down by sheet or associated individual line item indicated in the change associated narrative, whichever provides the most detailed breakdown. Change orders with inadequate breakdown will be rejected.
- B. Itemized pricing with unit cost shall be provided from all distributors and associated subcontractors.
- C. Change order work shall not proceed until authorized.

#### **1.11 EQUIPMENT SUPPLIERS' INSPECTION**

- A. The following equipment shall not be placed in operation until a representative of the manufacturer has inspected the installation and certified that the equipment is properly installed and that the equipment is ready for operation:
  1. Firestopping, including mechanical firestop systems.

**1.12 PRODUCT DELIVERY, STORAGE, HANDLING & MAINTENANCE**

- A. Exercise care in transporting & handling to prevent damage to fixtures, equipment & materials.
- B. Store materials on the site to prevent damage.
- C. Keep fixtures, equipment and materials clean, dry and free from deleterious conditions.

**1.13 NETWORK / INTERNET CONNECTED EQUIPMENT**

- A. These specifications may require certain equipment or systems to have network, Internet and/or remote access capability ("Network Capability"). Any requirement for Network Capability shall be interpreted only as a functional capability and is not to be construed as authority to connect or enable any Network Capability. Network Capability may only be connected or enabled with the express written consent of the Owner.

**1.14 WARRANTY**

- A. At a minimum, provide a one (1) year warranty for all equipment, materials, and workmanship. Individual specifications sections within Division 27 may require additional warranty requirements for specific equipment or systems.
- B. Warranty period for the entire installation described in this Division shall commence on the date of substantial completion unless a whole or partial system or any separate piece of equipment or component is put into use for the benefit of any party other than the installing contractor with prior written authorization. In this instance, the warranty period shall commence on the date when such whole system, partial system or separate piece of equipment or component is placed in operation and accepted in writing by the Owner or their representative.
- C. Warranty requirements shall extend to correction, without cost to the final user, of all work and/or equipment found to be defective or nonconforming to the contract documents. The Contractor shall bear the cost of correcting all damage resulting from such defects or nonconformance with contract documents exclusive of repairs required as a result of improper maintenance or operation, or of normal wear as determined by the Architect/Engineer.

**1.15 INSURANCE**

- A. Contractor shall maintain insurance coverage as set forth in Division 1 of these specifications.

**1.16 CONTINGENCY**

- A. Include in the Base Bid a contingency of <Insert> percent to be used only by change orders issued by the Architect/Engineer. The unused portion of the contingency shall be deducted from the Contract price before final payment is made.

**1.17 MATERIAL SUBSTITUTION**

- A. Where several manufacturers' names are given, the first named manufacturer constitutes the basis for job design and establishes the equipment quality required.
- B. Equivalent equipment manufactured by the other named manufacturers may be used. Contractor shall ensure that all items submitted by these other manufacturers meets all requirements of the drawings and specifications and fits in the allocated space. When using other listed manufacturers, the Contractor shall assume responsibility for any and all modifications necessary (including, but not limited to structural supports, electrical connections and rough-in, and regulatory agency approval, etc.) and coordinate such with other contractors. The Architect/Engineer shall make the final determination of whether a product is equivalent.

- C. Any material, article or equipment of other unnamed manufacturers which will adequately perform the services and duties imposed by the design and is of a quality equal to or better than the material, article or equipment identified by the drawings and specifications may be used if approval is secured in writing from the Architect/Engineer via addendum. The Contractor bears full responsibility for the unnamed manufacturers equipment adequately meeting the intent of design. The Architect/Engineer may reject manufacturer at time of shop drawing submittal. The Contractor assumes all costs incurred by other trades on the project as a result of changes necessary to accommodate the offered material, equipment or installation method.
- D. Should this Contractor be unable to secure approval from the Architect/Engineer for other unnamed manufacturers as outlined above, this Contractor may list voluntary add or deduct prices for alternate materials on the bid form. These items will not be used in determining the low bidder. Should a voluntary alternate material be accepted, Contractor shall assume all costs that may be incurred as a result of using the offered material, article or equipment necessitating extra expense on Contractor or on the part of other Contractors whose work is affected.

## **PART 2 - PRODUCTS**

### **2.1 CABLE JACKET RATING**

- A. This project requires all cable jackets to carry a plenum rating.

### **2.2 Refer to individual sections.**

## **PART 3 - EXECUTION**

### **3.1 JOBSITE SAFETY**

- A. Neither the professional activities of the Architect/Engineer, nor the presence of the Architect/Engineer or his or her employees and subconsultants at a construction site, shall relieve the Contractor and any other entity of their obligations, duties and responsibilities including, but not limited to, construction means, methods, sequence, techniques or procedures necessary for performing, superintending or coordinating all portions of the work of construction in accordance with the contract documents and any health or safety precautions required by any regulatory agencies. The Architect/Engineer and his or her personnel have no authority to exercise any control over any construction contractor or other entity or their employees in connection with their work or any health or safety precautions. The Contractor is solely responsible for jobsite safety. The Architect/Engineer and the Architect/Engineer's consultants shall be indemnified and shall be made additional insureds under the Contractor's general liability insurance policy.

### **3.2 GENERAL INSTALLATION REQUIREMENTS**

- A. Installation of all conduit and cabling shall comply with Sections 26 05 33 and 26 05 13. Additional conduit requirements described within this Division shall be supplemental to the requirement described in Section 26 05 33. Should conflicts exist between the two Divisions the more stringent (more expensive material and labor) condition shall prevail until bidding addendum or construction clarification or RFI can be submitted and responded to. In no case shall the Contractor carry the least stringent condition in the pricing.
- B. It is the Contractor's responsibility to survey the site and include all necessary costs to perform the installation as specified.
- C. The Contractor shall be responsible for identifying and reporting to the Architect/Engineer any existing conditions including but not limited to damage to walls, flooring, ceiling and furnishings prior to start of work. All damage to interior spaces caused by this Contractor shall be repaired



at this Contractor's expense to pre-existing conditions, including final colors and finishes.

- D. All cables and devices installed in damp or wet locations, including any underground or underslab location, shall be listed as suitable for use in such environments. Follow manufacturer's recommended installation practices for installing cables and devices in damp or wet locations. Any cable or device that fails as a result of being installed in a damp or wet location shall be replaced at the Contractor's expense.

### **3.3 FIELD QUALITY CONTROL**

#### **A. General:**

1. Refer to specific Division 27 sections for further requirements.
2. Contractor shall conduct all tests required and applicable to the work both during and after construction of the work.
3. The necessary instruments and materials required to conduct or make the tests shall be supplied by the Contractor who shall also supply competent personnel for making the tests who has been schooled in the proper testing techniques.
4. In the event the results obtained in the tests are not satisfactory, Contractor shall make such adjustments, replacements and changes as are necessary and shall then repeat the test or tests which disclose faulty or defective work or equipment, and shall make such additional tests as the Architect/Engineer or code enforcing agency deems necessary.
5. All communications cable tests that fail, including those due to excessive cabling lengths, shall be remedied by the Contractor without cost to the project.

#### **B. Protection of cable from foreign materials:**

1. It is Contractor responsibility to provide adequate physical protection to prevent foreign material application or contact with any cable type. Foreign material is defined as any material that would negatively impact the validity of the manufacturer's performance warranty. This includes, but is not limited, to overspray of paint (accidental or otherwise), drywall compound, or any other surface chemical, liquid or compound that could come in contact with the cable, cable jacket or cable termination components.
2. Application of foreign materials of any kind on any cable, cable jacket or cable termination component will not be accepted. It shall be the Contractor's responsibility to replace any component containing overspray, in its entirety, at no additional cost to the project. Cleaning of the cables with harsh chemicals is not allowed. This requirement is regardless of the PASS/FAIL test results of the cable containing overspray. Should the manufacturer and warrantor of the structured cabling system desire to physically inspect the installed condition and certify the validity of the structured cabling system (via a signed and dated statement by an authorized representative of the structured cabling manufacturer), the Owner may, at their sole discretion, agree to accept said warranty in lieu of having the affected cables replaced. In the case of plenum cabling, in addition to the statement from the manufacturer, the Contractor shall also present to the Owner a letter from the local Authority Having Jurisdiction stating that they consider the plenum rating of the cable to be intact and acceptable.

### **3.4 PROJECT CLOSEOUT**

- A. Refer to the Division 1 Section: PROJECT CLOSEOUT for requirements. The following paragraphs supplement the requirements of Division 1.

#### **B. Final Jobsite Observation:**

1. The Architect/Engineer will not perform a final jobsite observation until the project is ready. This is not dictated by schedule, but rather by completeness of the project.
2. Refer to the end of this specification section for a "STATEMENT INDICATING READINESS FOR FINAL JOBSITE OBSERVATION."

3. The Contractor shall sign this form and return it to the Architect/Engineer so that the final observation can commence.
- C. Before final payment will be authorized, this Contractor must have completed the following:
1. Submitted operation and maintenance manuals to the Architect/Engineer for review.
  2. Submitted bound copies of approved shop drawings.
  3. Record documents including edited drawings and specifications accurately reflecting field conditions, **inclusive** of all project revisions, change orders, and modifications.
  4. Submitted a report stating the instructions given to the Owner's representative complete with the number of hours spent in the instruction. The report shall bear the signature of an authorized agent of This Contractor and shall be signed by the Owner's representative as having received the instructions.
  5. Submitted testing reports for all systems requiring final testing as described herein.
  6. Submitted start-up reports on all equipment requiring a factory installation inspection and/or start.
  7. Provide spare parts, maintenance, and extra materials in quantities specified in individual specification sections. Deliver to project site; submit receipt to Architect/Engineer prior to final payment being approved.
  8. Provide System Assurance Warranty certificate for the telecommunications system.

### 3.5 OPERATION AND MAINTENANCE MANUALS

- A. General:
1. Provide an electronic copy of the O&M manuals as described below for Architect/Engineer's review and approval. The electronic copy shall be corrected as required to address the Architect/Engineer's comments. Once corrected, electronic copies and paper copies shall be distributed as directed by the Architect/Engineer.
  2. Approved O&M manuals shall be completed and in the Owner's possession prior to Owner's acceptance and at least 10 days prior to instruction of operating personnel.
- B. Electronic Submittal Procedures:
1. Distribution: Email the O&M manual as attachments to all parties designated by the Architect/Engineer.
  2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.
  3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.
  4. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.
    - a. O&M file name: O&M.div27.contractor.YYYYMMDD
    - b. Transmittal file name: O&Mtransmittal.div27.contractor.YYYYMMDD
  5. File Size: Files shall be transmitted via a pre-approved method. Larger files may require an alternative transfer method, which shall also be pre-approved.
  6. Provide the Owner with an approved copy of the O&M manual on compact discs (CD), digital video discs (DVD), or flash drives with a permanently affixed label, printed with the title "Operation and Maintenance Instructions", title of the project and subject matter of disc/flash drive when multiple disc/flash drives are required.
  7. All text shall be searchable.
  8. Bookmarks shall be used, dividing information first by specification section, then systems, major equipment and finally individual items. All bookmark titles shall include the nomenclature used in the construction documents and shall be an active link to the first page of the section being referenced.

C. Operation and Maintenance Instructions shall include:

1. Title Page: Include title page with project title, Architect, Engineer, Contractor, all subcontractors, and major equipment suppliers, with addresses, telephone numbers, website addresses, email addresses and point of contacts. Website URLs and email addresses shall be active links in the electronic submittal.
2. Table of Contents: Include a table of contents describing specification section, systems, major equipment, and individual items.
3. Copies of all final approved shop drawings and submittals. Include Architect's/Engineer's shop drawing review comments. Insert the individual shop drawing directly after the Operation and Maintenance information for the item(s) in the review form.
4. Copy of final approved test and balance reports.
5. Copies of all factory inspections and/or equipment startup reports.
6. Copies of warranties.
7. Schematic wiring diagrams of the equipment that have been updated for field conditions. Field wiring shall have label numbers to match drawings.
8. Dimensional drawings of equipment.
9. Capacities and utility consumption of equipment.
10. Detailed parts lists with lists of suppliers.
11. Operating procedures for each system.
12. Maintenance schedule and procedures. Include a chart listing maintenance requirements and frequency.
13. Repair procedures for major components.
14. List of lubricants in all equipment and recommended frequency of lubrication.
15. Instruction books, cards, and manuals furnished with the equipment.

### 3.6 INSTRUCTING THE OWNER'S REPRESENTATIVE

- A. Adequately instruct the Owner's designated representative or representatives in the maintenance, care, and operation of the complete systems installed under this contract.
- B. Provide verbal and written instructions to Owner representative or representatives by FACTORY PERSONNEL in the care, maintenance, and operation of the equipment and systems.
- C. Contractor shall make a DVD video recording of instructions to the Owner while explaining the system so additional personnel may view the instructions at a later date. The video recording shall be the property of the Owner.
- D. The Owner has the option to make a video recording of all instructions. Coordinate schedule of instructions to facilitate this recording.
- E. Architect/Engineer shall be notified of the time and place for the verbal instructions to be given to Owner representative so that their representative can be present if desirable.
- F. Refer to individual specification sections for minimum hours of instruction time for each system.
- G. Operating Instructions:
  1. The Contractor is responsible for all instructions to the Owner and/or Owner's operating staff on the Communications Systems.
  2. If the Contractor does not have Engineers and/or Technicians on staff who can adequately provide the required instructions on system operation, performance, troubleshooting, care and maintenance, they shall include in the bid an adequate amount to reimburse the Owner for the Architect/Engineer to perform these services.

### 3.7 SYSTEM STARTING AND ADJUSTING

- A. Communications Systems included in the construction documents are to be complete and

operating systems. The Architect/Engineer will make periodic job site observations during the construction period. The system start-up, testing, configuration, and satisfactory system performance is the responsibility of the Contractor. This shall include all calibration and adjustments of electrical equipment controls, equipment settings, software configuration, troubleshooting and verification of software, and final adjustments that may be required.

- B. All operating conditions & control sequences shall be simulated & tested during start-up period.
- C. Contractor, subcontractors, and equipment suppliers are expected to have skilled technicians to ensure that the system performs as designed. If the Architect/Engineer is requested to visit the job site for the purpose of trouble shooting, assisting in the satisfactory start-up, obtaining satisfactory equipment operation, resolving installation and/or workmanship problems, equipment substitution issues or unsatisfactory system performance, including call backs during the warranty period through no fault of the design; the Contractor shall reimburse the Owner on a time and material basis for services rendered at the Architect/Engineer's standard hourly rates in effect at the time the services are requested. The Contractor shall be responsible for making payment to the Owner for services required that are product, installation or workmanship related. Payment is due within 30 days after services are rendered.

### **3.8 RECORD DOCUMENTS**

- A. Refer to the Division 1 Section: PROJECT CLOSEOUT for requirements. The following paragraphs supplement the requirements of Division 1.
- B. Mark specifications to indicate approved substitutions, change orders, and actual equipment and materials used.
- C. This Contractor shall maintain at the job site, a separate and complete set of technology drawings which shall be clearly and permanently marked and noted in complete detail any changes made to the location and arrangement of equipment or made to the Technology Systems and wiring as a result of building construction conditions or as a result of instructions from the Architect or Engineer. All Change Orders, RFI responses, Clarifications and other supplemental instructions shall be marked on the documents. Record documents that merely reference the existence of the above items are not acceptable. Should This Contractor fail to complete Record Documents as required by this contract, This Contractor shall reimburse Architect/Engineer for all costs to develop record documents that comply with this requirement. Reimbursement shall be made at Architect/Engineer hourly rates in effect at the time of work.
- D. Record actual routing of all conduits sized 2" or larger.
- E. The above record of changes shall be made available for the Architect and Engineer's examination during any regular work time.
- F. Upon completion of the job, and before final payment is made, This Contractor shall give the marked-up drawings to the Architect/Engineer.

### **3.9 ADJUST AND CLEAN**

- A. Contractor shall thoroughly clean all equipment and systems prior to the Owner's final acceptance of the project.
- B. Contractor shall clean all foreign paint, grease, oil, dirt, labels, stickers, and other foreign material from equipment.
- C. Contractor shall remove all rubbish, debris, etc., accumulated during the Contractor's operations from the premises.

## STATEMENT INDICATING READINESS FOR FINAL JOBSITE OBSERVATION

To assist the contractor in a timely close-out of the project, it is crucial that the final jobsite observation is not conducted prior to the project being ready. The contractor is required to review the completion status of the project at the time the observation is scheduled. This review, and the subsequent submittal of this form to the Architect/Engineer, shall indicate the contractor's agreement that the area of the project being requested for final observation is ready as defined below. The following list represents the degree of completeness required prior to requesting a final observation:

1. All cabling pathways (cable tray, ladder rack, conduit sleeves, etc.) are installed and all cabling has been pulled through them.
2. All mechanical firestop products are installed and all other penetrations have been sealed.
3. All telecommunications jacks are installed in the faceplates.
4. All telecommunications cabling is pulled and at least 90% of all jacks have been terminated at the jack and at the telecom room.
5. Telecommunications testing is in progress and at least 50% of testing has been completed.
6. Telecommunications labeling has been provided on at least 50% of each type of component requiring a label.
7. All telecommunications related grounding is complete.
8. All Audio/Visual components, cabling and control systems are installed, programmed and operational.
9. All overhead or integrated paging systems, including speakers, back boxes, cabling, and power supplies, and all headend equipment is installed, programmed and operational.
10. All CCTV cameras, mounts, cabling and all headend equipment are installed, programmed and operational.
11. All access control system equipment, including card readers, conduits, cabling, electronic locks, controllers and all headend equipment, is installed, programmed and operational.

Prime Contractor: \_\_\_\_\_ By: \_\_\_\_\_

Requested Observation Date \_\_\_\_\_ Today's Date: \_\_\_\_\_

Contractor shall sign this readiness statement and transmit to Architect/Engineer at least 10 days prior to the requested date of observation.

It is understood that if the Architect/Engineer finds that the project is not complete as defined above and that the final jobsite observation cannot be completed on the requested date, the Architect/Engineer will return to the site at a later date. All additional visits to the site for the purposes of completing the final observation will be billed T&M to the Contractor at our standard hourly rates, including travel expenses or the contractor's retainage may be deducted for the same amount.

TELECOMMUNICATIONS - PROOF OF CERTIFICATION

There are specific Contractor qualification requirements for this project as defined in Section 27 05 00, which may include Manufacturer Certification and RCDD or CNIDP credentials. This Proof of Certification document, and the supporting documentation require herein, is required to be submitted at the time of bid to show compliance with the requirements of 27 05 00.

Statement of Compliance:

The named Contractor's base bid is a structured cabling solution from the connectivity manufacturer: \_\_\_\_\_ . Named Contractor is trained and certified, under the named manufacturer's formal certification program to provide and install all materials and work required by this project. Further, said Contractor is authorized, by the named manufacturer, to offer all product, labor and system assurance warranties required for this project by these contract documents.

The certification of this named manufacturer is valid, current and in effect as of the bid day of this project, the \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_.

The named Contractor is not employing any other sub-contractor on the telecommunications portion of this project that does not also meet this certification requirement.

Contractor Company Name: \_\_\_\_\_

Authorized Representative: (print) \_\_\_\_\_

Date: \_\_\_\_\_

Manufacturer Certification Number (if any): \_\_\_\_\_

If this project requires RCDD certification, complete the following:

RCDD or CNIDP Name: \_\_\_\_\_

RCDD #: \_\_\_\_\_ Expiration: \_\_\_\_\_

Submit the following with the bid:

This form.

Proof of Manufacturer Certification indicated above.

Proof of RCDD or CNIDP status.

**END OF SECTION**

## SECTION 27 05 03 - THROUGH PENETRATION FIRESTOPPING

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. Through-Penetration Firestopping.

#### 1.2 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in manufacturing products specified in this Section.
- B. Installer: Individuals performing work shall be certified by the manufacturer of the system selected for installation.

#### 1.3 REFERENCES

- A. UL 263 - Fire Tests of Building Construction and Materials
- B. UL 723 - Surface Burning Characteristics of Building Materials
- C. ANSI/UL 1479 - Fire Tests of Through Penetration Firestops
- D. UL 2079 - Tests for Fire Resistance of Building Joint Systems
- E. UL Fire Resistance Directory Through Penetration Firestop Systems (XHEZ)
- F. Intertek / Warnock Hersey - Directory of Listed Products
- G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials
- H. ASTM E814 - Standard Test Method for Fire Tests of Through-Penetration Firestops
- I. HCAI - Health Care Access and Information (California)
- J. The Building Officials and Code Administrators National Building Code
- K. 1997 Uniform Building Code
- L. 2018 International Building Code
- M. NFPA 5000 – Building Construction Safety Code

#### 1.4 SUBMITTALS

- A. Submit under provisions of Section 27 05 00.
- B. Submit Firestopping Installers Certification for all installers on the project.
- C. Shop Drawings: Submit for each condition requiring firestopping. Include descriptions of the specific penetrating item, actual wall/floor construction, manufacturer's installation instructions, and UL or Intertek / Warnock Hersey Assembly number.
- D. Through-Penetration Firestop System Schedule: Indicate locations of each through-penetration firestop system, along with the following information:
  - 1. Types of penetrating items.

2. Types of constructions penetrated, including fire-resistance ratings and, where applicable, thicknesses of construction penetrated.
  3. Through-penetration firestop systems for each location identified by firestop design designation of qualified testing and inspecting agency.
  4. F ratings for each firestop system.
- E. Maintain a notebook on the job site at all times that contains copies of approved submittals for all through penetration firestopping to be installed. Notebook shall be made available to the Authority Having Jurisdiction at their request and turned over to the Owner at the end of construction as part of the O&M Manuals.

## 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store, protect and handle products on site. Accept material on site in factory containers and packing. Inspect for damage. Protect from deterioration or damage due to moisture, temperature changes, contaminants, or other causes. Follow manufacturer instructions for storage.
- B. Install material prior to expiration of product shelf life.

## 1.6 PERFORMANCE REQUIREMENTS

- A. General: For penetrations through the following fire-resistance-rated constructions, including both empty openings and openings containing penetrating items, provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated.
  1. Fire-resistance-rated walls including fire partitions, fire barriers, and smoke barriers.
  2. Fire-resistance-rated horizontal assemblies including floors, floor/ceiling assemblies, and ceiling membranes of roof/ceiling assemblies.
- B. Rated Systems: Provide through-penetration firestop systems with the following ratings determined per UL 1479:
  1. F-Rated Systems: Provide through-penetration firestop systems with F-ratings indicated, but not less than equaling or exceeding fire-resistance rating of constructions penetrated.
  2. L-Rated Systems: Provide through-penetration firestop systems with L-ratings of not more than 5.0 cfm/sq.ft. at both ambient temperature and 400°F.
- C. For through-penetration firestop systems exposed to light, traffic, moisture, or physical damage, provide products that, after curing, do not deteriorate when exposed to these conditions both during and after construction.
- D. For through-penetration firestop systems exposed to view, provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.
- E. For through-penetration firestop systems in air plenums, provide products with flame-spread and smoke-developed indexes of less than 25 and 50, respectively, as determined per ASTM E 84.

## 1.7 MEETINGS

- A. **Pre-installation meeting: A pre-installation meeting shall be scheduled and shall include the Construction Manager, all Subcontractors associated with the installation of systems penetrating fire barriers, Firestopping Manufacturer's Representative, and the Owner.**
  1. Review foreseeable methods related to firestopping work.
  2. Tour representative areas where firestopping is to be installed; inspect and discuss each



type of condition and each type of substrate that will be encountered, and preparation to be performed by other trades.

## **1.8 WARRANTY**

- A. Provide one year warranty on parts and labor.
- B. Warranty shall cover repair or replacement of firestop systems which fail in joint adhesion, cohesion, abrasion resistance, weather resistance, extrusion resistance, migration resistance, stain resistance, general durability, or appear to deteriorate in any manner not clearly specified by the manufacturer as an inherent quality of the material.

## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURERS**

- A. Products: Subject to compliance with requirements, provide one of the through-penetration firestop systems indicated for each application that are produced by one of the following manufacturers. All firestopping systems installed shall be provided by a single manufacturer.
  - 1. 3M; Fire Protection Products Division
  - 2. Hilti, Inc.
  - 3. RectorSeal Corporation, Metacaulk
  - 4. Tremco; Sealant/Weatherproofing Division
  - 5. Johns-Manville
  - 6. Specified Technologies Inc. (STI)
  - 7. Spec Seal Firestop Products
  - 8. AD Firebarrier Protection Systems
  - 9. Dow Corning Corp
  - 10. Fire Trak Corp
  - 11. International Protective Coating Corp

### **2.2 THROUGH PENETRATION FIRESTOP SYSTEMS**

- A. Provide materials and systems classified by or listed by Intertek / Warnock Hersey to provide firestopping equal to time rating of construction being penetrated.
- B. All firestopping materials shall be free of asbestos, lead, PCBs, and other materials that would require hazardous waste removal.
- C. Firestopping shall be flexible to allow for normal penetrating item movement due to expansion and contraction.
- D. Firestopping systems for plumbing and wet pipe sprinkler piping shall be moisture resistant.
- E. Provide firestopping systems capable of supporting floor loads where systems are exposed to possible floor loading or traffic.
- F. Provide firestopping systems allowing continuous insulation for all insulated pipes.
- G. Provide firestopping systems classified by UL or listed by Intertek / Warnock Hersey for penetrations through all fire rated construction. Firestopping systems shall be selected from the UL or listed by Intertek / Warnock Hersey Fire Resistance Directory Category XHEZ based on substrate construction and penetrating item size and material and shall fall within the range of numbers listed:
  - 1. Combustible Framed Floors and Chase Walls - 1 or 2 Hour Rated:

- a. F Rating = Floor/Wall Rating
- b. L Rating = Penetrations in Smoke Barriers

<b>Penetrating Item</b>	<b>UL System No.</b>
No Penetrating Item	FC 0000-0999*
Metallic Pipe or Conduit	FC 1000-1999
Non-Metallic Pipe or Conduit	FC 2000-2999
Electrical Cables	FC 3000-3999
Cable Trays	FC 4000-4999
Insulated Pipes	FC 5000-5999
Bus Duct and Misc. Electrical	FC 6000-6999
Duct without Damper and Misc. Mechanical	FC 7000-7999
Multiple Penetrations	FC 8000-8999

\*Alternate method of firestopping is patching opening to match original rated construction.

2. Non-Combustible Framed Walls - 1 or 2 Hour Rated:

- a. F Rating = Wall Rating
- b. L Rating = Penetrations in Smoke Barriers

<b>Penetrating Item</b>	<b>UL System No.</b>
No Penetrating Item	WL 0000-0999*
Metallic Pipe or Conduit	WL 1000-1999
Non-Metallic Pipe or Conduit	WL 2000-2999
Electrical Cables	WL 3000-3999
Cable Trays	WL 4000-4999
Insulated Pipes	WL 5000-5999
Bus Duct and Misc. Electrical	WL 6000-6999
Duct without Damper and Misc. Mechanical	WL 7000-7999
Multiple Penetrations	WL 8000-8999

\*Alternate method of firestopping is patching opening to match original rated construction.

3. Concrete or Masonry Floors and Walls - 1 or 2 Hour Rated:

- a. F Rating = Wall/Floor Rating
- b. L Rating = Penetrations in Smoke Barriers

<b>Penetrating Item</b>	<b>UL System No.</b>
No Penetrating Item	CAJ 0000-0999*
Metallic Pipe or Conduit	CAJ 1000-1999
Non-Metallic Pipe or Conduit	CAJ 2000-2999
Electrical Cables	CAJ 3000-3999
Cable Trays	CAJ 4000-4999
Insulated Pipes	CAJ 5000-5999
Bus Duct and Misc. Electrical	CAJ 6000-6999
Duct without Damper and Misc. Mechanical	CAJ 7000-7999
Multiple Penetrations	CAJ 8000-8999

\*Alternate method of firestopping is patching opening to match original rated construction.

H. Any opening in walls or floors not covered by the listed series of numbers shall be coordinated with the firestopping manufacturer.

I. Any openings in floors or walls not described in the UL or listed by Intertek / Warnock Hersey Fire Resistance Directory, or outlined in manufacturer's information shall be sealed in a manner agreed upon by the Firestopping Manufacturer, Owner, and the Authority Having Jurisdiction.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Ensure all surfaces that contact seal materials are free of dirt, dust, grease, oil, rust, or loose materials. Clean and repair surfaces as required. Remove laitance and form-release agents from concrete.
- B. Ensure substrate and penetrating items have been permanently installed prior to installing firestopping systems. Ensure penetrating items have been properly spaced and have proper clearance prior to installing firestopping systems.
- C. Surfaces to which sealing materials are to be installed must meet the selected UL or Intertek / Warnock Hersey system substrate criteria.
- D. Prime substrates where recommended in writing by through-penetration firestop system manufacturer. Confine primer to area of bond.

### **3.2 INSTALLATION**

- A. In existing construction, provide firestopping of openings prior to and after installation of penetrating items. Remove any existing coatings on surfaces prior to firestopping installation. Temporary firestopping shall consist of packing openings with fire resistant mineral wool for the full thickness of substrate, or an alternate method approved by the Authority Having Jurisdiction. All openings shall be temporarily firestopped immediately upon their installation and shall remain so until the permanent UL or listed by Intertek / Warnock Hersey listed firestopping system is installed.
- B. Install penetration seal materials in accordance with printed instructions of UL or Intertek / Warnock Hersey Fire Resistance Directory and with manufacturer application instructions.
- C. Install dams as required to properly contain firestopping materials within openings and as required to achieve required fire resistance rating. Remove combustible damming after appropriate curing.

### **3.3 CLEANING AND PROTECTING**

- A. Clean excess fill materials adjacent to openings as Work progresses by methods and with cleaning materials that are approved in writing by through-penetration firestop system manufacturers and that do not cause damage.
- B. Provide final protection and maintain conditions during and after installation that ensure that through-penetration firestop systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, remove damaged or deteriorated through-penetration firestop systems immediately and install new materials to produce systems complying with specified requirements.

### **3.4 IDENTIFICATION**

- A. Provide and install labels adjacent to each firestopping location. Label shall be provided by the firestop system supplier and contain the following information in a contrasting color:
  - 1. The words "Warning - Through Penetration Firestop System - Do Not Disturb. Notify Building Management of Any Damage."
  - 2. Firestop System Supplier; UL or listed by Intertek / Warnock Hersey system number; date installed; contractor name and phone number; manufacturer's representative name, address, and phone number.

### **3.5 INSPECTION**

- A. All penetrations shall be inspected by manufacturer representative to ensure proper installation.
- B. Access to firestop systems shall be maintained for examination by the Authority Having Jurisdiction at their request.
- C. Proceed with enclosing through-penetration firestop system with other construction only after inspection reports are issued and firestop installations comply with requirements.
- D. The contractor shall allow for visual destructive review of 5% of installed firestop systems (minimum of one) to prove compliance with specifications and manufacturer's instructions and details. Destructive system removal shall be performed by the contractor and witnessed by the Architect/Engineer and manufacturer's factory representative. The Architect/Engineer shall have sole discretion of which firestop system installations will be reviewed. The contractor is responsible for all costs associated with this requirement including labor and material for removing and replacing the installed firestop system. If any firestop system is found to not be installed per manufacturer's specific instructions and details, all firestop systems are subject to destructive review and replacement at Architect/Engineer discretion and contractor expense.

**END OF SECTION**

## SECTION 27 05 26 - COMMUNICATIONS BONDING

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. Bonding Conductors
- B. Bonding Connectors
- C. Grounding Busbar (PBB and SBB)
- D. Rack-mount Telecommunications Grounding Busbar

#### 1.2 RELATED WORK

- A. Section 26 05 33 - Conduit and Boxes
- B. Section 26 05 36 - Cable Trays
- C. Section 26 05 13 - Wire and Cable
- D. Section 26 05 26 - Grounding and Bonding
- E. Section 26 41 00 - Lightning Protection Systems
- F. Section 27 05 00 - Basic Communications Systems Requirements
- G. Section 27 05 03 - Through Penetration Firestopping
- H. Section 27 11 00 - Communication Equipment Rooms
- I. Section 27 05 28 - Interior Communication Pathways
- J. Section 27 05 53 - Identification and Administration

#### 1.3 QUALITY ASSURANCE

- A. Refer to Section 27 05 00 for relevant standards.
- B. Communications bonding system component, device, equipment, and material manufacturer(s) shall have a minimum of five (5) years documented experience in the manufacture of communications bonding products.
- C. The entire installation shall comply with all applicable electrical codes, safety codes, and standards. All applicable components, devices, equipment, and material shall be listed by Underwriters' Laboratories, Inc.

#### 1.4 REFERENCES

- A. ANSI/IEEE 1100 - Recommended Practice for Power and Grounding Sensitive Electronic Equipment in Industrial and Commercial Power Systems
- B. ANSI/TIA 568-C - Commercial Building Telecommunications Cabling Standard
- C. ANSI/TIA 569-A - Commercial Building Standard for Telecommunications Pathways & Spaces

- D. ANSI/TIA 606 - Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
- E. ANSI/TIA 758 - Customer Owned Outside Plant
- F. ANSI-J-STD-607-A - Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications
- G. IEEE 81 - IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System Part 1: Normal Measurements
- H. IEEE 837 - IEEE Standard for Qualifying Permanent Connections Used in Substation Grounding
- I. NFPA 70 - National Electrical Code
- J. NFPA 780 - Standard for the Installation of Lightning Protection Systems
- K. UL 96 - Lightning Protection Components
- L. UL 96A - Installation Requirements for Lightning Protection Systems
- M. UL 467 - Grounding and Bonding Equipment

## **1.5 SUBMITTALS**

- A. Submit product data and shop drawings under provisions of Section 27 05 00 and Division 1.
- B. Provide manufacturer's technical product specification sheet for each individual component type. Submitted data shall show the following:
  - 1. Compliance with each requirement of these documents. The submittal shall acknowledge each requirement of this section, item-by-item, including construction, materials, ratings, and all other parameters identified in Part 2 - Products.
  - 2. Manufacturer's installation instructions indicating application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.
- C. Provide CAD-generated, project-specific system shop drawings as follows:
  - 1. Provide a system block diagram indicating system configuration, system components, interconnection between components, and conductor routing. The diagram shall clearly indicate all wiring and connections required in the system. When multiple devices or pieces of equipment are required in the exact same configuration (e.g., multiple identical equipment racks or sections of ladder tray), the diagram may show one device and refer to the others as "typical" of the device shown. The diagram shall list room numbers where system equipment will be located.
  - 2. Installation details for all system components.
- D. Provide system checkout test procedure to be performed at acceptance.

## **1.6 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver products to the site under the provisions of Section 27 05 00.
- B. Store and protect products under the provisions of Section 27 05 00.
- C. Contractor shall exercise care to prevent corrosion of any products prior to installation. Corroded products shall not be acceptable for use on this project.

## 1.7 SYSTEM DESCRIPTION

- A. Section describes the requirements for furnishing, installation, adjusting, and testing of a complete turnkey communications bonding system, including connection to electrical ground grid.
- B. Performance Statement: This specification section and the accompanying drawings are performance based, describing the minimum material quality, required features, operational requirements, and performance of the system. These documents do not convey every wire that must be installed, every equipment connection that must be made, or every feature and function that must be configured. Based on the equipment constraints described and the performance required of the system as presented in these documents, the Contractor is solely responsible for determining all components, devices, equipment, wiring, connections, and terminations required for a complete and operational system that provides the required performance.
- C. This document describes the major components of the system. All additional hardware, subassemblies, supporting equipment, and other miscellaneous equipment required for complete, proper system installation and operation shall be provided by the Contractor.
- D. Basic System Requirements:
  - 1. A complete communications bonding infrastructure is required for this project. Refer to drawings and requirements of ANSI-J-STD-607-A & NFPA 70 for complete information.
  - 2. The bonding system shall include, but not be limited to, the following major components:
    - a. Telecommunications Bonding Conductor (TBC)
    - b. Primary Bonding Busbar (PBB)
    - c. Telecommunications Bonding Backbone (TBB)
    - d. Secondary Bonding Busbar(s) (SBB)
    - e. Rack mount Telecommunications Grounding Busbar(s)
    - f. Bonding Conductor(s) (BC)
    - g. Bonding Connectors
    - h. Bonding system labeling and administration as defined in Section 27 05 53.

## 1.8 PROJECT RECORD DOCUMENTS

- A. Submit documents under the provisions of Section 27 05 00.
- B. Provide final system block diagram showing any deviations from approved shop drawing submittal.
- C. Provide floor plans that document the following:
  - 1. Actual locations of system components, devices, and equipment.
  - 2. Actual conductor routing.
  - 3. Actual system component, device, equipment, and conductor labels.
- D. Provide statement that system checkout test, as outlined in the approved shop drawing submittal, is complete and test results were satisfactory.
- E. Complete all operation and maintenance manuals as described below.

## 1.9 OPERATION AND MAINTENANCE DATA

- A. Submit under provisions of Section 27 05 00.
- B. Submitted data shall include:
  - 1. Approved shop drawings.
  - 2. Descriptions of recommended system maintenance procedures, including:

- a. Inspection
- b. Periodic preventive maintenance
- c. Fault diagnosis
- d. Repair or replacement of defective components

**PART 2 - PRODUCTS**

**2.1 BONDING CONDUCTORS**

A. Bare Copper:

- 1. Annealed uncoated stranded conductor.
- 2. Minimum size 6 AWG.

B. Insulated Copper:

- 1. Annealed uncoated stranded conductor.
- 2. Insulation:
  - a. PVC insulation with nylon outer jacket.
  - b. Rated at 600 volts.
  - c. Green.
- 3. Minimum size 6 AWG.

C. All bonding conductors shall be listed and recognized by a nationally recognized testing laboratory as being suitable for the intended purpose and for installation in the space in which they are installed.

D. Bonding Conductor Sizing:

- 1. All communications bonding system conductors shall be sized by length as follows:

<b>Length Linear ft (m)</b>	<b>Size (AWG)</b>
Less than 13 (4)	6
14 - 20 (4 - 6)	4
21 - 26 (6 - 8)	3
27 - 33 (8 - 10)	2
34 - 41 (10 - 13)	1
42 - 52 (13 - 16)	1/0
53 - 66 (16 - 20)	2/0
67 - 84 (20 - 26)	3/0
85 - 105 (26 - 32)	4/0
106 - 125 (32 - 38)	250 kcmil
126 - 150 (38 - 46)	300 kcmil
151 - 175 (46 - 53)	350 kcmil
176 - 250 (53 - 76)	500 kcmil
251 - 300 (76 - 91)	600 kcmil
Greater than 301 (91)	750 kcmil

- 2. The TBC shall be the same size as the TBB or larger.

**2.2 BONDING CONNECTORS**

A. Acceptable Types:



1. Two-hole compression lug
2. Exothermic weld
3. Irreversible compression

- B. Connectors shall be provided in kit form and selected per manufacturer written instructions.
- C. Connectors shall comply with IEEE 837 and UL 467 and be listed for use for specific types, sizes, and combinations of conductors and connected items.

### **2.3 GROUNDING BUSBAR (PBB AND SBB)**

A. Features:

1. Wall-mount configuration.
2. Listed and recognized by a nationally recognized testing laboratory as being suitable for intended purpose.
3. Hole patterns compliant with BICSI recommendations and ANSI-J-STD-607-D standards.
4. Predrilled holes.
5. Integral insulators.
6. Stainless steel offset mounting brackets.

B. Specifications:

1. Material: Electrolytic tough pitch copper bar with tin plating.
2. Refer to drawings for grounding busbar size(s).
  - a. Minimum Dimensions: Refer to drawings.
  - b. Increase dimensions and/or quantity furnished and installed as required to accommodate all terminations required by the project, plus 20% spare capacity.
  - c. Hole patterns on busbars accommodate two-hole lugs per the recommendation of ANSI/BICSI N3-20 and ANSI/TIA-607 standards.

### **2.4 RACK-MOUNT TELECOMMUNICATIONS GROUNDING BUSBAR**

A. Features:

1. Listed and recognized by a nationally recognized testing laboratory as being suitable for intended purpose.
2. Predrilled holes.
3. Mounts in a standard 19" equipment rack.

B. Specifications:

1. Material: Electrolytic tough pitch copper bar with tin plating.
2. Minimum Dimensions: 3/16" thick x 3/4" high x 19" long.
  - a. Increase dimensions and/or quantity furnished and installed as required to accommodate all terminations required by the project, plus 20% spare capacity.
3. Hole pattern shall include:
  - a. A minimum of eight (8) 6-32 tapped lug mounting holes on 1" centers.
  - b. A minimum of two (2) pairs of 5/16" diameter holes spaced 3/4" apart.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

#### **A. General Bonding Requirements:**

1. The communications bonding system shall be a complete system. Contractor shall furnish and install all necessary miscellaneous components, devices, equipment, material, and hardware, including, but not limited to, lock washers, paint-piercing washers, hex nuts, compression lugs, insulators, mounting screws, lugs, etc., to provide a complete system.
2. A licensed electrician shall perform all bonding.
3. Comply with the manufacturer's instructions and recommendations for installation of all products.

#### **B. Main Cross Connect and Service Entrance Room Bonding Requirements:**

1. Locate the PBB in the service entrance room unless otherwise noted on the drawings.
2. The location of the PBB shall be the shortest practical distance from the telecommunications primary lightning protection devices.
3. Bond the telecommunications primary protectors to the PBB. Maintain a minimum 1 foot separation of the bonding conductor from all DC power cables, switchboard cable, and high frequency cable.
4. In service entrance rooms where the entrance pathway contains an isolation gap, the pathway on the facility side of the gap shall be bonded to the PBB.

#### **C. Where the service entrance cable contains a shield, the shield(s) shall be bonded to the PBB using manufacturer-approved hardware.**

#### **D. Primary Bonding Busbar (PBB) Requirements:**

1. Install PBB such that it is insulated from its support with a minimum 2" standoff.
2. Bond the PBB to the electrical service ground via the TBC.
  - a. A minimum of 1 foot separation shall be maintained between the TBC and any DC power cables, switchboard cable, or high frequency cables.
3. Where backbone or horizontal cabling contains a shield, the shield(s) shall be bonded to the PBB.
4. PBB shall be bonded to all electrical panels located in the same room or space as the PBB. PBB shall be bonded to all electrical panels providing electrical power to communications equipment located in the same room or space as the PBB.
5. PBB shall be bonded to accessible metallic building structure located within the same room or space as the PBB.
6. All metallic continuous cable pathways, including, but not limited to, cable trays, basket trays, ladder racks, raceways, conduits, conduit sleeves, and fire-rated cable pathway devices, located within the same room or space as the PBB, shall be bonded to the PBB.
7. All metallic communications equipment, including, but not limited to, cable pair protectors, surge suppressors, cross-connect frames, patch panels, equipment cabinets, etc., located within the same room or space as the PBB, shall be bonded to the PBB.

#### **E. Secondary Bonding Busbar (SBB) Requirements:**

1. Provide a SBB in each telecommunications equipment room.
2. Install SBB such that it is insulated from its support with a minimum 2" standoff.
3. Bond each SBB to the PBB via the TBB.
  - a. A minimum of 1 foot separation shall be maintained between the TBB and any DC

power cables, switchboard cable, or high frequency cables.

- b. The TBB may be routed from PBB to SBB or as a radial feed to each SBB as the layout requires.
4. When two or more TBBs are used within a multi-story building, the TBBs shall be bonded together with a BBC at the top floor and at a minimum of every third floor in between the lowest floor level.
  5. If more than one (1) SBB is provided within the same room or space, they shall all be bonded together via a BC the same size as the TBB.
  6. Where horizontal cabling contains a shield, the shield(s) shall be bonded to the SBB.
  7. SBBs shall be bonded to accessible metallic building structure located within the same room or space as the SBBs.
  8. SBBs shall be bonded to all electrical panels located in the same room or space as the SBB. SBBs shall be bonded to all electrical panels providing electrical power to communications equipment located in the same room or space as the SBB.
  9. All metallic continuous cable pathways, including, but not limited to, cable trays, basket trays, ladder racks, raceways, conduits, conduit sleeves, and fire-rated cable pathway devices, located within the same room or space as the SBB, shall be bonded to the SBB.
  10. All metallic communications equipment, including, but not limited to, cable pair protectors, surge suppressors, cross-connect frames, patch panels, equipment cabinets, etc., located within the same room or space as the SBB, shall be bonded to the SBB.
- F. Rack Bonding Busbar Requirements (RBB):
1. Provide a rack-mount telecommunications ground bar in each equipment rack and equipment rack enclosure.
  2. Install RBB such that it is electrically bonded to the rack. Where necessary, remove paint and/or use paint-piercing washers to provide proper electrical bond between RBB and equipment rack.
  3. Bond each RBB to the PBB/SBB via a telecommunications equipment bonding conductor (TEBC).
  4. If more than one (1) RBB is provided within the same room or space, they shall all be bonded together via a TEBC.
  5. Where horizontal cabling containing a shield is terminated on rack-mounted termination hardware, the shield(s) shall be bonded to the RBB.
  6. All contractor-furnished and/or contractor-installed metallic communications equipment, including, but not limited to patch panels, fiber optic distribution enclosures, splice enclosures, active electronics, uninterruptible power supplies, etc., mounted within the same equipment rack as the RBB, shall be bonded to the RBB. Where necessary, remove paint and/or use paint-piercing washers to provide proper electrical bond between equipment rack and installed metallic communications equipment. Active electronics and uninterruptible power supplies shall be bonded to the RBB via a dedicated unit bonding conductor (UBC) for each device.
- G. Metallic Interior Communication Pathway Bonding Requirements:
1. All metallic interior continuous communication cable pathways, including, but not limited to, conduit, conduit sleeves, fire-rated cable pathway devices, cable tray, basket tray, and ladder rack, shall be bonded to the communications bonding system.
- H. Bonding Conductor Requirements:
1. Bonding conductors shall be green or marked with a distinctive green color.
  2. Bonding conductors shall be routed parallel and perpendicular to building structure along shortest and straightest paths possible. Number of bends and changes in direction should be minimized. Install and secure conductors in a manner that protects the conductors from impact and from physical or mechanical strain or damage.
  3. Bonding conductors shall not be installed in metallic conduit.

4. All conductors, including, but not limited, to the TBC, TBB, BBC, and TEBC(s), shall be installed splice-free. If the Contractor believes that site conditions do not allow a splice-free installation, the Contractor may request permission from the Architect/Engineer to splice a specific communications bonding system conductor.
  - a. Where documented permission to splice a conductor is granted:
    - 1) The number of splices shall be limited to as few as possible.
    - 2) Splices shall be made using exothermic welding or irreversible compression-type connections only. Splice hardware shall be listed for grounding and bonding. Solder is not an acceptable means of splicing conductors.
    - 3) Splices shall be made in telecommunications spaces in accessible locations to facilitate future inspection and maintenance.
    - 4) Splices shall be adequately supported and protected from impact and from physical or mechanical strain or damage.
  
5. All bonding conductors shall be labeled in accordance with the requirements of Section 27 05 53. In addition to the requirements of Section 27 05 53:
  - a. Labels shall be nonmetallic.
  - b. Labels shall be printer-generated.
  - c. Labels shall be located on conductors as close as is practical to their point of termination in a readable position.
  - d. Additionally, conductors shall be labeled as follows:
    - 1) "IF THIS CONNECTOR OR CABLE IS LOOSE OR MUST BE REMOVED, PLEASE CALL THE BUILDING TELECOMMUNICATIONS MANAGER."
  
6. Interior water piping is not acceptable for use as a communications bonding system bonding conductor.
7. Metallic cable shields are not acceptable for use as communications bonding system bonding conductors.
  
- I. Bonding Connection Requirements:
  1. Make all connections in accessible locations to facilitate future inspection and maintenance.
  2. Communications bonding system connections shall be made using exothermic welding, two-hole compression lugs, or other irreversible compression-type connections. The use of 1-hole lugs is prohibited, except for connections to a rack-mount telecommunications ground bar. Connection hardware shall be listed for grounding and bonding. Sheet metal screws shall not be used to make communications bonding system connections.
  3. Thoroughly clean conductors before installing lugs and connectors.
  4. Install and tighten all connectors in accordance with manufacturer's instructions, using the appropriate purpose-designed tool(s) recommended by the manufacturer for that purpose. Exercise care not to tighten connectors beyond manufacturer's recommendations.
  5. Where necessary, remove paint and/or use paint-piercing washers to provide proper electrical bond at all connections.
  6. All bonding connections shall be coated in anti-oxidant joint compound that is purpose-designed and purpose-manufactured for that use. Anti-oxidant joint compound shall be applied in accordance with manufacturer's recommendations and instructions.
  7. All installed connectors on conductors installed in damp locations shall be sealed with dielectric grease and then covered with heat shrink tubing to protect against moisture ingress. Applied heat shrink tubing shall overlap conductor's outer jacket a minimum of four (4) inches past connector and be installed in accordance with manufacturer's recommendations and instructions.

### **3.2 FIELD QUALITY CONTROL**

- A. Field inspection and testing shall be performed under provisions of Section 27 05 00.
- B. Where these specifications require a product or assembly without the use of a brand or trade name, provide a product from a reputable manufacturer that meets the requirements of the specifications.
- C. Periodic observations will be performed during construction to verify compliance with the requirements of the specifications. These services do not relieve the Contractor of responsibility for compliance with the contract documents.

### **3.3 ADJUSTING**

- A. Adjust work under provisions of Section 27 05 00.
- B. Contractor shall make any and all adjustments to the communications bonding system necessary to ensure that the installed system meets all requirements listed herein. Modifications necessary to comply with listed requirements or to provide specified performance shall be completed by the Contractor at no additional cost to the Owner.

### **3.4 TESTING**

- A. Measure and document resistance to ground at PBB, each SBB, each RBB, and each electrical distribution panel bonded to the PBB or a SBB.
  - 1. Measurements shall be made not less than two full days after last trace of precipitation, and without the soil being moistened by any means other than natural drainage or seepage, and without chemical treatment or other artificial means of reducing natural ground resistance. Perform tests by the fall-of-potential method according to IEEE 81.
  - 2. The preferred measured resistance to ground for the grounding electrode system is 5 ohms or less. Refer to Division 26 for exact project requirements.
  - 3. Under no circumstances shall any point in the communications bonding system have a lower resistance to ground than that of nearby electrical distribution system components that it is bonded to.
- B. Two-point Ground/Continuity Test:
  - 1. Two-point ground continuity test shall be performed per TIA-607D standards.
  - 2. Contractor shall use an earth ground resistance tester to confirm a resistance of less than 100 milliohms between the building's electrical grounding electrode system and any other point in the telecommunications bonding system.
  - 3. At a minimum, perform tests in the following areas:
    - a. PBB to the electrical ground in distributors
    - b. Each SBB to the electrical ground in distributors
    - c. PBB/SBB to the structural metal (if present)
    - d. PBB to SBB(s)
    - e. Structural metal (if present) to the electrical ground
  - 4. Complete testing prior to installation of Owner-provided equipment.
- C. Measure and document voltage between screen of installed and terminated ScTP, FTP, and/or SSTP horizontal cables and electrical ground of electrical outlet(s) serving the information outlet location area.
  - 1. The voltage between the screen and the ground wire shall not exceed 1.0 V rms, and 1.0 V dc for any installed and terminated ScTP, FTP, and/or SSTP horizontal cables.

- D. Include measurement documentation in test data submitted at completion of project under provisions of Section 27 17 10.

**END OF SECTION**

## SECTION 27 05 28 - INTERIOR COMMUNICATION PATHWAYS

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. Work covered under this section consists of the furnishing of all necessary labor, supervision, materials, equipment, tests and services to install complete wire mesh support systems, conduits, sleeves, innerduct, etc. for an interior cabling plant as shown on the drawings.
- B. Wire mesh support systems are defined to include, but are not limited to straight sections of continuous wire mesh, field-formed horizontal & vertical bends, tees, drop outs, supports & accessories.

#### 1.2 RELATED WORK

- A. Section 26 05 33 - Conduit and Boxes
- B. Section 27 05 00 - Basic Communications Systems Requirements
- C. Section 27 05 26 - Communications Bonding

#### 1.3 QUALITY ASSURANCE

- A. Refer to Section 27 05 00 for requirements.

#### 1.4 REFERENCES

- A. ANSI/NFPA 70 - National Electrical Code
- B. NEMA VE 2-2000 - Cable Tray Installation Guidelines

#### 1.5 SUBMITTALS

- A. Under the provisions of Section 27 05 00 & Division 1, prior to start of work Contractor shall submit:
  - 1. Manufacturer data covering all products proposed, including construction, materials, ratings and all other parameters identified in Part 2 - Products, below.
  - 2. Manufacturer's installation instructions.
- B. Coordination Drawings:
  - 1. Include cable tray and conduit sleeve layout in composite electronic coordination files. Refer to Section 27 05 00 for coordination drawing requirements.

#### 1.6 DRAWINGS

- A. Drawings, which constitute a part of these specifications, indicate the general route of the wire mesh support systems, conduit, sleeves, etc. Data presented on these drawings is as accurate as preliminary surveys and planning can determine until final equipment selection is made. Accuracy is not guaranteed and field verification of all dimensions, routing, etc., is required.

### PART 2 - PRODUCTS

#### 2.1 CONDUIT

- A. Refer to Section 26 05 33 for conduit requirements for this project.

## 2.2 WIRE MESH CABLE TRAY - OVERHEAD

- A. General: Provide wire mesh of types and sizes indicated on drawings; with connector assemblies, clamp assemblies, connector plates, splice plates and splice bars. Provide drop-out fittings where cable tray is installed over equipment racks. Two drop-out fittings shall be installed over each rack so that a controlled radius is maintained into each side of every equipment rack that cable tray passes over. Construct units with rounded edges and smooth surfaces; in compliance with applicable standards; and with the following additional construction features.
- B. Wire mesh shall be made of high strength steel wires and formed into a standard 2 inch by 4-inch wire mesh pattern with intersecting wires welded together. All wire ends along wire mesh sides (flanges) shall be rounded during manufacturing for safety of cables and installers.
- C. Materials & Finishes: Material and finish specifications for each wire mesh type are as follows:
  - 1. Electro-Galvanized Zinc: Straight sections shall be made from steel meeting the minimum mechanical properties of ASTM A510 and shall be electro-plated zinc in accordance with ASTM B633 SC2. Flat Black.
- D. Type of Overhead Wire Mesh Support System:
  - 1. All straight section longitudinal wires shall be straight (with no bends).
  - 2. Wire mesh supports shall be trapeze hangers or wall brackets. Center hung supports will not be allowed.
  - 3. Trapeze hangers are to be supported by 1/4 inch or 3/8-inch diameter rods.
  - 4. Provide manufacturer approved grounding clips as necessary for continuous grounding of tray.
  - 5. Basis of Design
    - a. nVent Caddy WBTray "Shaped" WBT#x# S Series
  - 6. Additional acceptable manufacturers:
    - a. Cooper B-Line "Flextray"
    - b. Cablofil, Inc,
    - c. Wiremold "Fieldmate"

## 2.3 CABLE HANGERS AND SUPPORTS

- A. Provide a non-continuous cable support system suitable for use with open cable.
- B. Cable Hooks:
  - 1. Construction: Flat bottom design with a minimum cable bearing surface of 1-5/8". Hooks shall have 90-degree radius edges.
  - 2. All cable hook mounting hardware shall be recessed to prevent damage to cable during installation. Installed cabling shall be secured using a cable latch retainer that shall be removable and reusable.
  - 3. Finish: Pre-galvanized steel, ASTM A653 suitable for general duty use.
- C. Cable Hangers:
  - 1. Adjustable, non-continuous cable support slings for use with low voltage cabling.
  - 2. Steel and woven laminate construction, rated for indoor non-corrosive use. Laminate material shall be suitable for use in plenum environments.
  - 3. Sling length shall be adjustable to a capacity of 425 4-pair UTP cables.
  - 4. Cabling hanger load limit shall be 100 lbs per foot.
  - 5. Manufacturer:
    - a. Erico Caddy
    - b. CableCat CAT425



- c. Arlington Fittings TI Series
- d. Or approved equal.

## **2.4 INNERDUCT - CORRUGATED**

- A. Fabricated from self-extinguishing high-impact polyvinyl chloride (PVC), orange in color.
- B. Fittings and accessories fabricated from same material as conduit and usable with rigid nonmetallic conduit.
- C. Solvent-cement type joints as recommended by manufacturer.
- D. Inside diameter not less than that of rigid steel conduit.
- E. Dielectric strength a minimum of 400 volts per mil.
- F. Corrugated wall construction.
- G. Pull rope pre-installed by manufacturer.
- H. Innerduct installed within buildings (not including riser paths) or utility tunnels shall meet all the above General requirements plus:
  - 1. Be fabricated of flame-retardant materials (plenum rated) suitable for installation in such environments.
  - 2. Meet or exceed all requirements for flame resistant duct as required by Bellcore TR-NWT-000356 (Section 4.33).
- I. Innerduct installed within building riser shafts shall meet all above general requirements plus:
  - 1. Be fabricated of flame-retardant materials suitable for installation in such environment.
- J. Meet or exceed all requirements for flame propagation as specified by test method UL-1666 and referenced by the National Electrical Code (NEC) Section 770-53 for listed optical fiber raceways being installed in vertical runs in a shaft between floors.

## **PART 3 - EXECUTION**

### **3.1 INNER DUCT INSTALLATION REQUIREMENTS**

- A. Inner duct shall be riser or plenum rated as required by the installation environment. At minimum, inner duct should extend to the ladder rack above the termination enclosure at system endpoints. Where not installed in a continuous length, inner duct segments should be spliced using couplings designed for that purpose.
- B. All exposed inner duct is to be labeled at 35-foot intervals with tags indicating ownership, the cable type (e.g., "Fiber Optic Cable") and the cables it contains (e.g., MA-CS or FS-CS).
- C. Where exposed, fiber optic cable shall be installed in protective inner duct.
- D. Contractor shall determine optimum size and quantity to satisfy the requirements of the installation and to ensure that the mechanical limitations, including minimum bend radius of the cable, are considered.
- E. The inner duct should extend into the termination enclosure at system endpoints.
- F. Where not installed in a continuous length, inner duct segments should be spliced using

couplings designed for that purpose.

### **3.2 CABLE HOOK SUPPORT SYSTEM**

- A. In areas where cabling is not supported by cable tray, ladder rack, enclosed wireway or installed in conduit, such cabling shall be supported by an approved cable hook support system.
- B. Refer to manufacturer's requirements for allowable fill capacity for selected cable hook. In no case shall a 40% fill capacity be exceeded.
- C. Cable hooks shall be securely mounted per manufacturer's instructions. In no case shall the side-to-side travel of any cable hook exceed 6".
- D. Cable hooks shall be selected based on the contractor's cable routing. Hooks shall be capable of supporting a minimum of 30 pounds with a safety factor of 3.
- E. J-hook support spans shall be based on the smaller of manufacturer load ratings and code requirements. In no case shall horizontal spans exceed 5 feet and vertical spans exceed 4 feet.
- F. The resting and supporting of cabling on structural members shall not meet the requirements for cabling support specified herein.
- G. The use of tie-wraps or hook and loop type fasteners is specifically prohibited as a substitute for cable hooks specified herein.

### **3.3 CONDUIT AND CABLE ROUTING**

- A. Refer to Section 26 05 33 for additional requirements.
- B. All conduits shall be reamed and shall be installed with a nylon bushing.
- C. Maintain appropriate conduit bend radius at all times. For conduits with an internal diameter of less than 2", maintain a bend radius of at least 6 times the internal diameter. For conduits with an internal diameter 2" or greater, maintain a bend radius of at least 10 times the internal diameter.
- D. No conduit or sleeve containing more than two (2) cables shall exceed 40% fill ratio, regardless of length.
- E. Any conduit exceeding 90' in length or containing more than two (2) 90-degree bends shall contain a pull box sized per ANSI/TIA/EIA 569 requirements.
  - 1. A separate pull box is required for each 90' (or greater) length section.
  - 2. A separate pull box is required after any two (2) consecutive 90-degree bends.
  - 3. Pull box shall be located in an area that maintains accessibility of box, including the ability to remove box lid without removal or relocation of any other materials.
- F. Any conduit with bends totaling 90 degrees or more shall have the fill capacity derated by 15% for each 90 degrees of cumulative bend.
- G. Cables installed in any conduits that do not meet the above requirements shall be replaced at the Contractor's expense, after the conduit condition has been remedied.

### **3.4 WIRE MESH TRAY INSTALLATION**

- A. The wire mesh cable tray system shall be only for telecommunications.
- B. Install wire mesh as indicated; in accordance with recognized industry practices (NEMA VE-2 2000), to ensure that the cable tray equipment complies with requirements of NEC, and

applicable portions of NFPA 70B and NECA's "Standards of Installation" pertaining to general electrical installation practices.

- C. Cable tray sections shall be grounded in accordance with manufacturer's recommendations using manufacturer approved hardware. Painted sections shall have paint removed at each grounding attachment point.
- D. Test wire mesh support systems to ensure electrical continuity of bonding and grounding connections, and to demonstrate compliance with specified maximum grounding resistance. Refer to NFPA 70B, Chapter 18, for testing and test methods.
- E. Provide sufficient space encompassing wire mesh to permit access for installing and maintaining cables.
- F. Tray shall be continuous from source to termination and shall not change elevation, direction or otherwise expose cables to travel without 2" x 4" mesh support.
- G. Overhead Tray shall be field cut using only manufacturer-approved cutting device and methods. Cutting device shall be an offset blade bolt cutter; standard bolt cutters are specifically not permitted.
- H. Bends in overhead tray shall be accomplished by utilizing manufacturer cutting guides.
- I. All splices of tray shall be provided with splice washers, bars or springs as recommended by the manufacturer.

### **3.5 ATTACHMENT TO METAL DECKING**

- A. Where supports for cable trays and cable hook systems attach to metal roof decking, excluding concrete on metal decking, do not exceed 25 lbs. per hangar and a minimum spacing of 2'-0" on center. This 25-lb. load and 2'-0" spacing include adjacent electrical and mechanical items hanging from deck. If the hanger restrictions cannot be achieved, supplemental framing off steel framing will need to be added.

**END OF SECTION**

## SECTION 27 05 43 - EXTERIOR COMMUNICATION PATHWAYS

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. This section describes the products and execution requirements relating to furnishing and installing exterior racks, ladders, conduits, sleeves, innerduct, etc. for an exterior cabling plant.

#### 1.2 REFERENCES

- A. Section 27 05 00 - Basic Communications Systems Requirements.
- B. AASHTO HS-20 - Standard Specification for Highway Bridges.
- C. ANSI/ASTM A153 - Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- D. ANSI/ASTM A569 - Steel, Sheet and Strip, Carbon (0.15 Maximum Percent), Hot-Rolled, Commercial Quality.
- E. ASTM A48 - Gray Iron Castings.
- F. ASTM A123 - Zinc (Hot-Galvanized) Coatings on Products Fabricated from Rolled, Pressed, and Forged Steel Shapes, Plates, Bars, and Strips.

#### 1.3 REGULATORY REQUIREMENTS

- A. Equipment and material shall be UL (Underwriters Laboratory) listed and labeled.

### PART 2 - PRODUCTS

ASTM Test	Description	Values HDPE
D-1505	Density g/CM 3	Less than 0.941
D-1238	Melt Index, g/10 min Condition E	Greater than 0.55 grams/10 min.
D-638	Tensile Strength at yield (psi)	3000 min.
D-1693	Environmental Stress Crack Resistance Condition B, F 20	96 hrs.
D-790	Flexural Modulus, MPa (psi)	Less than 80,000
D-746	Brittleness Temperature	-75°C Max

SIZE	OD	ID
1"	1.375" (Max.)	1.0" (Min.)
1-1/4"	1.67" (Max.)	1.25" (Min.)
1-1/2"	2.0" (Max.)	1.5" (Min.)

### PART 3 - EXECUTION

#### 3.1 INSTALLATION - DUCTBANK

- A. Make duct bank installations and penetrations through foundation walls watertight.
- B. Top of duct banks shall be a minimum of 24 inches below grade, unless otherwise indicated on drawings.
- C. Assemble duct banks using non-magnetic saddles, spacers and separators. Position

separators to provide 3-inch minimum separation between the outer surfaces of the ducts.

- D. Transition from non-metallic to galvanized rigid steel conduit where duct banks enter buildings, manholes, and hand-holes.
- E. Where ducts enter structures such as manholes, hand-holes, pullboxes and buildings, terminate the ducts in suitable end bells.
- F. Slope duct runs for drainage toward manholes and away from buildings with a slope of approximately 3-inches per 100 feet.
- G. After completion of the duct bank and prior to pulling cable, pull a mandrel, not less than 12 inches long and with a cross section approximately 1/4 inch less than the inside cross section of the duct, through each duct. Then pull a rag swab or sponge through to make certain that no particles of earth, sand, or gravel have been left in the duct.
- H. Plug and seal empty spare ducts entering buildings and structures. Seal watertight all ducts in use entering buildings and structures.

### **3.2 EXCAVATION, FILL, BACKFILL, COMPACTION**

#### **A. General:**

1. Contractor shall do all necessary excavating, securing, filling, backfilling, compacting, and restoration in connection with their work.

#### **B. Excavation:**

1. Excavations for trenches shall be excavated to proper dimensions to permit installation and inspection of work.
2. Where excavations are carried in error below indicated levels, thoroughly compacted sand-gravel fill, shall be placed in such excess excavations.
3. Excavations shall be protected against frost action and freezing.
4. Care shall be exercised in excavating so as to not damage surrounding structures, equipment, and buried utilities. In no case shall any major structural footing or foundation be undermined.
5. Excavation shall be performed in all ground characteristics, including rock, if encountered. Each bidder shall visit the premises and determine, by actual observations, borings, or other means, the nature of the soil conditions. The cost of all such inspections, borings, etc., shall be borne by the bidder.
6. In the case where the trench is excavated in rock, a compacted bed with a depth of 3" (minimum) of sand and gravel shall be used to support the conduit unless masonry cradles or encasements are used.
7. Where satisfactory bearing soil is not found at the indicated levels, the Architect/Engineer or their representative shall be notified immediately and no further work shall be done until further instructions are given.
8. Mechanical excavation of the trench to line and grade of the conduit, unless otherwise indicated on the drawings.

#### **C. Dewatering:**

1. Contractor shall be responsible for the furnishing, installation, operation and removal of all dewatering pumps and lines necessary to keep excavation free of water at all times.

#### **D. Underground Obstructions:**

1. Prior to the commencement of any excavation or digging, the Contractor shall verify all underground utilities with the regional utility locator. Provide prior notice to the locator

before excavations. Contact information for most regional utility locaters can be found by calling 811. The Contractor is responsible for obtaining all utility locates for all trades on the project to determine obstructions indicated. The Contractor shall use great care in installing in the vicinity of underground obstruction.

E. Fill and Backfilling:

1. No rubbish or waste material shall be permitted in excavations for trench fill and backfill.
2. Contractor shall provide the necessary sand for backfilling.
3. Dispose of the excess excavated earth as directed.
4. Soils for backfill shall be suitable for required stability and compaction, clean and free from perishable materials, frozen earth, debris or earth with an exceptionally high void content, and free from stones greater than 4 inches in diameter. Under no circumstances shall water be permitted to rise in unbackfilled trenches after installation has been placed.
5. All trenches shall be backfilled immediately after installation of conduit, unless other protection is directed.
6. All conduit shall be laid on a compacted bed of sand at least 3" deep. Backfill around the conduit with sand, spread in 6" layers, then compact each layer.
7. Use sand for backfill up to grade for all conduit located under building slabs or paved areas. Native soil materials may be used as backfill if approved by the Geotechnical Engineer. All other conduit shall have sand backfill to 6" above the top of the conduit.
8. The backfilling above the sand shall be placed in uniform layers not exceeding 6" in depth. Each layer shall be placed, then carefully and uniformly tamped, so as to eliminate the possibility of lateral or vertical displacement.
9. Install a warning tape approximately 12 inches below finished grade over all underground duct banks. The identifying warning tape shall be as specified above.
10. Where the fill and backfilling will ultimately be under a building, floor or paving, each layer of fill shall be compacted to 95% of the maximum density as determined by AASHTO Designation T-99 or ASTM Designation D-698. Moisture content of soil at time of compaction shall not exceed plus or minus 2% of optimum moisture content as determined by AASHTO T-99 or ASTM D-698 test.
11. After backfilling of trenches, no superficial loads shall be placed on the exposed surface of the backfill until a period of 48 hours has elapsed.

### 3.3 RESTORATION REQUIREMENTS

- A. Where soil and sod has been removed, it shall be replaced as soon as possible after backfilling is completed. All areas disturbed by work shall be restored to their original condition. The restoration shall include any necessary topsoiling, fertilizing, liming, seeding, or mulching,

**END OF SECTION**

## SECTION 27 05 53 - IDENTIFICATION AND ADMINISTRATION

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. This section describes the identification and administration requirements relating to the structured cabling system and its termination components and related subsystems.
- B. Administration of structured cabling system, utilizing identifiers, records, record linkages and presentation.
  - 1. Identifier: Information that links a specific element of the telecommunications infrastructure with its corresponding record.

#### 1.2 RELATED WORK

- A. Section 27 05 00 - Basic Communications Systems Requirements

#### 1.3 QUALITY ASSURANCE

- A. Refer to Section 27 05 00 for relevant standards.
- B. Perform all work in accordance with State of South Dakota standard.

#### 1.4 SUBMITTALS

- A. Under the provisions of Section 27 05 00 and Division 1, prior to the start of work the Contractor shall submit:
  - 1. Documentation of labeling scheme.
  - 2. Complete documentation of nomenclature for all Administration components.

### PART 2 - PRODUCTS

#### 2.1 ADMINISTRATION

- A. Administrative requirements include identifiers, records, record linkages and labeling for purposes of administering building cabling, pathways and spaces and grounding/bonding within a facility.
- B. The administrative system shall be developed in Microsoft Word format or other electronics program approved by the Architect/Engineer. Should the Contractor elect to provide documentation of the administrative system in a proprietary format, the owner shall be provided with a retail licensed version of the software by the Contractor allowing the full editing and reading the documentation.
- C. Refer to the Administrative System Outline below for minimum requirements.
- D. Identifiers:
  - 1. Identifiers shall be marked at the equipment to be administered.
  - 2. Identifiers shall be unique for each type of equipment. For example, in no case shall the identifier for a cable be the same as the identifier for a pathway.
- E. Administrative System Outline:
  - 1. The format of the outline is as follows:

- a. Subsystem:
  - 1) Required identifiers
  - 2) Linked records.
- 2. Pathways:
  - a. Pathway identifier, type, fill, loading.
  - b. Cable records, space records, pathway records, grounding records.
- 3. Spaces:
  - a. Space identifier, space type
  - b. Pathway records, cable records, grounding records.
- 4. Cable:
  - a. Cable identifier, cable type, total pair count, damaged pair count, unterminated pair count.
  - b. Termination records, splice records, pathway records, grounding records.
- 5. Cabling Termination Hardware:
  - a. Termination identifier, hardware type, damaged position numbers.
  - b. Termination position records, space records, grounding records.
- 6. Termination Position:
  - a. Termination position identifier, termination type.
  - b. Cable records, termination hardware records, space records.
- 7. Splice:
  - a. Splice identifier, splice type
  - b. Cable records, space records.
- 8. Telecommunications Main Ground Bar:
  - a. TMGB identifier, busbar type, grounding conductor identifier
  - b. Bonding conductor records, space records.
- 9. Bonding Conductors:
  - a. Bonding conductor identifier, conductor type, busbar identifier
  - b. Grounding busbar records, pathway records.
- 10. Telecommunications Ground Bar:
  - a. TGB identifier, busbar type
  - b. Bonding conductor records, space records.

## **2.2 DOCUMENTATION/AS-BUILTS/RECORDS**

### **A. General:**

- 1. Upon completion of the installation, the Contractor shall submit as-builts per the requirements of Section 27 05 00 and Division 1. Documentation shall include the items detailed in the subsections below.



2. All documentation, including hard copy & electronic forms shall become property of Owner.
- B. Record Drawings:
1. Drawings are to include cable routes and outlet locations. Outlet locations shall be identified by their sequential number as defined elsewhere in this document. Numbering, icons and drawing conventions used shall be consistent throughout all documentation provided.

## **PART 3 - EXECUTION**

### **3.1 IDENTIFICATION AND LABELING**

- A. Termination Hardware Labeling:
1. An identifier shall be provided at each termination hardware location or its label.
- B. Grounding/Bonding Labeling:
1. The TMGB shall be labeled "TMGB." There shall be only one TMGB in the facility.
  2. Label all TBB conductors connecting to the TMGB with a unique label, located at both ends of the TBB.
  3. Each TGB shall be labeled with a unique label.
  4. All TBB conductors connecting to TGB shall be labeled uniquely at each end of the cable.

### **3.2 ADMINISTRATION**

- A. Provide administrative documentation of cabling, termination hardware, termination positions, splices and grounding as described above.
- B. Identifiers:
1. Cable Identifiers: Provide a unique identifier for each cable serving as a link to the cable record. The identifier shall be marked on the cable or on the cable label.
  2. Termination Hardware Identifiers:
    - a. Provide a unique identifier for each termination hardware unit, serving as a linkage the unit record.
  3. Termination Position Identifiers:
    - a. A unique identifier shall be provided to each termination position to serve as a link to the termination position record.
    - b. An identifier shall be marked on each position label. Each termination position shall be marked with the termination position identifier.
  4. Splice Enclosure Identifier:
    - a. Provide a unique identifier for each splice enclosure to serve as a link to its record.
  5. Grounding/Bonding Identifiers:
    - a. The TMGB shall be marked "TMGB". Only one TMGB shall be located in a facility.
    - b. Provide a unique identifier for each TBB attached to the TMGB.
    - c. A unique identifier shall be provided for each TBG in a facility.
    - d. Provide a unique identifier for each TBB attached to the TBG.

**END OF SECTION**

## SECTION 27 11 00 - COMMUNICATION EQUIPMENT ROOMS (CER)

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. This section describes the products and execution requirements related to furnishing and installing equipment for communication equipment rooms.

#### 1.2 RELATED WORK

- A. Section 27 05 00 - Basic Communications Systems Requirements
- B. Section 27 05 26 - Communications Bonding
- C. Section 27 05 28 - Interior Communication Pathways
- D. Section 27 15 00 - Horizontal Cabling Requirements

#### 1.3 QUALITY ASSURANCE

- A. Refer to Section 27 05 00 for applicable standards.

#### 1.4 SUBMITTALS

- A. Under the provisions of Section 27 05 00 and Division 1, prior to the start of work the Contractor shall submit:
  - 1. Manufacturer's data covering all products including construction, materials, ratings and all other parameters identified in Part 2 - Products, below.
  - 2. Manufacturer's installation instructions.
- B. Coordination Drawings:
  - 1. Include ladder racking, equipment racks, cable tray and conduit sleeve layout in composite electronic coordination files. Refer to Section 27 05 00 for coordination drawing requirements.

### PART 2 - PRODUCTS

#### 2.1 EQUIPMENT GROUNDING

- A. Refer to specification section 27 05 26 for grounding requirements.
- B. All equipment required to be grounded shall be provided with a grounding lug suitable for termination of the specified size electrode conductor.

#### 2.2 EQUIPMENT RACKS AND CABINETS

- A. Where identified on the drawings in Communication Equipment Rooms, equipment racks and/or equipment cabinets shall be furnished and installed by the Contractor to house cable termination components (e.g., copper, optical fiber, coax) and network electronics.
- B. The equipment rack shall conform to the following requirements:
  - 1. Standard TIA/EIA 19" Floor Rack:

- a. Equipment rack shall be 84" in height, self-supporting and provide a useable mounting height of 45 rack units (RU) (1 RU = 1 3/4").
- b. Channel uprights shall be spaced to accommodate industry standard 19" mounting.
- c. Equipment rack shall be double side drilled and tapped to accept 12-24 screws. Uprights shall also be drilled on back to accept cable brackets, clamps, power strip(s), etc. Hole pattern on rack front shall be per TIA/EIA specifications (5/8"-5/8"-1/2"). Hole pattern on the rear shall be at 3" intervals to accept cable brackets.
- d. Equipment racks shall be provided with a supply of spare screws (minimum of 24).
- e. Equipment racks shall be provided with a ground bar and #6 AWG ground lug.
- f. Provide all mounting hardware and accessories as required for a complete installation.

## 2.3 CABLE MANAGEMENT - [ VERTICAL AND] HORIZONTAL

### A. Equipment Racks:

1. Equipment racks shall be equipped with vertical and horizontal cable management hardware in the form of rings and guides. Racks shall incorporate vertical and horizontal covers, to allow an orderly, hidden, routing of copper, optical fiber, and coax jumpers from the modular patch panels and/or 110-type termination blocks to the customer provided network electronics. Vertical and horizontal cable management hardware shall be as follows:
  - a. Horizontal cable management hardware shall be 16 gauge cold rolled steel construction with six (6) pass-thru holes and seven (7) front-mounted 3.5" steel rod D-rings. Provide with cover designed to conceal and protect cable.
  - b. At a minimum, horizontal cable management hardware shall be positioned above and below (a) each grouping of two rows of jacks on modular patch panels, and (b) above and below each optical fiber patch panel and (c) each grouping of two rows of F-type connectors on coax patch panels.
  - c. Vertical cable management hardware shall provide for cable routing on front and rear of each rack and be 14" deep x 6" wide (minimum). Where multiple equipment racks are to be installed, this hardware shall be mounted between the uprights of adjacent equipment racks. Equipment rack uprights and the spacers shall be secured together per manufacturer's recommendations. Provide with cover designed to conceal and protect cable.
2. Each equipment rack shall be supplied with a minimum of 12 releasable (e.g., "hook and loop") cable support ties.
3. Where cable termination hardware is wall-mounted, the Contractor shall be responsible for establishing a cable pathway for jumpers routed from the equipment rack(s) to the wall. This shall be in the form of slotted ducts or troughs. Routing of jumpers via the overhead cable tray or ladder rack system is NOT acceptable. The proposed method shall be included in the submittals required by this document and shall be approved by the Architect/Engineer prior to installation.

## 2.4 PATCH PANELS

- A. Where identified on the drawings in Communication Equipment Rooms, modular patch panels shall be furnished and installed by the Contractor for termination of copper cable.
- B. Copper cabling shall be terminated in Communication Equipment Rooms on modular patch panels consisting of a modular connector system incorporating modular jacks meeting the specifications for the jacks detailed in Section 27 15 00. On wall-mounted panels, this interface shall be accessible from the front of the panel.
- C. Wall-mounted modular patch panels shall incorporate a standoff bracket to allow copper cabling to be routed behind the modular patch panel.

- D. The largest single modular patch panel configuration shall not exceed 48-Ports. Modular patch panels shall be fully populated (all ports occupied by jacks) and be provided in increments of no less than 12 jacks. High-density modular patch panels will not be accepted.
- E. The modular patch panel blocks shall have the ability to seat and cut eight (8) conductors (4 pairs) at a time and shall have the ability of terminating 22- through 26-gauge plastic insulated, solid and stranded copper conductors. Modular patch panel blocks shall be designed to maintain the cables' pair twists as closely as possible to the point of mechanical termination.
- F. Modular patch panels shall incorporate cable support and/or strain relief mechanisms to secure the horizontal cables at the termination block and to ensure that all manufacturers minimum bend radius specifications are adhered to.

## 2.5 OPTICAL FIBER PANELS

- A. All terminated optical fibers shall be mated to simplex LC-type couplings mounted on enclosed fiber distribution cabinets. Couplings shall be mounted on a panel that, in turn, snaps into the enclosure. The proposed enclosure shall be designed to accommodate a changing variety of connector types including SC, ST, Fixed Shroud Duplex (e.g., "FDDI Connector"), Biconic, FC, and MT-RJ by changing panels on which connector couplings are mounted.
- B. The fiber distribution cabinet shall be sized to accommodate the total fiber count to be installed at each location as defined in the specifications and drawings, including those not terminated (if applicable). Connector panels and connector couplings (sleeves, bulkheads, etc.) adequate to accommodate the number of fibers to be terminated shall be furnished and installed by the Contractor.
- C. The fiber distribution cabinet shall be an enclosed assembly affording protection to the cable subassemblies and to the terminated ends. The enclosures shall incorporate a hinged or retractable front cover designed to conceal and protect the optical fiber couplings, connectors, and cable.
- D. Access to the inside of the fiber distribution cabinet's enclosure during installation shall be from the front and/or rear. Panels that require any disassembly of the fiber distribution cabinet to gain entry will not be accepted.
- E. The fiber distribution cabinet's enclosure shall provide for strain relief of incoming optical fiber cables and shall incorporate radius control mechanisms to limit bending of the optical fiber to the manufacturer's recommended minimums or 1/2", whichever is larger.
- F. All fiber distribution cabinets shall provide protection to both the "facilities" and "user" side of the coupling. The fiber distribution cabinet's enclosure shall be configured to require front access only when patching. The incoming optical fiber cables (e.g., backbone, riser, horizontal, etc.) shall not be accessible from the patching area of the panel. The fiber distribution cabinet's enclosure shall provide a physical barrier to access such optical fiber cables.
- G. Where "Loose Buffered" cables are installed, the 250 µm coated optical fibers contained in these cables may be terminated either by (1) splicing of factory-terminated cable assemblies ("pigtailed") or (2) the use of a "fan-out" kit. In the latter approach, individual fibers are to be secured in a protective covering, an Aramid (e.g., Kevlar™) reinforced tube for example, with connectors mated to the resulting assembly. In both instances, the proposed termination hardware shall incorporate a mechanism by which cable and subassemblies are secured to prevent damage. Splicing shall be by the "fusion" method. Individual splice loss shall not exceed 0.3 dB for multi-mode fibers. Direct termination of 250 µm coated optical fibers shall not be permitted.
- H. Fiber distribution cabinets for horizontal cabling: Where optical fiber horizontal cabling is to be terminated, the enclosure shall be compliant to all the above requirements plus the enclosure

shall incorporate a storage mechanism designed to allow simplified identification, access to and termination of individual optical fibers. This may be in the form of a storage cassette, tray or other appropriate mechanism.

<b>Test Procedure</b>	<b>Maximum Attenuation Change</b>
Cable Retention (FOTP-6)	0.2 dB
Durability (FOTP-21)	0.2 dB
Impact (FOTP-2)	0.2 dB
Thermal Shock (FOTP-3)	0.2 dB
Humidity (FOTP-5)	0.2 dB

## **2.6 LADDER RACK**

- A. Provide complete ladder rack system including metallic ladder rack, splice connectors, fastening hardware and other miscellaneous materials as required for a complete installation per manufacturer's recommendations.
- B. Tubing Style Ladder Rack:
  - 1. Rolled steel siderail stringer, minimum 1.5" stringer height, 9" spaced welded rungs.
  - 2. Steel shall meet the requirements of ASTM A1011 SS Grade 33.
  - 3. Loading limits shall be 185 lbs/ft for 4 ft spans.
- C. Ladder rack finish shall be flat black powder coat.

## **2.7 COPPER PATCH CORDS**

- A. 110-type Termination Block:
  - 1. Provide Category 6 copper patch cords for each assigned port on the 110-type termination block. These patch cords shall be the cross-connect between the copper backbone 110-type termination block and the horizontal RJ-45 modular patch 110-type termination block. Copper patch cords shall be equipped with a 2-pair 110-type connector on the backbone end and a RJ-45 connector 2-pair 110-type on the horizontal cable end. Provide lengths as required by the layout of the room.
  - 2. Refer to Section 27 15 00 for cable and connector performance requirements.
  - 3. Patch cords shall not be made-up in the field.
  - 4. Basis of Design (Refer to 27 17 20 for Acceptable Manufacturers):
    - a. Hubbell 2-Pair 110 to RJ-45
- B. Modular Patch Panel:
  - 1. Provide Category 6 copper patch cords for 50% of all assigned ports on the modular patch panel. Of these cords, 60% shall be 3' in length and 40% shall be 5' in length. These patch cords shall be the cross-connect between the network electronics and the horizontal RJ-45 modular patch panel. Copper patch cords shall be equipped with a 4-pair RJ-45 connector on each end.
  - 2. Refer to Section 27 15 00 for cable and connector performance requirements.
  - 3. Patch cords shall not be made-up in the field.
  - 4. Basis of Design (Refer to 27 17 20 for Acceptable Manufacturers):
    - a. Hubbell HC Series

## **2.8 FIBER PATCH CORDS**

- A. Optical Fiber Patch Cords (Multimode):
  - 1. Provide 50/125 mm multimode (MM) optical fiber utilizing tight buffer construction for 50%

of all assigned ports on the fiber distribution cabinet. These patch cords shall be the cross-connect between the backbone fiber distribution cabinet and the Owner's network electronics (hub/switch). Optical fiber patch cords shall be equipped with a ceramic tipped LC-type connector on each end and shall be a minimum of 5 feet in length. Connector body shall be of materials similar to that used in the proposed couplings. Provide required lengths as determined on the plans.

2. Channels shall be of equal length.
3. Refer to Section 27 15 00 for cable and connector performance requirements.
4. Basis of Design (Refer to 27 17 20 for Acceptable Manufacturers):

a. Hubbell DFPC Series

B. Optical Fiber Patch Cords (Singlemode):

1. The optical fiber patch cord shall be 8.3/3 mm singlemode (SM) optical fiber, utilizing tight buffer construction. The optical fiber patch cords shall be a minimum of 5 feet in length.
2. Provide 8.3/3 mm singlemode (SM) optical fiber utilizing tight buffer construction for 50% of all assigned ports on the fiber distribution cabinet. These patch cords shall be the cross-connect between the backbone fiber distribution cabinet and the Owner's network electronics (hub/switch). Optical fiber patch cords shall be equipped with a ceramic tipped LC-type connector on each end and shall be a minimum of 5 feet in length. Connector body shall be of materials similar to that used in the proposed couplings. Provide required lengths as determined on the plans.
3. Channels shall be of equal length.
4. Refer to Section 27 15 00 for cable and connector performance requirements.
5. Basis of Design (Refer to 27 17 20 for Acceptable Manufacturers):

a. Hubbell DFPC Series

## 2.9 DEMARCATION REQUIREMENTS

- A. Contractor shall coordinate all requirements for the demarcation point with the Owner's selected service provider.
- B. The Contractor shall not proceed with any installation without written communication with the Architect/Engineer should the service provider's requirements differ from the work shown on the contract documents.
- C. Refer to the drawings for further requirements.

## PART 3 - EXECUTION

### 3.1 EQUIPMENT RACKS

- A. Equipment racks shall be furnished and installed as shown on the drawings.
- B. The Contractor shall bolt the rack to the floor as recommended by the manufacturer. Multiple racks shall be joined and the ground made common on each. The rack shall be stabilized by extending a brace to the wall. Alternately, overhead ladder rack by which the cabling accesses the equipment rack(s) may provide this function.
- C. A space between the rack upright and the wall (approximately 4") should be provided to allow for cabling in that area. The rear of the rack should be approximately 40" from the wall to allow for access by maintenance personnel. In all cases, a minimum of 40" workspace in front of the rack is also required. Locations where these guidelines cannot be followed should be brought to the attention of the Architect/Engineer for resolution prior to installation.

- D. All hardware and equipment is to be mounted between 18" and 79" above floor level. This is to afford easy access and, in the case of the lower limit, prevent damage to the components. Positioning of hardware should be reviewed and approved by the Architect/Engineer and Site Coordinator(s) prior to installation.
- E. Equipment racks shall be equipped with cable management hardware as to allow an orderly and secure routing of optical fiber and/or copper cabling to the optical fiber distribution cabinets and/or modular patch panels. At minimum, one such horizontal jumper management panel shall be placed below each optical fiber distribution cabinet installed by the Contractor. Additional Jumper Management panels may be required pending installation of other cable types on the equipment rack.
- F. Each rack shall be grounded to the Telecommunications Ground Bar (GND) using a #6 AWG (or larger) insulated stranded copper conductor (GREEN jacket) directly or via an adjacent grounded equipment rack. Refer to grounding requirements below.

### **3.2 LADDER RACK**

- A. Provide support for ladder rack on 4 ft centers.
- B. Maintain a 1.5 safety factor on all load limits specified herein.
- C. Ladder rack support shall be by 5/8" diameter threaded rod when ceiling mounted. Ladder rack requiring wall mounting shall utilize accessories supplied by the ladder rack manufacturer specifically for the purpose of wall mounting ladder rack.

### **3.3 GROUNDING**

- A. Provide a complete grounding system in accordance with the requirements of Section 27 05 26.

### **3.4 CROSS CONNECT INSTALLATION**

- A. Bend radius of cable shall not exceed 4 times the outside cable diameter or manufacturer's recommendation, whichever is less.
- B. Cables shall be neatly bundled and dressed to their respective panels and/or blocks. Each shall be fed by an individual bundle separated and dressed to the point of cable entrance into the rack and/or frame.
- C. The cable jacket shall be maintained as close as possible to the termination point.
- D. Each cable shall be clearly labeled on the cable jacket behind the patch panel at a location that is visible without removing the bundle support.

### **3.5 CONDUITS AND CABLE ROUTING**

- A. Refer to Section 26 05 33 for additional requirements.
- B. Where conduits enter a telecommunications room, conduits shall be terminated on the wall where shown on the contract documents. Conduits entering the room from the floor shall extend 3" above the floor slab.
- C. Where cabling rises vertically in a telecommunications rooms, provide vertical cable management to support the cabling from floor to ceiling level.
- D. All conduits shall be reamed and shall be installed with a nylon bushing.
- E. Maintain appropriate conduit bend radius at all times. For conduits with an internal diameter of



2" or less, maintain a bend radius of at least 6 times the internal diameter. For conduits with an internal diameter greater than 2", maintain a bend radius of at least 10 times the internal diameter.

**END OF SECTION**

## SECTION 27 13 00 - BACKBONE CABLING REQUIREMENTS

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. Section describes the products and execution requirements relating to furnishing and installing backbone communications cabling and termination components and related subsystems as part of a cabling plant. The cabling plant consists of both optical fiber and/or copper cabling.

#### 1.2 RELATED WORK

- A. Section 27 05 00 - Basic Technology Systems Requirements.
- B. Section 27 15 00 - Horizontal Cabling Requirements.
- C. Section 27 17 20 - Structured Cabling System Warranty.

#### 1.3 QUALITY ASSURANCE

- A. Refer to Section 27 05 00 for relevant standards.

#### 1.4 SUBMITTALS

- A. Under the provisions of Section 27 05 00 and Division 1, prior to the start of work the Contractor shall submit:
  - 1. Manufacturer's data covering all products proposed, including construction, materials, ratings and all other parameters identified in Part 2 - Products, below.

### PART 2 - PRODUCTS

#### 2.1 GENERAL

- A. The basis of design is listed herein. Refer to Section 27 17 20 for additional acceptable manufacturers.

#### 2.2 OPTICAL FIBER BACKBONE - OUTSIDE PLANT

- A. Exterior Conduit (Singlemode):
  - 1. This optical fiber cable shall be suitable for installation in underground duct and in innerduct.
  - 2. Optical fiber cable materials shall be all dielectric (no conductive materials).
  - 3. Optical fiber cable shall be filled with a water-blocking material.
  - 4. Outer Sheath: Polyethylene (PE). The outer sheath shall be marked with the manufacturer's name, words identifying the cable type (e.g., "Optical Fiber Cable" or "Fiber Optic Cable"), year of manufacture, and sequential length markings. The actual length of the optical fiber cable shall be within -0/+1% of the length markings. The marking shall be in a contrasting color to the cable jacket.
  - 5. Temperature Range:
    - a. Storage: -40°C to +70°C (no irreversible change in attenuation).
    - b. Operating: -40°C to +70°C.
  - 6. Humidity Range: 0% to 100%.

7. Maximum Tensile Strength:
  - a. During Installation: 2700 Newton (600 lb. force) (no irreversible change in attenuation).
  - b. Long Term: 890 N (200 lb. force).
8. Bending Radius:
  - a. During Installation: 20 times cable diameter.
  - b. No Load: 10 times cable diameter.
9. Basis of Design (Singlemode):
  - a. Additional acceptable manufacturers:
    - 1) Hubbell
    - 2) Mohawk
    - 3) Berk-Tek
    - 4) Superior Essex

<b>Test Procedure</b>	<b>Maximum Attenuation Change</b>
Cable Retention (FOTP-6)	0.2dB
Durability (FOTP-21)	0.2dB
Impact (FOTP-2)	0.2dB
Thermal Shock (FOTP-3)	0.2dB
Humidity (FOTP-5)	0.2dB

B. Optical Fiber Connectors (LC-type) (Singlemode):

1. LC-type Optical Fiber Connectors: Shall be used to terminate optical fiber in communication equipment rooms.
2. LC-type optical fiber connector plugs shall be snap-type with an integrated pull-proof design.
3. LC-type optical fiber connector plugs shall incorporate a zirconium ceramic ferrule and shall utilize a factory pre-polish end face to ensure fiber-to-fiber physical contact for low loss and reflections.
4. LC-type optical fiber connector plugs shall accept 1.6mm - 2.0mm and 3.0mm outside diameter fiber.
5. The average insertion loss is 0.3db for single mode connectors
6. LC-type optical fiber connector plugs shall meet the following performance criteria:

<b>Test Procedure</b>	<b>Maximum Attenuation Change</b>
Cable Retention (FOTP-6)	0.2dB
Durability (FOTP-21)	0.2dB
Impact (FOTP-2)	0.2dB
Thermal Shock (FOTP-3)	0.2dB
Humidity (FOTP-5)	0.2dB

7. Additional Performance Requirements:
  - a. Length: 2.23 inches
  - b. Operating Temperature: -40 to 85 degrees C
8. Basis of Design:

### 2.3 OPTICAL FIBER BACKBONE PERFORMANCE

A. Singlemode (SM):

1. Fiber Type: Singlemode; doped silica core surrounded by a concentric glass cladding.

2. Core Diameter: 8 to 9  $\mu\text{m}$ . All optical fibers shall be of the same nominal core diameter and profile.
3. Cladding Diameter:  $125 \pm 1.0 \mu\text{m}$ .
4. Cladding Non-circularity:  $\pm 1\%$ .
5. Core to Cladding Offset:  $\pm 0.8 \mu\text{m}$ .
6. Fiber Coating Diameter:
  - a.  $245 \pm 15\mu\text{m}$  (primary coating).
  - b. 900-nm (nominal) secondary coating (tight buffer).
  - c. All coatings shall be mechanically strippable without damaging the optical fiber.
7. Cut-off Wavelength (cabled fiber;  $\lambda_{ccf}$ )  $\leq 1260\text{-nm}$ .
8. Mode Field Diameter: 8.3 to 9.8  $\mu\text{m}$  at 1300-nm;  $10.5 \pm 1.0 \mu\text{m}$  at 1550-nm.
9. Zero Dispersion Wavelength ( $\lambda_0$ ): 1301.5 nm less than  $\lambda_0$  less than 1321.5 nm.
10. Zero Dispersion Slope (S0): Less than 0.092 ps/nm<sup>2</sup>\*km.
11. Fiber Attenuation (maximum @  $23 \pm 5^\circ\text{C}$ ; Backbone):
  - a. @ 1300-nm: 2.0 dB/km
  - b. @ 1550-nm: 1.75 dB/km
    - 1) When tested in accordance with FOTP-3, "Procedure to Measure Temperature Cycling Effects on Optical Fibers, Optical Cable, and Other Passive Fiber Optic Components," the average change in attenuation over the rated temperature range of the optical fiber cable shall not exceed 0.05 dB/km at 1550-nm. The magnitude of the maximum attenuation change of each individual optical fiber shall not be greater than 0.15 dB/km at 1550-nm.
12. Fiber Dispersion (maximum):
  - a. @ 1285 to 1330-nm: 3.2-ps/nm\*km
  - b. @ 1550-nm: 18-ps/nm\*km
13. No optical fiber shall show a point discontinuity greater than 0.1 dB at the specified wavelengths. Such a discontinuity or any discontinuity showing a reflection at that point shall be cause for rejection of that optical fiber by the Owner.

## 2.4 COPPER BACKBONE - OUTSIDE PLANT

### A. CAT 3 Backbone Cable:

1. CAT 3 backbone cable shall incorporate 24 AWG solid, annealed, bare copper conductors. All conductors shall be continuous and splice free. Bridge taps shall not be allowed.
2. Conductors shall be insulated with a thermoplastic skin. Maximum diameter of the insulated conductor shall be 0.048 in (1.22 mm). Insulated conductors shall be stranded into pairs of varying lengths to minimize crosstalk.
3. Conductors shall be identified by the insulation color of each conductor. The color code shall follow the industry standard composed of 10 distinctive colors to identify 25-pairs in accordance with ICEA publication S-80-576-1988. Marking of each mate of the primary conductor in a pair with the color of that primary conductor is optional.
4. When CAT 3 backbone cables of larger than 25 pairs are required, the core shall be assembled into 25-pair sub-units, each color-coded in accordance with ICEA publication S-80-576-1988. CAT 3 backbone cables with over 600-pair shall have 25-pair binder groups combined into super units. These super units shall be wrapped with a solid color thread that follows the primary color scheme of white, red, black, yellow and violet. Binder color code integrity shall be maintained wherever CAT 3 backbone cables are spliced.
5. CAT 3 backbone cable shall meet the physical and electrical requirements of 100 Ohm "Backbone Cable" as defined by the ANSI/TIA/EIA-568 Standard for Commercial Building Wiring and shall conform to Category 3 performance specifications or better.

- Measurements should be in accordance with ASTM D 4566 (ref. B.17).
6. CAT 3 backbone cable shall be UL listed and be compliant with Article 800 (Communications Circuits) of the National Electrical Code (NEC) and be suitable for installation in underground duct or direct burial (REA PE-89).
  7. A flooding compound shall be applied over the core and to all surfaces of the shield/armor to resist moisture entry and to inhibit corrosion.
  8. The CAT 3 backbone cable core shall be filled with a waterproofing compound and wrapped with a non-hydroscopic core tape.
  9. CAT 3 backbone cable shall contain an overall corrugated, coated aluminum shield, which is electrically continuous over its entire length.
  10. CAT 3 backbone cable shall be finished with a black polyethylene jacket, which is sequentially printed with a footage marker at regular intervals.
  11. Basis of Design:
    - a. Belden ANMW.

### **PART 3 - EXECUTION**

#### **3.1 CABLE INSTALLATION REQUIREMENTS**

- A. Cable slack shall be provided in each backbone fiber optic cable. This slack is exclusive of the length of fiber that is required to accommodate termination requirements and is intended to provide for cable repair and/or equipment relocation. The cable slack shall be stored in a fashion as to protect it from damage and be secured in the termination enclosure or a separate enclosure designed for this purpose. Multiple cables may share a common enclosure.
- B. A minimum of 5 meters (approximately 15 feet) of slack cable (each cable if applicable) shall be coiled and secured at both ends located in the entrance room, Telecommunications Room or main equipment room, for backbone and intra-building cable.
- C. Where exposed, all backbone fiber optic cable shall be installed in protective inner duct. This includes areas where the cable is routed in cable tray and where making a transition between paths (e.g., between conduit and cable tray or into equipment racks). The inner duct should extend into the termination and/or storage enclosure(s) at system endpoints.

#### **3.2 CROSS-CONNECTS**

- A. The Owner will be responsible for all cross-connects between the data backbone cabling and network electronics and between the data network electronics and horizontal cabling.
- B. The Owner shall be responsible for the cross-connect wiring between the horizontal and backbone voice cabling.
  1. All four (4) pairs of the horizontal cable shall be terminated on modular patch panels. Two (2) pairs of the horizontal cable shall be cross-connected to the backbone cable. Refer to the drawings for requirements of the 110 to RJ-45 cross connect cable.
  2. All four (4) pairs in each horizontal cable shall be terminated on 110-type termination blocks in a field dedicated for horizontal cabling. Two (2) pairs of the horizontal cable shall be cross-connected to the backbone cable. 2-pair cross-connect wire, color-coded to identify each pair, shall be used. The 25TH pair position (50th, 75th, etc.) of each riser voice block shall remain vacant.
  3. Fastening cables directly to support brackets with wire or plastic ties will not be accepted. All cabling shall be neatly laced, dressed and supported. Avaya 88A retainer clips (or equivalent) shall be used on each 110-type termination block to secure jumper wires on the wiring block(s).
- C. Contractor shall not be responsible for cross-connects between the cabling terminations at the

Entrance Room and the telephone utility network point-of-presence. It shall be the responsibility of the Contractor, to work with the Owner and provide the necessary assistance to allow Owner and/or telephone company personnel to make the necessary connections to establish service on the new cable system. These activities include, but are not limited to cross-connect documentation, general wiring overview and cable pair identification.

**END OF SECTION**

## SECTION 27 15 00 - HORIZONTAL CABLING REQUIREMENTS

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. This section describes the products and execution requirements relating to furnishing and installing horizontal communications cabling and termination components and related subsystems as part of a cabling plant. The cabling plant consists of copper and optical fiber cabling.

#### 1.2 RELATED WORK

- A. Section 27 05 00 - Basic Communications Systems Requirements
- B. Section 27 17 20 - Structured Cabling System Warranty

#### 1.3 QUALITY ASSURANCE

- A. Refer to Section 27 05 00 for relevant standards and plenum or non-plenum cable requirements.
- B. The channel shall be required to meet the performance requirements indicated herein. The manufacturer shall warranty the performance of their system to the required performance (and not just to the Standard, should the required performance exceed the Standard).
- C. Specific components of the channel shall be required, at a minimum, to meet the Standard component requirements for that particular component.
- D. The installing contractor must be certified by the manufacturer of the structured cabling system.

#### 1.4 SUBMITTALS

- A. Under the provisions of Section 27 05 00 and Division 1, prior to the start of work the Contractor shall submit:
  - 1. Manufacturer's data covering all products proposed, including construction, materials, ratings and all other parameters identified in Part 2 - Products, below.
  - 2. Manufacturer's installation instructions.

### PART 2 - PRODUCTS

#### 2.1 HORIZONTAL CABLE

Test Parameter	100 MHz	250 Mhz
Attenuation:	22.0 dB	36.9 dB
NEXT:	35.3 dB	31.3 dB
PS NEXT:	32.3 dB	28.3 dB
ACR:	13.3 dB	-5.5 dB
PS ACR:	N/A	-8.5 dB
ELFEXT:	23.8 dB	18.8 dB
PS ELFEXT:	20.8 dB	15.8 dB
Return Loss:	20.1 dB	17.3 dB
Propagation Delay:	548 ns	N/A
Delay Skew:	50 ns	25 ns

Test Parameter	100 MHz	150 Mhz
Attenuation:	24.0 dB	30.1 dB
NEXT:	30.1 dB	28.5 dB
PS NEXT:	27.1 dB	25.5 dB
ACR:	6.1 dB	-1.5 dB
PS ACR:	3.1 dB	-4.5 dB
ELFEXT:	17.4 dB	16.3 dB
PS ELFEXT:	14.4 dB	13.3 dB
Return Loss:	10.0 dB	8.2 dB

Electrical Value (1 - 250 MHz)	Minimum Margin
Insertion Loss:	14.0%
NEXT:	7.0 dB
PS NEXT:	8.0 dB
ACR-F (ELFEXT):	8.0 dB
PS ACR-F (PS ELFEXT):	8.0 dB
Return Loss:	4.0 dB

Electrical Value (1 - 250 MHz)	Minimum Margin
Insertion Loss:	5%
NEXT:	3.0 dB
PS NEXT:	5.0 dB
ACR-F (ELFEXT):	4.0 dB
PS ACR-F (PS ELFEXT):	5.0 dB
Return Loss:	2 dB

A. CAT 6A Cable: Data Network and AV Over IP Network

1. The horizontal cable requirements must be met, as well as the following channel requirements.
2. CAT 6A cable shall terminate on rack-mounted modular patch panels in their respective communication equipment room as indicated on the drawings.
3. Cable shall exceed transmission requirements listed in ANSI/TIA/EIA-568-C.2. Performance tests shall be conducted using swept frequency testing through 500 MHz for the channel. All numbers given are for a 4-connection channel. Discrete frequency testing results at 500 MHz is not acceptable.
4. Performance tests shall be conducted using swept frequency testing through 500 MHz for the channel. All numbers given are for a 4-connection channel. Discrete frequency testing results at 500 MHz is not acceptable.
5. Performance data shall be provided by third-party independent testing laboratories only. Testing data shall be submitted on the third-party testing laboratory letterhead. Test data will only be accepted if it displays testing as a channel. Electrical characteristics of the performance of the cable itself will not satisfy this requirement.
6. The structured cabling and connectivity may be provided by the same company. For the purpose of this specification that shall mean that the cabling and connectivity must be marketed, branded, supported, warranted, and distributed by the same company. Specifically, ally or partnerships between cabling manufacturers and connectivity manufacturers do not meet this requirement unless otherwise listed in Section 27 17 20 as an acceptable manufacturer. Specifically, products made by others through an OEM relationship are acceptable if the products are marketed, branded, supported, warranted, and distributed by the same company.
7. The 4-connector channel performance margins in the table below shall be guaranteed margins above ANSI/TIA/EIA-568-C.2:



<b>Electrical Value (1 - 500 MHz)</b>	<b>Minimum Margin</b>
Insertion Loss:	3%
NEXT:	2 dB
PS NEXT:	3 dB
PSA NEXT:	3 dB
PSA NEXT (Average):	
ACR-F:	2 dB
PS ACR-F:	3 dB
PSA ACR-F:	3 dB
PSA ACR-F (Average):	3 dB
Return Loss:	2 dB

8. The jacket color for CAT 6A cable shall be blue for all data network applications. The jacket color for AV Over IP Network CAT 6A cable shall be Yellow.
9. Basis of Design:
  - a. Hubbell C6ASP Series
  - b. Additional acceptable manufacturers:
    - 1) Belden
    - 2) Berk-Tek
    - 3) General Cable
    - 4) Panduit
    - 5) Siemon
    - 6) Superior Essex

## 2.2 FACEPLATES/JACKS

### A. Cat 6A Jacks: Data Network and AV Over IP Network

1. CAT 6A horizontal cable shall each be terminated at its designated work area location on RJ-45 modular jacks. These modular jack assemblies shall snap into a modular mounting frame. The combined modular jack assembly is referred to as an information outlet.
2. The same orientation and positioning of modular jacks shall be utilized throughout the installation. Prior to installation, the Contractor shall submit the proposed configuration for each information outlet type for review by the Architect/Engineer.
3. Information outlet faceplates shall incorporate recessed designation strips at the top and bottom of the frame for identifying labels. Designation strips shall be fitted with clear plastic covers.
4. Where standalone CAT 6A only modular jacks are identified, the information outlet faceplate shall be configured as to allow for the addition of one (1) additional modular jack (CAT 3, CAT 5E, or CAT 6) to be installed to supplement each such modular jack as defined by this project. The installation of these supplemental modular jacks is NOT part of this project.
5. Any unused modular jack positions on an information outlet faceplate shall be fitted with a removable blank inserted into the opening.
6. All modular jacks will be fitted with a dust cover. Modular jacks shall incorporate a dust cover that fits over and/or into the modular jack opening. The dust cover shall be designed to remain with the modular jack assembly when the modular jack is in use. No damage to the modular jack pinning shall result from insertion or removal of these covers. Dust covers that result in deformation of the modular jack pinning, will not be accepted.
7. The information outlet faceplate shall be constructed of high impact plastic (except where noted otherwise). The information outlet faceplate color shall:
  - a. Match the receptacle color used for other utilities in the building, or
  - b. When installed in surface raceway (if applicable), match the color of that raceway.
8. Different faceplate and frame designs for locations, which include optical fiber cabling

relative to those, that terminate only copper cabling are acceptable. Information outlets that incorporate optical fiber shall be compliant with the above requirements plus:

- a. Be a low-profile assembly.
  - b. Incorporate a mechanism for storage of cable and fiber slack needed for termination.
  - c. Position the optical fiber couplings to face downward or at a downward angle to prevent contamination.
  - d. Incorporate a shroud that protects the optical fiber couplings from impact damage.
9. All information outlets and the associated modular jacks shall be of the same manufacturer throughout the project.
  10. The CAT 6A modular jacks shall be non-keyed 8-pin modular jacks.
  11. The interface between the modular jack and the horizontal cable shall be an angled insulation displacement type contact and shall provide separation for ANEXT suppression. Termination components shall be designed to maintain the horizontal cable's pair twists as closely as possible to the point of mechanical termination.
  12. CAT 6A modular jacks shall be pinned per T-568B.
  13. CAT 6A termination hardware shall, as a minimum, meet all the mechanical and electrical performance requirements of the following standards:
    - a. ANSI/TIA/EIA-568-B.2-10
    - b. IEEE 802.af (PoE)
    - c. IEEE 802.an 10GBASE-T
    - d. ISO/IEC 60603-7
    - e. ISO 11801 Class E Compliant
    - f. FCC PART 68.5 SUBPART F
  14. The color for CAT 6A jacks shall be for voice applications and blue for all data network applications. Alternately, a color-coded bezel or icon may be used to identify the CAT 6A modular jack. The color for AV Over IP Network jacks shall be Yellow.

## **2.3 COPPER WORK AREA CORDS**

- A. RJ-45:
  1. Provide the same quantity of Category 6A copper work area cords as copper patch panel cords specified in Section 27 11 00. Copper work area cords shall be equipped with an 8-pin modular RJ-45 connector on each end.
  2. Work area cords shall be 10' in length.
  3. Manufacturer of copper patch cable shall be the same as the manufacturer of the horizontal copper cable.

## **PART 3 - EXECUTION**

### **3.1 CABLE INSTALLATION REQUIREMENTS**

- A. Horizontal Cabling: Data Network and AV Over IP Network
  1. The maximum horizontal cable drop length for Data UTP shall not exceed 295 feet (90 meters) in order to meet data communications performance specifications. This length is measured from the termination panel in the wiring closet to the outlet and must include any slack required for the installation and termination. The Contractor is responsible for installing horizontal cabling in a fashion so as to avoid unnecessarily long runs. Any area that cannot be reached within the above constraints should be identified and reported to the Architect/Engineer prior to installation. Changes to the contract documents shall be approved by the Architect/Engineer.
  2. All cable shall be free of tension at both ends. In cases where the cable must bear some stress, Kellum grips may be used to spread the strain over a longer length of cable.

3. Manufacturer's minimum bend radius specifications shall be observed in all instances.
  4. Horizontal cabling installed as open cabling shall be supported at a maximum of 5' between supports. Refer to the specifications for required cable supports.
  5. Horizontal cabling installed as open cable or in cable tray shall be bundled at not less than 10' intervals with hook-and-loop tie wraps. The use of plastic cable ties is strictly prohibited.
  6. The maximum conduit fill for horizontal cabling shall not exceed 40% regardless of conduit length.
  7. Cable sheaths shall be protected from damage from sharp edges. Where a cable passes over a sharp edge, a bushing or grommet shall be used to protect the cable.
- B. A coil of 3 feet in each cable shall be placed in the ceiling at the last support (e.g., J-hook, bridle ring, etc.) before the cables enter a fishable wall, conduit, surface raceway or box. At any location where cables are installed into movable partition walls or modular furniture via a service pole, approximately 15-feet of slack shall be left in each horizontal cable under 250 feet in length to allow for change in the office layout without re-cabling. These "service loops" shall be secured at the last cable support before the cable leaves the ceiling and shall be coiled from 100% to 200% of the cable recommended minimum bend radius.
1. Category 6A cables shall not be mixed with any other category cable in any bundle. Bundles of Category 6A cable shall maintain a 0.5" separation from bundles of cables containing different categories (e.g., Cat 6, Cat 5E).
  2. To reduce or eliminate EMI, the following minimum separation distances from 480V power lines shall be adhered to:
    - a. Twelve (12) inches from power lines of less than 5-kVa.
    - b. Eighteen (18) inches from high-voltage lighting (including fluorescent).
    - c. Thirty-nine (39) inches from power lines of 5-kVa or greater.
    - d. Thirty-nine (39) inches from transformers and motors.
  3. Information outlets shown on floor plans with the subscript "W" are intended to be used for wall mounted telephones. Back boxes for wall mounted telephones shall not be located within 12" vertically, or horizontally, from any light switches, power receptacles, nurse call devices, thermostats, or any other architectural element that would otherwise prevent the installation of a wall mounted telephone on the mating lugs.
- C. Horizontal Cabling in Modular Furniture:
1. This Contractor shall be responsible for providing and installing cable completely to the information outlet in the furniture. This Contractor's responsibility does not end at the furniture feed point.
  2. Where furniture panels are installed to include contact with a wall, cabling shall be fed to the furniture panels via conduit.
  3. Where modular furniture is installed without wall contact, the Contractor shall install cabling through floor fittings as shown on the drawings.
  4. Cabling shall be protected in the transition from the floor or wall fittings to the modular furniture via a length of flexible plastic conduit or other approved protective means. Conduit fittings shall be compatible with the Floor and Wall Fittings proposed. There shall be no exposed cable in the transition to the modular furniture. Fill ratio (cable area vs. conduit area) in each feed shall not exceed 40%.
  5. For purposes of bidding, it is to be assumed that the cable pathway shall be limited to the bottom panel of the modular furniture only. Communications cables would be run through these channels to the jack location.
  6. For purposes of bidding, it is to be assumed that it will be the responsibility of the Contractor to punch and reinstall the bottom molding panels on the modular furniture as required to accommodate the communications cabling and information outlets. The panels shall be marked prior to installation by the Owner to identify the desired location of the information outlets.

7. The information outlet shall be secured to the panel via mounting tabs, pop-rivets, screws or other approved method. Use of adhesive tape is not acceptable. The method of securing the information outlet to the panel shall not result in sharp protrusions (e.g., sheet metal screw tip) into the channel behind the panel.

### **3.2 CABLE TERMINATION REQUIREMENTS**

#### **A. Cable Termination - CAT 3 Voice Horizontal Cabling:**

1. Voice pairs shall terminate on wall-mounted 110-type termination blocks at the entrance room, main equipment room and/or telecommunications rooms.
2. If the "last" Horizontal termination block is greater than 50% utilized, one additional block shall be provided for future use. Provide additional horizontal termination blocks to accommodate a minimum of <Insert> additional drops.
3. The Contractor shall furnish and install cable management hardware (e.g., D-rings and cable guides) to neatly and securely route the cable from the nearest cable tray to the cable termination hardware.
4. The height of the voice termination field shall not exceed 6 feet (72 inches) above floor level to facilitate cable maintenance.
5. Termination blocks on which the backbone and horizontal cabling are terminated shall be positioned in separate columns. Backbone cabling should be positioned to the left; horizontal cabling to the right and be in close proximity to simplify installation and subsequent tracing of cross-connect wiring. Where new cabling is to be integrated with existing cabling at the building entrance, it will be the responsibility of the Contractor, in cooperation with the Owner, to coordinate placement of voice termination hardware of the local exchange carrier(s) serving the site.
6. Cables shall be fed from below termination hardware in a manner that will facilitate growth.
7. Horizontal troughs incorporating split plastic distribution rings shall be provided by the Contractor to accommodate routing of jumpers. Troughs shall be positioned at the top of and between each column of termination blocks. Rings shall be positioned between the backbone and horizontal blocks for vertical routing of jumpers and/or cross-connect wiring.
8. Termination of horizontal voice cabling shall be accomplished by using 4-pair (e.g., C4-type) clips. The 25<sup>th</sup> of each row on the 110-type termination block located in the telecommunication room shall not be used for termination of horizontal voice cable.
9. Termination of backbone voice cabling shall be accomplished by using 5-pair (e.g., C5-type) clips.
10. The Contractor shall ensure that the twists in each cable pair are preserved to within 1.0 inch of the termination for all voice UTP cables. The cable jacket shall be removed only to the extent required to make the termination.
11. A jumper wire spool holder shall be installed at the main equipment room. Two full 1000-foot (305 meter) spools of 24 AWG one-pair jumper wire, one spool each of white-blue/blue and white-green/green, shall be supplied with the holder. The spool holders shall be assemblies designed for that purpose.

#### **B. Cable Terminations - Data UTP:**

1. Modular patch panels shall be designed and installed in a fashion as to allow future horizontal cabling to be terminated on the panel without disruption to existing connections.
2. If the "last" patch (per rack) is greater than 50% utilized, one additional patch panel shall be provided for future use.
3. At information outlets and modular patch panels, the Contractor shall ensure that the twists in each cable pair are preserved to within 0.5-inch of the termination for data cables. The cable jacket shall be removed only to the extent required to make the termination.

**END OF SECTION**

## SECTION 27 17 10 - TESTING

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. This section describes the testing requirements relating to the structured cabling system and its termination components and related subsystems.

#### 1.2 RELATED WORK

- A. Section 27 05 00 - Basic Communications Systems Requirements

#### 1.3 QUALITY ASSURANCE

- A. Refer to Section 27 05 00 for relevant standards.

#### 1.4 SUBMITTALS

- A. Under the provisions of Section 27 05 00 and Division 1, prior to the start of work, the Contractor shall submit:
  - 1. Complete information on testing procedure as described herein.
  - 2. Test plan summary for each cable type to be tested including equipment to be used, setup, test frequencies or wavelengths, results format, etc.

### PART 2 - PRODUCTS

#### 2.1 TESTING COPPER

- A. General Requirements:
  - 1. Perform acceptance tests as indicated below for each sub-system (e.g., backbone, horizontal, etc.) as it is completed.
  - 2. Supply all equipment and personnel necessary to conduct the acceptance tests. The method of testing shall be approved by the Architect/Engineer.
  - 3. Visually inspect all cabling and termination points to ensure that they are complete and conform to the wiring pattern defined herein. Provide the Architect/Engineer with a written certification that this inspection has been made.
  - 4. Conduct acceptance testing according to a schedule coordinated with the Owner/Architect/Engineer. Representatives of the Owner may be in attendance to witness the test procedures. Provide a minimum of one (1) week's advance notice to Architect/Engineer to allow for such participation. The notification shall include a written description of the proposed conduct of the tests, including copies of blank test result sheets to be used.
  - 5. Tests related to connected equipment of others shall only be done with the permission and presence of the Contractor involved. The Contractor shall ascertain that testing only is required to prove the wiring connections are correct.
  - 6. Provide test results and describe the conduct of the tests including the date of the tests, the equipment used, and the procedures followed. At the request of the Architect/Engineer, provide copies of the original test results in their native format.
  - 7. All cabling shall be 100% fault-free unless noted otherwise. If any cable is found to be outside the specification defined herein, that cable and the associated termination(s) shall be replaced at the expense of the Contractor. The applicable tests shall then be repeated.
  - 8. Should it be found by the Architect/Engineer that the materials or any portion thereof furnished and installed under this Contract fail to comply with the specifications and drawings with respect or regard to the quality, amount, or value of materials, appliances, or labor used in the work, it shall be rejected and replaced by the Contractor and all work

disturbed by changes necessitated in consequence of said defects or imperfections shall be made good at the Contractor's expense.

a. CAT 3 Cable:

1) Backbone Cable:

a) Backbone CAT 3 copper cable shall be free of shorts within the pairs and be verified for continuity, pair validity and polarity, and conductor position on the termination blocks (e.g., 110). Any mis-positioned pairs must be identified and corrected. The percentage of "bad" pairs shall not exceed 3% in any backbone (riser or tie) cable based on total pair count. All bad pairs must be identified and documented.

2) CAT 3 horizontal cable shall be tested as defined in TIA/EIA 568-B. Measurements shall be of the "Permanent Link", including cabling, modular jacks at the information outlets, and 110-type termination blocks. Parameters to be tested must include:

- a) Wire Map
- b) Length
- c) NEXT Loss (Pair-to-Pair)
- d) Attenuation

b. CAT 6A Cable:

1) Testing shall be from the modular jack at the information outlet to the modular patch panel in the communication equipment room.

2) Horizontal cable shall be free of shorts within the pairs and be verified for continuity, pair validity and polarity, and conductor position on the modular jack (e.g., wire map). Any defective, split, or mis-positioned pairs must be identified and corrected.

3) CAT 6A horizontal cable shall be tested to 500 MHz as defined by TIA/EIA-568-C.2. Measurements shall be of the "Permanent Link", including cabling and modular jacks at the information outlet and modular patch panel. Parameters to be tested must include:

- a) Wire Map
- b) Length
- c) NEXT Loss (Pair-to-Pair)
- d) NEXT (Power Sum)
- e) ELFEXT (Pair-to-Pair)
- f) ELFEXT (Power Sum)
- g) Return Loss
- h) Attenuation
- i) Propagation Delay
- j) Delay Skew

4) The maximum length of horizontal cable shall not exceed 295 feet, which allows 33 feet for technology equipment and modular patch cords.

5) To establish testing baselines, cable samples of known length and of the cable type and lot installed shall be tested. The cable may be terminated with an eight-position CAT 6A modular connector (8-pin) to facilitate testing. Nominal Velocity of Propagation (NVP) and nominal attenuation values shall be calculated based on this test and be used during the testing of the installed cable plant. This requirement can be waived if NVP and nominal attenuation data is available from the cable manufacturer for the exact cable type under test.

- 6) CAT 6A horizontal cable testing shall be performed using a test instrument designed for testing to 500 MHz or higher. Test records shall verify "PASS" on each cable and display the specified parameters, comparing test values with standards based "templates" integral to the unit. Test records that report a PASS\*, FAIL\*, or FAIL result for any of the parameters will not be accepted.
- 7) In the event results of the tests are not satisfactory, the Contractor shall make adjustments, replacements, and changes as necessary and shall then repeat the test or tests that disclosed faulty or defective material, equipment, or installation methods, and shall make additional tests as the Architect/Engineer deems necessary at no additional expense to the project or user agency.

## 2.2 TESTING FIBER

### A. General Requirements:

1. Perform acceptance tests as indicated below for each optical fiber sub-system (e.g., backbone, horizontal, etc.) as it is completed.
2. Supply all equipment and personnel necessary to conduct the acceptance tests. The method of testing shall be approved by the Architect/Engineer.
3. Visually inspect all optical fiber cabling and termination points to ensure that they are complete and conform to the standards defined herein. Provide the Architect/Engineer with a written certification that this inspection has been made.
4. Conduct acceptance testing according to a schedule coordinated with the Owner/Architect/Engineer. Representatives of the Owner may be in attendance to witness the test procedures. Provide a minimum of one (1) week's advance notice to the Architect/Engineer to allow for such participation. The notification shall include a written description of the proposed conduct of the tests, including copies of blank test result sheets to be used.
5. Tests related to connected equipment of others shall only be done with the permission and presence of the Contractor involved. The Contractor shall ascertain that testing only is required to prove that the optical fiber connections are correct.
6. Provide test results and describe the conduct of the tests including the date of the tests, the equipment used and the procedures followed. At the request of the Architect/Engineer, provide copies of the original test results.
7. All optical fiber cabling shall be 100% fault-free unless noted otherwise. If any optical fiber cable is found to be outside the specification defined herein, that optical fiber cable and the associated connector(s) shall be replaced at the expense of the Contractor. The applicable tests shall then be repeated.
8. Should it be found by the Architect/Engineer that the materials or any portion thereof furnished and installed under this Contract fail to comply with the specifications and drawings with respect or regard to the quality, amount, or value of materials, appliances, or labor used in the work, it shall be rejected and replaced by the Contractor and all work disturbed by changes necessitated in consequence of said defects or imperfections shall be made good at the Contractor's expense.
9. The optical fibers utilized in the installed cable shall be traceable to the manufacturer. Upon request by the Owner, provide cable manufacturer's test report for each reel of cable provided. These test reports shall include manufacturer's on-reel attenuation test results at 850-nm and 1300-nm for each optical fiber of each reel prior to shipment from the manufacturer.
  - a. On-the-reel bandwidth performance as tested at the factory. Factory data shall be provided upon request.
  - b. The testing noted for optical fiber cabling utilizes an Optical Time Domain Reflectometer (OTDR). However, the Contractor may submit to the Architect/Engineer for pre-approval of alternate fiber optic testing equipment.

- B. Tests Prior to Installation: The Contractor, at their discretion and at no cost to the Owner, may perform an attenuation test with an OTDR at 850-nm or 1300-nm on each optical fiber of each cable reel prior to installation. Supply this test data to the Architect/Engineer prior to installation.
- C. Tests After Installation: Upon completion of cable installation and termination, the optical fiber cabling shall be tested to include:
1. Optical Attenuation ("Insertion Loss" Method):
    - a. Optical Attenuation shall be measured on all terminated optical fibers in one direction of transmission using the "Insertion Loss" method measurement in accordance with the TIA/EIA 526-14, Method B, and be inclusive of the optical connectors and couplings installed at the system endpoints. Access jumpers shall be used at both the transmit and receive ends to ensure that an accurate measurement of connector losses is made. Multimode optical fibers shall be tested at  $850 \pm 30$  nm. Singlemode optical fibers (if applicable) shall be tested at  $1300 \pm 20$  nm.
    - b. Attenuation of optical fibers shall not exceed the values calculated as follows:
      - 1) Attenuation (max.) =  $2 * C + L * F + S$  dB.
      - 2) Where C is the maximum allowable Connector Loss (in dB), L is the length of the run (in kilometers), and F is the maximum allowable optical fiber loss (in dB/km). S is the total splice loss (# of splices \* maximum attenuation per splice).
  2. Verification of Link Integrity (OTDR):
    - a. All optical fibers shall be documented in one direction of transmission using an Optical Time Domain Reflectometer (OTDR). Multimode optical fibers shall be tested at 850-nm and 1300-nm (nominal). Singlemode optical fibers (if applicable) shall be tested at 1310-nm and 1550-nm (nominal). The OTDR(s) shall incorporate high-resolution optics optimized for viewing of short cable sections. Access jumpers of adequate length to allow viewing of the entire length of the cable, including the connectors at the launch and receive end, shall be used. Access jumpers used for testing shall match the type and core diameter of the fiber optic strand under test.
    - b. Set OTDRs test variables to the manufacturer's published backscatter coefficient and velocity of propagation figure for the specific strand of fiber under test. OTDRs range should be set to approximately 1.5 times the length of the strand under test, pulse width should be optimized for the length of the fiber optic strand under test, and number of averages should be adjusted to approximately 120 seconds per wavelength.
    - c. OTDR traces revealing a point discontinuity greater than 0.2 dB in a multimode optical fiber or 0.1 dB in a singlemode optical fiber (if applicable) at any of the tested wavelengths or any discontinuity showing a reflection at that point shall be a valid basis for rejection of that optical fiber by the Owner. The installation of that optical fiber cable shall be reviewed in an effort to remove any external stress that may be causing the fault. If such efforts do not remove the fault, that optical fiber cable and the associated terminations shall be replaced at the expense of the Contractor.

## 2.3 DOCUMENTATION/AS-BUILTS/RECORDS

- A. General:
1. Upon completion of the installation, submit as-builts per the requirements of Section 27 05 00 and Division 1. Documentation shall include the items detailed in subsections below.
  2. All documentation, including hard copy and electronic forms, shall become the property of the Owner.
  3. The Architect/Engineer may request that a 10% random field retest be conducted on the cable system at no additional cost to verify documented findings. Tests shall be a repeat of those defined above. If findings contradict the documentation submitted by the



Contractor, additional testing can be requested to the extent determined necessary by the Architect/Engineer, including a 100% retest. This retest shall be at no additional cost to the Owner.

B. Copper Media Test Data:

1. Test results shall include a record of test frequencies, cable type, conductor pair and cable (or Outlet) I.D., measurement direction, test equipment type, model and serial number, date, reference setup, and crew member name(s).
2. Printouts generated for each cable by the wire test instrument shall be submitted as part of the documentation package. The Contractor shall furnish this information in electronic form (USB thumb drive). The thumb drive shall contain the electronic equivalent of the test results as defined by the bid specification and be in the tester's native format as well as summaries of each test in pdf format. Provide a licensed copy of the software required to view and print the data that is provided in a proprietary format. Furnish one (1) copy of the data and display (if applicable) software.

C. Optical Fiber Media Test Data:

1. Test results shall include a record of test wavelengths, cable type, fiber and cable (or Outlet) I.D., measurement direction, test equipment type, model and serial number, date, reference setup, and crew member name(s).
2. OTDR traces of individual optical fiber "signatures" obtained as specified above shall be provided to the Architect/Engineer in electronic form for review. Trace files shall be so named as to identify each individual optical fiber by location in the cable system and optical fiber number or color. Where traces are provided in electronic form, provide along with the above documentation, one (1) licensed copy of software that will allow for the display of OTDR traces provided. The software shall run on a Microsoft Windows-based personal computer.

**PART 3 - EXECUTION (NOT USED)**

**END OF SECTION**

## **SECTION 27 17 20 - STRUCTURED CABLING SYSTEM WARRANTY**

### **PART 1 - GENERAL**

#### **1.1 SECTION INCLUDES**

- A. This section describes support and warranty requirements relating to the structured cabling system and related subsystems.

#### **1.2 RELATED WORK**

- A. Section 27 05 00 - Basic Technology Systems Requirements.
- B. Section 27 11 00 - Communication Equipment Room (CER).
- C. Section 27 13 00 - Backbone Cabling Requirements.
- D. Section 27 15 00 Horizontal Cabling Requirements.

#### **1.3 QUALITY ASSURANCE**

- A. Refer to Section 27 05 00 for relevant standards.

#### **1.4 SUBMITTALS**

- A. Under the provisions of Section 27 05 00 and Division 1, prior to close of the project the Contractor shall submit:
  - 1. A numbered certificate from the manufacturing company registering the installation.

### **PART 2 - PRODUCTS**

#### **2.1 WARRANTY**

- A. A twenty-five (25) year Product Installation Warranty and System Assurance Warranty shall be provided for the structured cabling system as described in the contract documents.
- B. The Product Installation Warranty shall cover the replacement or repair of the defective product(s) and labor for the replacement or repair of such defective product(s).
- C. The system assurance warranty shall cover the failure of the wiring system to support the application it was designed to support, as well as additional applications introduced in the future by recognized standards or user forums that use the TIA/EIA 568A component and link/channel specifications for cabling.
- D. Upon successful completion of the installation and subsequent inspection, Owner shall be provided with a numbered certificate from the manufacturing company registering installation.

### **PART 3 - EXECUTION**

#### **3.1 WARRANTY REQUIREMENTS**

- A. This Contractor shall be responsible for providing, installing and testing a structured cabling system that will meet the manufacturer's warranty requirements.

**END OF SECTION**

## SECTION 27 41 00 - PROFESSIONAL AUDIO/VIDEO SYSTEM

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. System Components
- B. Audio Connectors
- C. Audio Cabling

#### 1.2 RELATED WORK

- A. Section 26 05 33 - Conduit
- B. Section 26 05 13 - Wire and Cable
- C. Section 27 05 00 - Basic Communications Requirements
- D. Section 27 05 26 - Communications Bonding
- E. Section 27 05 03 - Through Penetration Firestopping
- F. Section 27 11 00 - Communication Equipment Rooms
- G. Section 27 05 28 - Interior Communications Pathway
- H. Section 27 15 00 - Horizontal Cabling Requirements
- I. Section 27 42 00 - Electronic Digital Signage Systems

#### 1.3 QUALITY ASSURANCE

- A. Manufacturer: The manufacturer of equipment shall have a complete service organization for all products in the manufacturer's line.
- B. Integrator/Dealer: The Contractor shall be a factory-authorized and certified integrator/dealer specializing in each selected manufacturer's products, with demonstrated prior experience with the selected manufacturer's system installation and programming.
- C. The following qualifications have been endorsed by the AudioVisual and Integrated Experience Association (AVIXA), which is formerly known as InfoComm International.
  - 1. The Contractor shall have a Certified Technology Specialist with a specialized Installation endorsement (CTS-I) on staff and supervising the project. In addition to supervising the project, the CTS-I shall perform the following tasks on the project:
    - a. Review submittals and provide a letter stating the submittals are in compliance with the contract documents.
    - b. Provide written and dated confirmation of an observation of the contractor's installation activities no less than every 2 weeks month during the construction period.
    - c. Provide a final written and dated confirmation of a final construction review prior to testing.
    - d. Review final testing and calibration of the systems and provide a letter with the documented results or transmittal of the results stating the test results and

calibration compliance with the contract documents.

- D. Control System Dealer: The media control system shall be provided, terminated, installed, and programmed by a factory-authorized and certified dealer and integrator in good standing with the manufacturer. The dealer shall have direct purchasing and support authority. These services shall not be subcontracted.
- E. Control System Programmer: The media control system shall be programmed by a factory-trained and certified programmer.
  - 1. The Contractor shall have all certifications required by the manufacturer(s) for the installed system components on staff for the appropriate duties and responsibilities required by the manufacturer.
- F. Audio System Programmer: All digital sound processing equipment (DSP) used on the project shall be setup, programmed and calibrated by a factory-trained and certified technician. The audio system programmer shall have the following complementary certifications:
  - 1. Associated manufacturer certifications
- G. Video System Programmer: All video distribution and processing used on the project shall be setup, programmed and calibrated by a factory-trained and certified technician.
- H. The Contractor shall have acquired and maintained all certifications for a minimum of one (1) month prior to the posted bid date of this project.
- I. Servicing Contractor: The installer must be factory certified to provide service on the installed manufacturer's equipment and must have local service representatives within a 100 mile radius of the project site.

#### **1.4 REFERENCES**

- A. ADA - Americans with Disabilities Act
- B. ADAAG - Americans with Disability Accessibility Guidelines
- C. ANSI - American National Standards Institute
- D. AVIXA - Audiovisual and Integrated Experience Association (Formerly InfoComm)
- E. ANSI/InfoComm A102.01:2017 - Audio Coverage Uniformity
- F. ANSI/InfoComm 2M-2010 - Standard Guide for Audiovisual Systems Design and Coordination Processes
- G. ANSI/InfoComm F501.01:2015 - Cable Labeling for Audiovisual Systems
- H. ANSI/InfoComm 10:2013 - Audiovisual Systems Performance Verification
- I. ANSI/AVIXA V202.01:2016 - Display Image Size for 2D Content in Audiovisual Systems
- J. IBC - International Building Code
- K. IEC - International Electrotechnical Commission
- L. NFPA 70 - National Electrical Code (NEC)

- M. UL 813 - Commercial Audio Equipment
- N. UL 1419 - Professional Video and Audio Equipment
- O. UL 1480 - Speakers for Fire Alarm, Emergency, and Commercial and Professional Use
- P. UL 1492 - Audio/Video Products and Accessories

## 1.5 SUBMITTALS

- A. Submit shop drawings and product data under provisions of Section 27 05 00.
- B. General Requirements:
  - 1. Submittals will be submitted in multiple passes over the course of construction. Each pass will be a dedicated single submission for review as outlined in the general submittal requirements outlined in section 27 05 00.
  - 2. Upon acceptance of an item in the submittal, the Contractor shall remove them from future resubmittals of the same submittal "pass".
  - 3. Should the Contractor not provide shop drawings in a timely fashion, not complete requirements, or extend the time of any resubmittals so as to jeopardize schedules, cause delay, or limit access for field work, the Contractor bears responsibility for impact and delay that may occur. This includes access or lift to overhead positions and associated protection of work already in place.
- C. First Pass Submittals: To be submitted after the project is awarded but before equipment is submitted, purchased and installed.
  - 1. Contractor(s) resume of qualifications.
  - 2. All certifications shall be current and valid. Any certificate with expired dates will not be accepted.
  - 3. All applicable AudioVisual and Integrated Experience Association (AVIXA) certifications. Qualifications from InfoComm that have not expired will be accepted.
  - 4. All certifications outlined in the qualifications shall be included in this submittal. Refer to the qualifications section for additional information. Certifications include, but are not limited to:
    - a. All installed manufacturer certifications required by the manufacturer.
    - b. Control system authorized dealer certification.
    - c. Control system certified programmer certification(s).
    - d. Audio system DSP dealer certification.
    - e. Audio system DSP programmer certification.
- D. Second Pass Submittals: To be submitted after all initial submittals have been approved but before equipment is purchased, installed, configured, and programmed.[ This can be submitted with the first pass submittal but will require to be submitted as a separate document.]
  - 1. Alternate System Drawings: If an approved alternate manufacturer is submitted, the Contractor shall provide project-specific system CAD drawings. These will be required to be submitted with the product data.
    - a. Provide a system block diagram noting system components and interconnection between components. The interconnection of components shall clearly indicate all wiring required in the system. When multiple pieces of equipment are required in the exact same configuration (e.g., multiple identical controllers), the diagram may show one device and refer to the others as "typical" of the device shown.
  - 2. Product Data: Provide manufacturer's technical product specification sheet for each

individual component type. Submitted data shall show the following:

- a. Compliance with each requirement of these documents.
  - b. All component options and accessories specific to this project.
  - c. Electrical power consumption rating and voltage.
  - d. Wiring requirements.
  - e. Pre-terminated cable distances and requirements identified by each room where required.
  - f. Product manuals are not an acceptable format and will be rejected.
3. Available wireless microphone frequencies within a [ 50] <Insert> mile range based on the submitted system(s) and coordinated with the number of channels.
- E. Final Pass Submittals: To be submitted after all initial submittals have been approved but before the equipment is installed, configured and programmed. These should not be submitted until after the pre-installation meeting outlined in Part 3.
1. System Drawings: Project-specific system drawings shall be provided as follows:
    - a. Provide a system block diagram noting system components and interconnection between components. The interconnection of components shall clearly indicate all wiring required in the system. When multiple pieces of equipment are required in the exact same configuration (e.g., multiple identical controllers), the diagram may show one device and refer to the others as "typical" of the device shown.
    - b. Submittals shall contain shop drawings indicating physical plan locations and placement of installed devices and accessories with associated scope or field conditions for review and coordination. Provide mounting details, suspensions, and rough-in notes with trade demarcations.
      - 1) Identify any non-standard back boxes or mounting assembly required by product or specifications and elaborate contractor means and methods for mounting.
      - 2) Provide rack drawing(s) showing the mounting of equipment in each rack or cabinet on the project.
      - 3) All display mounts shall be coordinated with the Architect to verify the exact vertical and horizontal positioning of the display. Coordinate in-wall stud locations for installation of recessed display mounts to install in the exact location as coordinated with the architectural drawings.
      - 4) Projector mounts shall be coordinated with other utilities on the ceiling and wall to minimize any potential obstructions for the visual beam of the projector prior to installation of the projector mount.
      - 5) Projector mounts, projector screens, recessed ceiling speakers, in-ceiling microphones, and all other above ceiling devices shall be coordinated with other trades in the field (e.g., mechanical ductwork, lights, diffusers, etc.) to minimize changes that will impact the performance of the system design.
    - c. Submit wiring and cable path requirements, including field wiring, path verification, signal separation, and outside diameter of cables for conduit sizing and verification that can be used for field installation and electrical coordination.
    - d. Reproduction of contract documents is not acceptable for submittals. Wire CAD type drawings and cable tag lists or schedules, or typical manufacturer's abbreviated single lines alone, are not complete.
  2. The Contractor shall submit graphic or emulated representations of the control system touch panels for each unique space and layout prior to purchase, installation and programming for review and comment by the Architect/Engineer and Owner. These shall show and describe the intended programming/macro control features and functions of each button/icon for all pages.

3. The Contractor shall submit graphic or emulated representations of the control system keypads for each unique space and layout prior to purchase, installation and programming for review and comment by the Architect/Engineer and Owner. These shall show and describe the intended programming/macro control features and functions of each button/knob.
4. The Contractor shall submit the actual DSP audio processor files or single line audio path file diagram prior to installation for review and comment by the Architect/Engineer. Provide preliminary settings with processor blocks identified and note resources allocated.
5. The Contractor shall submit the number of IP addresses, VLANS, and subnetworks that will be required from the Owner's Information Systems Department.
6. Provide system checkout and commissioning procedure to be performed at acceptance.
  - a. The A/E provides electro-acoustic and technical testing including punch list on behalf of the Owner for final performance verification and optimization of the systems. The AVC shall include a site test in his/her bid for A/E Commissioning and testing services.
  - b. AVC shall provide two (2) week written advance notice to the Prime Contractor for the A/E and schedule a minimum of one "quiet day" on the CM project schedule chart for A/E electro-acoustic testing, when project nears Substantial Completion and loudspeakers are properly aimed.
    - 1) A "quiet day" means General Contractor activity may proceed in certain areas, but A/E shall retain the ability to call off any noise or intrusive construction activity in the main seat area for noise control measurements and main loudspeaker testing as required. This is at the will of the site acoustician and AV Commissioning Firm (A/E).
    - 2) A test report and pre-commissioning check list shall be filed by AVC prior to scheduling A/E performance verification.
7. Submit meeting agenda for planning/programming meetings as required in Part 3 of this specification.
8. Submit detailed description of Owner training to be conducted at project end, including specific training times and typical attendees expected.
9. Provide rack drawing(s) showing the mounting of equipment in each rack or cabinet on the project. Rack drawings shall include the following:
  - a. Equipment placement including mounting on the front or rear of the rack.
  - b. Spacing separation as required by equipment for adequate airflow and heat dissipation.
  - c. Signal separation based on AVIXA standards as required by the design.
  - d. Heating/cooling load requirements for submitted equipment to verify the heating/cooling load of the rack. This shall include Owner-provided equipment coordinated with the Owner.
  - e. Power requirements for each rack including plug type and loads based on the final approved products.
10. A console and equipment rack plan shall be provided showing console, countertop, rough-in, cable paths, and wall plates with dimensions in plan view and elevation. The plan shall include equipment layout within the console and rack.
11. Submit the detailed engineered and coordinated mounting solution(s) for wall-mounted and ceiling-mounted devices including the following items:
  - a. Surface-mounted and/or flown loudspeakers.
  - b. Ceiling-mounted and/or flown projectors, including distance from the screen, height to the lens, and the angle of the projector based on actual field conditions.
  - c. Projection screens, including height from the finished floor and black screen masking from finished ceiling.



- d. Video displays including blocking or ceiling span requirements, height from finished floor, and back box location.
- e. Projector lifts, including height from the finished floor and decorative ceiling cover.

F. Discontinued Products and New Model Releases:

- 1. For each product, the Contractor shall submit (in addition to the specified product) a product cut sheet if the specified product has been replaced, improved upon, phased out or otherwise upgraded at the time of shop drawing submittal.
  - a. The intent of this requirement is for the Contractor to submit only direct replacements for the specified products. A direct replacement shall be defined as a product of newer release that has equal or greater capabilities.
  - b. It is not the intent of this requirement for the Contractor to submit new products or other product options that significantly differ in capability and/or cost from the specified product.

## 1.6 SYSTEM DESCRIPTION

- A. This specification section describes the furnishing, installation, commissioning and programming of audio/video components and systems.
- B. Performance Statement: This specification section and the accompanying Contract Documents are performance based, describing the minimum material quality, required features, and operational requirements of the system. These documents do not convey every wire that must be installed, every equipment connection that must be made and every feature and function that must be programmed and configured. Based on the equipment constraints described and the performance required of the system, as presented in these documents, the Vendor and the Contractor are solely responsible for determining all wiring, programming and miscellaneous equipment required for a complete and operational system.
- C. This document describes the major components of the system. All additional hardware, subassemblies, supporting equipment and other miscellaneous equipment required for proper system installation and operation shall be provided by the Contractor.
- D. This document describes the major programming features and functions of the system. All additional programming, configuration and integration required for proper system installation and operation shall be provided by the Contractor.
- E. When a specific manufacturer is not provided in this document for minor pieces of equipment, the Contractor shall provide only those materials considered to be of the same industry commercial and professional quality level as the major equipment manufacturers.
- F. General System Description:
  - 1. The purpose of this section is to define the overall AV system requirements for each space identified on the project drawings. This is to represent the end-user needs, applications, tasks and Functions and features for each space to assist with identifying programming requirements for each space.
- G. Room Type Requirements:
  - 1. General System Requirements:
    - 1) All flat panel displays and dvLED video walls to have an in-wall storage box with power receptacles mounted behind the display.
    - 2) A dedicated AV Over IP network will be installed to distribute Audio, Video, Control signals in-room and/or between audio, video, and control equipment

- located in the AV Equipment Rack in the Level 01 MDF
- 3) Along with the dedicated AV Over IP network, a campus data network will also be utilized in the classrooms for: Wireless Access Points, Information Outlets, audio/video hardware LAN connections.

2. Active Learning, Large Classrooms, Conference Rooms, Debrief Rooms:

- a. The Active Learning Room, Large Classrooms, Conference Rooms to offers support for class instruction as well as presentations.

- b. System Requirements:

- 1) Provide flat panel displays at learning pod table locations. Each learning pod table to have a Solstice Pod for wireless presentations, HDMI cable for hard-wired connection. A Crestron NVX-D (AV Over IP decoder) to connect to the flat panel display. The decoder will have access to AV Over IP content available on the AV Over IP Network. Each learning pod table will also have a Crestron NVX-E (AV Over IP encoder). The encoder will will allow learning pod table device content to be available on the AV Over IP Network. A Crestron PBC-8 keypad will be mounted at each learning pod table location for basic flat panel display control (on/off/input).
- 2) Provide the capability for the display of temporary computer sources connected through a rack plate (located on the lectern equipment rack) or through a Solstice Pod wireless presentation system located in the equipment rack.
- 3) Provide quantity three (3) QSC PTZ12X72 PTZ cameras. Cameras to connect and distribut video over the AV Over IP Network. The Q-SYS Core 110f will provide camera video via its USB port to the USB port on the in-room rack-mounted Solstice Pod. This connectivity will allow BYOM laptops access to the PTZ cameras. This will also allow the local small-format PC (mounted in the rack) access to the PTZ camera video.
- 4) Provide Shure MXA920 ceiling-mounted microphone for room coverage. Provide Shure Microflex wireless system for lapel and handheld microphone needs. Provide Shure MX-series wired microphone at lectern.
- 5) Provide quantity two (2) ceiling mounted video projectors and quantity two (2) motorized video projection screens. The video projectors to receive video from Crestron NVX-D (decoder).
- 6) Provide Crestron Control Processor to be mounted in in-room equipment rack. Provide room control via 7" table top touchpanel. Touchpanel to be tabletop version. Control system to control devices on the AV Over IP Network.
- 7) Provide document camera at lectern location.
- 8) Provide routing of in-room video sources and accompanying audio via an Atlona matrix switcher located in the in-room equipment rack.
- 9) Provide ceiling loudspeakers and associated electronics to reproduce the mono or summed-stereo to mono audio signal.
- 10) Provide AV equipment to mount in owner-furnished lectern AV rack (Active Learning 101, 102, Classrooms 201 and 202, and Large Classroom 212)..
- 11) Provide Q-SYS Core 110f for DSP functions.
- 12) The control system to provide control for:
  - a) System on/off
  - b) Audio and/or video source and destination selection
  - c) Audio level
  - d) Source on/off
  - e) Software-based Codec (software to run on in-room mini PC or on BYOM laptop).

- c. Architectural and Infrastructure Requirements:

- 1) Provide appropriate backing and support for mounting the video projector and projection screen. Coordinate with electrical backboxes.
- d. Electrical Requirements:
- 1) At Video Projector and Projection Screen:
    - a) Provide one (1) 120VAC, 15A duplex receptacle at video projector ceiling location. Refer to drawings.
    - b) Provide hardwired 120VAC, 15A connection for video projection screens.
  - 2) At Lectern:
    - a) Provide one (1) 120VAC, 20A quad receptacle in floor box.
    - b) Provide AV passthrough with one (1) 1-1/2" conduit to accessible ceiling and one (1) 1-1/2" conduit to Level 01 cable tray.
  - 3) At Table:
    - a) Provide one (1) 20A duplex receptacle mounted 6" above table height and below flat panel display.
  - 4) Information Technology (IT) and AV Over IP Requirements (Recommendations):
    - a) Provide WAN coverage.
    - b) Provide network drop at video projector.
    - c) Provide network drops and AV Over IP Network drops at lectern floor box and other AV equipment locations noted on the Technology Set. Debrief 227C and 227M and Innovation Conference Room AV Over IP Network cabling to connect to AV Over IP Network patch panel located in AV Equipment Rack in Level 01 MDF.
    - d) Provide network drop at wall phone location.
3. Commons/Study Space:
- a. The Commons/Study Space system shall provide support for video playback as well as presentations, and messaging.
  - b. Systems Description:
    - 1) Provide direct view LED video wall on front wall..
    - 2) Provide pre-wire Network cabling and pre-wire AV Over IP Network cabling for future mezzanine-level dvLED display. See Technology Set for pre-wire details.
    - 3) Provide 75" flat panel display on back wall.
    - 4) Provide the capability for the display of temporary computer and video sources connected through an auxiliary AV Over IP input panel at the front wall and back wall.
    - 5) Provide Shure Microflex wireless microphone system for space.
    - 6) Provide QSC PTZ 12X72 PTZ video camera on front and back wall. PTZ camera video to be distributed over AV Over IP Network...
    - 7) Provide routing of video sources and accompanying audio via an Atlona matrix switcher located in the AV Equipment Rack in the Level 01 MDF.
    - 8) Provide surface mount loudspeakers mounted left and right of dvLED wall. Provide associated electronics to reproduce the mono or summed-stereo to mono audio signal.
    - 9) Provide an AV equipment rack for the systems' permanently mounted

- equipment. AV equipment rack located in Level 01 MDF near Commons area. .
- 10) Provide a control system with 7" wall-mounted touchpanels. Touchpanels located front and rear.
  - 11) The control system shall control devices on the AV Over IP Network..
  - 12) The control system to provide control for:
    - a) System on/off
    - b) Audio and/or video source and destination selection
    - c) Audio level
    - d) Source on/off

c. Architectural and Infrastructure Requirements:

- 1) Provide appropriate backing for mounting the direct view LED displays to the front wall. Coordinate with electrical backboxes.
- 2) Provide appropriate backing for mounting the 75" flat panel display to back wall of Commons space.
- 3)
- 4) Electrical Requirements:
  - a) At dvLED and Flat Panel Displays:
  - b) Provide two (2) 120VAC, 20A duplex receptacle installed in in-wall storage box. Refer to drawings for elevation.
- 5) Information Technology (IT) Requirements (Recommendations):
  - a) Provide WAN coverage.
  - b) Provide network drops and AV Over IP Network drops behind dvLED display and 75" flat panel display. Refer to Technology Set for quantity

4. Huddle & Lounge Spaces

- a. The huddle & lounge spaces shall provide support for meetings, presentations, and video collaboration via a soft codec.
- b. System Requirements:
  - 1) Provide capability for the display of temporary computer and video sources connected through an HDMI pass-through wall plate mounted 6" above the work surface and below the display.
  - 2) Provide a Solstice Pod wireless collaboration device at each display location. Solstice Pod to mount in in-wall storage box.
  - 3) Provide a 4K LED flat panel display with built-in speakers mounted to the wall of the room as the primary display device.
  - 4) Provide a Crestron PBC-8 keypad at each flat panel display location for basic control (display on/off/input).
- c. Architectural and Infrastructure Requirements:
  - 1) Provide appropriate backing for mounting the display to the wall. Coordinate with electrical backboxes.
- d. Electrical Requirements:
  - 1) At Display:
    - a) Provide two (2) 120VAC, 20A duplex receptacles in in-wall recessed storage box. behind display. Refer to drawings for elevation.

- 2) At Table:
  - a) Provide one (1) 120VAC, 20A duplex receptacle 6" above table height and below flat panel display.
- 3) Information Technology (IT) Requirements (Recommendations):
  - a) Provide WAN coverage.
  - b) Provide data network drops and AV Over IP network drops behind display. See Technology Set for quantity of drops.
- 4) AV System Description:
  - a) A wall plate mounted below the display will allow one (1) HDMI source connection via an HDMI pass-through wall plate. The HDMI cabling shall be routed from the wall plate to the display. The USB connection shall be routed to a USB camera mounted below the display. The pass-through HDMI cable will connect to a Solstice Pod located behind the flat panel display. The BYOM laptop will then be able to connect to the flat panel display via HDMI or wirelessly to the Solstice Pod.
  - b) AV equipment to mount in in-wall recessed backbox behind display.
- 5) Provide four (4) network drops at SIM Lab Control Room equipment rack.

## **1.7 LICENSING REQUIREMENTS**

- A. All user licenses required for system operation shall be included in the Contractor's bid. User licenses shall include, but not be limited to, server and workstation software and any other licensing that is required by the manufacturer for operation of any system component.
  1. Licenses shall be provided on a one-to-one basis. One license shall be provided for each server, workstation, and device requiring a license. In the event the manufacturer requires the purchase of a block of licenses, the minimum standard licensing package to support all devices.

## **1.8 INTELLECTUAL PROPERTY OWNERSHIP**

- A. All supporting documentation, programming, uncompiled source code, graphic files, DSP code and diagrams, written and electronic files, including all latest versions of the documentation and software necessary to edit and adapt the system(s), shall be provided to the Owner for all spaces and all systems. The integrator and/or programmer shall also maintain a current copy to be provided at the Owner's request.
  1. The Owner shall have the right to modify the intellectual property directly, or to have the intellectual property modified by any party of the Owner's choosing.

## **1.9 PROJECT RECORD DOCUMENTS**

- A. Submit documents under the provisions of Section 27 05 00.
- B. Provide all applicable certifications.
- C. Provide statement that system checkout test, as outlined in the shop drawing submittal, is complete and satisfactory.
- D. Provide schedules documenting all terminal block wiring, including cable numbers.

- E. Warranty: Submit written warranty and complete all Owner registration forms.
- F. Complete all operation and maintenance manuals as described below.
- G. Contractor shall include all factory-provided test results for equipment installed on the project.
- H. Contractor shall include all test results from system demonstration and performance testing specified in this document.
- I. Record Drawings shall minimally include:
  - 1. All revisions to, or deviations from the original drawings, as well as final dimensions, cable routes, connector panel drawings, cable numbering charts, and control system programming documentation. A complete as-installed equipment list, listed by room, and with manufacturers' names, model numbers, serial numbers, and quantities of each item.
  - 2. A complete and correct system schematic, showing detailed connections for all parts of the system, including wire numbers, terminal block numbers and layouts, and other designations and programming code.
  - 3. Complete equipment rack layouts showing locations of all rack-mounted equipment items.
  - 4. Additional information, diagrams or explanations as designated under respective equipment or systems specification section.
- J. Within each equipment room, the appropriate floor plan for which that equipment room serves shall be laminated and mounted for use by the Owner. Functional drawings shall be posted at each AV closet or included at every AV rack within a room.
- K. Upon completion and final acceptance of the project, the Contractor shall provide Owner a copy of the programming code for any and all AV systems and devices programmed by Contractor.
  - 1. For any subsequent modifications to the programming code, an updated copy of the code shall be provided to the Owner.

#### **1.10 OPERATION AND MAINTENANCE DATA**

- A. Submit documents under the provisions of Section 27 05 00.
- B. Manuals: Final copies of the manuals shall be delivered after completing the installation. Each manual's contents shall be identified on the cover. The manual shall include names, addresses, and telephone numbers of the Contractor responsible for the installation and maintenance of the system and the factory representatives for each item of equipment for each system. The manuals shall have a table of contents and labeled sections. The final copies delivered after completion of the installation shall include all modifications made during installation, checkout, and acceptance. Manuals shall be submitted in[ both hard copy and] electronic format. The manuals shall consist of the following:
  - 1. Functional Design Manual: The functional design manual shall identify the operational requirements for the system and explain the theory of operation, design philosophy, and specific functions. A description of hardware and software functions, interfaces, and requirements shall be included.
  - 2. Hardware Manual: The manual shall describe all equipment furnished including:
    - a. General description and specifications.
    - b. Installation and checkout procedures.
    - c. Equipment layout and electrical schematics to the component level.
    - d. System layout drawings and schematics.
    - e. Alignment and calibration procedures.
    - f. Manufacturers repair parts list indicating sources of supply.

3. Software Manual: The software manual shall describe the functions of all software and shall include all other information necessary to enable proper loading, testing, and operation. The manual shall include:
    - a. Definition of terms and functions.
    - b. System use and application software.
    - c. Initializations, startup, and shutdown.
    - d. Reports generation.
    - e. Details on forms customization and field parameters.
  
  4. Operator's Manual: The operator's manual shall fully explain all procedures and instructions for the operation of the system including:
    - a. Computers and peripherals.
    - b. System startup and shutdown procedures.
    - c. Use of system, command, and applications software.
    - d. Recovery and restart procedures.
    - e. Use of report generator and generation of reports.
    - f. Data entry.
    - g. Operator commands.
    - h. Alarm messages and reprinting formats.
    - i. System permissions functions and requirements.
  
  5. Maintenance Manual: The maintenance manual shall include descriptions of maintenance for all equipment including inspection, periodic preventive maintenance, fault diagnosis, and repair or replacement of defective components.
- C. Video Calibration Data: Provide documentation of all calibrated settings for each projector & display.
- D. Audio Calibration Data: Provide documentation on all EQ settings, crossover points, limiter settings, gate settings and all other applicable settings.
- E. Intellectual Property Ownership: Provide all uncompiled source code and DSP programming for all systems and spaces as described in Part 3 of this specification section.

#### **1.11 WARRANTY**

- A. Unless otherwise noted, provide warranty for one (1) year after Date of Substantial Completion for all materials and labor.
  
- B. Onsite Work During Warranty Period: This work shall be included in the Contractor's bid and performed during regular working hours, Monday through Friday.
  1. Inspections: The Contractor shall perform two (2) minor inspections at even intervals (or more often if required by the manufacturer), and two (2) major inspections offset equally between the minor inspections.
  2. Minor Inspections: These inspections shall include:
    - a. Visual checks and operational tests of all equipment, field hardware, and electrical and mechanical controls.
    - b. Mechanical adjustments if required on any mechanical or electromechanical devices.
  3. Major Inspections: These inspections shall include all work described under paragraph Minor Inspections and the following work:
    - a. Clean all equipment, including filters, interior and exterior surfaces.
    - b. Perform diagnostics on all equipment.

- c. Check, test, & calibrate (if required) any sensors or other equipment containing settings.
  - d. Check zoom and focus of all projectors.
  - e. Run all system software diagnostics and correct all diagnosed problems.
- C. Operation: Upon the performance of any scheduled adjustments or repairs, Contractor shall verify operation of the systems.
- D. Emergency Service: The Owner will initiate service calls when the systems are not functioning properly. Qualified personnel shall be available to provide service within the distance defined within this specification section. The Owner shall be furnished with telephone number(s) where service personnel can be reached 24/7/365. Service personnel shall be at site within 24 hours after receiving a request for service.
- E. Records and Logs: The Contractor shall keep records and logs of each task completed under warranty. The log shall contain all initial settings at substantial completion. Complete logs shall be kept and shall be available for review on site, demonstrating that planned and systematic adjustments and repairs have been accomplished for the systems.
- F. Work Requests: The Contractor shall separately record each service call request on a service request form. The form shall include the model and serial number identifying the component involved, its location, date and time the call was received, specific nature of trouble, names of service personnel assigned to the task, instructions describing what must be done, the amount and nature of the materials used, the time and date work started, and the time and date of completion. Contractor shall deliver a record of the work performed within five (5) business days after work is accomplished.
- G. System Modifications: Contractor shall make any recommendations for system modification in writing to the Owner. No system modifications shall be made without prior approval of Owner. Any modifications made to the system shall be incorporated into the operations and maintenance manuals, and other documentation affected. To the fullest extent possible, Owner shall be provided with electronic restorable versions of all configurations prior to the modifications being made.
- H. Software: Contractor shall provide all software and firmware updates during the period of the warranty and verify operation of the system upon installation. These updates shall be accomplished in a timely manner, fully coordinated with system operators, shall include training for the new changes/features, and shall be incorporated into the operations and maintenance manuals, and software documentation.
- I. Refer to individual product sections for further warranty requirements of individual system components.

## **1.12 ANNUAL SERVICE CONTRACT**

- A. Provide annual cost for extended service and maintenance warranty after the first year for the audio/video systems according to the following terms:
1. The term of the warranty shall begin on the system acceptance date and shall continue for one (1) year. The extended service and maintenance warranty may begin following this first year if accepted by the Owner. The term may be automatically renewed for successive one-year periods unless canceled by the Owner. The service and maintenance agreement shall include the following basic services to the Owner, including all necessary parts, labor and service equipment:
    - a. Repair or replace any equipment item that fails to perform as initially installed, as specified, or as determined per the manufacturer's performance criteria.
    - b. Perform semi-annual preventive maintenance on the equipment. This preventive maintenance shall include, but is not limited to, cleaning, realignment, bulb replacement, filter cleaning and replacement, inspection, re-calibration, and testing of devices. The Owner shall receive a written report of these inspections that identifies the device's status and, if required, a list of all necessary repairs or



- replacements.
    - c. Provide software and firmware maintenance on the system. Contractor shall install and configure any software and firmware updates that the manufacturer provides at no cost. Any additional software or firmware options, updates, or enhancements purchased by Owner shall be installed. The Contractor shall not be responsible for the purchase of additional software packages or the maintenance of Owner data.
  - 2. The Contractor shall be compensated for any repairs or maintenance provided as a result of Owner abuse, misuse, intentional damage, accidental damage, or power fluctuations exceeding specified equipment tolerances.
  - 3. System defects or failures shall be corrected within four (4) hours on the same business day if Owner makes a service request before 11:00 am, or before 12:00 noon the next business day if the Owner makes the request after 11:00 am. If requested by the Owner, the Contractor shall respond or remain at the site after normal business hours, and the Owner shall reimburse the Contractor for the incremental cost difference between premium labor rates and standard labor rates. This reimbursement applies to premium labor rates that do not exceed time-and-one-half rates after normal business hours and double-time rates for Sundays and holidays. Contractor services shall be performed in a good and workmanlike manner and remain free from defects for a period of one (1) year.
- B. Provide complete terms and conditions of warranty and service.
  - C. Owner will enter into a contract directly with the vendor. This specification is not a contract between the Owner and the vendor to perform these services.

## **PART 2 - PRODUCTS**

### **2.1 SYSTEM COMPONENTS**

- A. Refer to the project drawings for basis of design system components. Equivalent products shall meet or exceed all requirements defined on the project drawings. The following product information represents the minimum additional requirements for equivalent products:
- B. Audio/Video GUI Control Systems:
  - 1. Contractor shall furnish a programmable software-based audio/video control system. The system shall be field configurable and programmable by the factory and/or a factory-trained programmer.
  - 2. The control system shall be TCP/IP based (using AV Over IP Network) allowing direct connection of the system processors to a 10/100BaseT compatible Ethernet network.
  - 3. The control system(s) shall connect to a centralized software-based management system for central control, monitoring and statistical information.
  - 4. Virtual touch panel and keypad control shall be provided for remote troubleshooting & control.
  - 5. Refer to project drawings for required central processors, touch panels, keypads and additional information.
- C. Microphone Systems:
  - 1. Wireless Microphones:
    - a. Wireless microphones shall not operate in 614 to 806 MHz band (channels 38 to 69).
    - b. Features:
      - 1) Dual antenna reception with true diversity reception.
    - c. Microphone systems common (shared) by multiple spaces or when the receivers are in a remote area shall include a compatible wireless antenna distribution

- system by the same manufacturer as the wireless microphone system.
- d. Provide antenna cabling and connectors per manufacturer recommendations.

D. Audio Amplifiers:

1. Power Amplifier(s), 25, 70.7 and 100 Volt:
  - a. Power: The following calculation shall be used to determine the minimum required output of the amplifier(s):
    - 1) Calculate the total power tap value of each transformer with insertion loss using the following equation:
      - a) Tap wattage  $\times 10^{(x\text{dB}/10)}$  where x = the rated insertion loss at 1,000Hz.
    - 2) Calculate the total wattage loss based on cable distance, cable gauge and cable resistance.
    - 3) Add together all the speaker taps' total power values that will be on a single channel of the amplifier. Multiply that total by 1.2, which will allow for a 20% future expansion. Multiply that number by 1.25 to ensure the amplifier never exceeds 75% of its total output. Utilize the final number to determine the minimum amplifier power requirements.

E. Power Conditioning and Surge Protective Devices:

1. All equipment shall be plugged in through a power conditioning surge arrestor.
2. Provide a minimum of 50 dB noise attenuation.
3. Provide a minimum of 1,500 joules of surge protection.
4. UL 1449 – Standard for Safety for Surge Protective Devices listed to 330 volt clamping voltage.
5. Provide automatic voltage regulation from 97 VAC to 137 VAC at a minimum to maintain a stable 120 VAC where specified.
6. Power sequencers shall be equipped with contact closures or Ethernet control for remote turn on and off.
7. Refer to the project drawings for additional information.

F. Uninterruptible Power Supplies (UPS):

1. UPS shall be sized to accommodate the full startup VA load of all connected equipment for a minimum of fifteen (15) minutes. Adequate time shall be provided so all equipment can go through its normal shutdown sequence.
2. UPS shall be equipped with bi-directional RS-232 or Ethernet control for remote turn on/off control and status monitoring.
3. UPS shall provide automatic voltage regulation to maintain a stable 120VAC.
4. UPS shall provide power conditioning and surge protection to meet the UL 1449 – Standard for Safety for Surge Protective Devices listing to 330 volt clamping voltage.
5. UPS shall be UL 1778 – Uninterruptible Power Supply Equipment listed.

G. Refer to project drawings for all other equipment not listed.

## 2.2 AUDIO CONNECTORS

- A. This article includes minimum requirements for all connectors that are acceptable on this project. Should the Contractor request an alternative connector, it shall be submitted with the product submittals and clearly identified with which connector it will be replaced.
- B. XLR Jack: for XLR plates located on the front and rear walls of the Commons/Study space.

1. Manufacturers:

- a. Switchcraft
  - b. Neutrik
- C. Loudspeaker Connector:
  - 1. Panel Mount: Twist-lock type, 4-conductor.
  - 2. Manufacturers:
    - a. Neutrik
    - b. Speakon

## **2.3 AUDIO CABLING**

- A. Refer to Section 27 05 00 for cable rating requirements.
- B. Microphone Level Audio Cabling:
  - 1. For patch cables less than or equal to 25 feet:
    - a. 24 AWG 2-conductor, foil shield, twisted, stranded (19x36) tinned bare copper.
  - 2. For cable runs greater than or equal to 25 feet:
    - a. 22 AWG 2-conductor, foil and braid shield, twisted, stranded (16x34) tinned bare copper.
- C. Line Level Audio Cabling:
  - 1. For patch cables less than or equal to 25 feet:
    - a. 22 AWG 2-conductor, foil shield, twisted, stranded (7x30) tinned bare copper.
  - 2. For cable runs greater than or equal to 25 feet:
    - a. 18 AWG 2-conductor, foil shield, twisted, stranded (16x30) tinned bare copper.
- D. Constant Voltage Speaker Cabling:
  - 1. Class 2, stranded, twisted, 2-conductor, minimum of 16-gauge wire for all 25/70.7/100-volt applications unless noted otherwise.
  - 2. Contractor shall size cabling as required for distance power and shall provide larger gauge cable as required.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Verify surfaces are ready to receive work.
- B. Verify field dimensions and coordinate physical size of all equipment with the architectural requirements of the spaces into which they are to be installed. Allow space for adequate ventilation and circulation of air.
- C. Verify required utilities are available, in proper location, and ready for use.
- D. Beginning of installation means installer accepts existing conditions.

### 3.2 PRE-INSTALLATION

- A. A pre-installation meeting shall be held after the project has been awarded but before any submittals or work has been conducted. The purpose of this meeting is to review the drawings and specifications to assist with the construction and installation process that will occur during construction. The meeting will include the Engineer, Architect, Owner's Representative, and all relevant installing contractors for this system. The meeting will be chaired by the project manager for the AV contract and will include the following topics:
- B. Contractor shall be responsible for submitting all requested submittals and holding the pre-installation meeting prior to any purchasing, installation, programming, and construction coordination. Any delays or changes to the project as a result of meeting this requirement will be at the Contractor's expense.

### 3.3 INSTALLATION

- A. Comply with the manufacturer's instructions and recommendations for installation of all products.
- B. Provide all system wiring between all components as directed by the manufacturer or required for proper system operation.
- C. Mount all touch screen and keypad devices where shown on plans in accordance with Americans with Disabilities Act (ADA) requirements for both side reach and front reach.
- D. Cabling Requirements:
  - 1. Non-plenum rated cabling may be used instead of plenum when installed with-in conduit in plenum rated areas.
  - 2. All cabling shall be routed according to function. Cabling shall be grouped and bundled by groups, such as: microphone and line level audio, control, video and speaker. In no case shall cabling from different functional groups be intermixed. No cabling shall be routed parallel to 120 VAC or higher power circuits unless separated by a minimum of 6" and the 120 VAC or higher power is installed in conduit.
  - 3. When cabling is installed in conduit, a separate conduit shall be provided for each cabling functional type.
  - 4. Cable bundles shall be loosely bundled to allow the visual following of individual cables within the bundle and to permit the easy removal and addition of cables as necessary.
  - 5. Horizontal cabling installed as open cable or in cable tray shall be bundled at not less than 10' intervals with hook-and-loop tie wraps. The use of plastic cable zip ties is strictly prohibited in any situation.
  - 6. Cabling shall not be spliced under any circumstances.
  - 7. Each cable shall be appropriately identified (as defined on the record documents) at each end's termination point using pressure sensitive label strips.
  - 8. Audio Cabling:
    - a. All amplified audio cabling shall not be in the same enclosed pathway as any other type of cabling as required by the NEC. Refer to the NEC for definitions and additional requirements.
    - b. The polarity of all cabling shall remain consistent throughout the project, on all equipment. Red conductors shall be used for the positive "+" side, and black used for the negative "-" side.
    - c. Cable shield length shall be equal to the cable's conductor length.
    - d. All shielded cables drain wire SHALL be grounded and continuous throughout the entire length of the system, including splices where speakers are installed.
    - e. Balanced audio connections shall be used whenever the mating equipment allows.
    - f. Do not run unbalanced cables longer than 3m. For interconnecting of unbalanced equipment in lengths longer than 3m, the Contractor shall provide a line driver

located at the source.

9. Twisted Pair Cabling for All Applications:

- a. The Contractor shall ensure that the twists in each cable pair are preserved to within 0.5 inch of the termination. The cable jacket shall be removed only to the extent required to make the termination.
- b. The Contractor shall ensure that the cable shields are continuous throughout, terminated, and grounded according to the manufacturer's recommendations.

E. Grounding Requirements:

1. Provide a minimum of #6 AWG conductor from the nearest electrical service ground bus or nearest telecommunications room ground bus bar to the A/V equipment racks and cabinets regardless of location. Size cable as required by the NEC.
2. Cables containing shields shall not have the shields grounded at conduits, boxes, racks, etc. Ground the shield only at the equipment end.
3. Audio cable shields for line-level signals shall be connected to the metal equipment chassis at both ends of the cable.
4. Audio cables connected to transformers shall have the cable shield connected to the transformer shield and transformer case ground.
5. The Contractor shall not connect cable shields together from differing cables.
6. XLR cable shields shall be connected to chassis ground.
7. Signal-grounded balanced shields are not acceptable and shall not be installed. All balanced shields shall be chassis grounded.

F. Rack and Cabinet Requirements:

1. Ground equipment racks/cabinets as noted within this specification section and Section 27 05 26 - Communications Grounding.
2. Provide one (1) RU of space between adjacent pieces of equipment with top and/or bottom vents, above the topmost piece of equipment, and below the bottommost piece of equipment. Provide a vented cover panel covering each rack space.
3. Terminate all speaker cabling on individual barrier strips for positive "+", negative "-", and shield. The shield barrier strip shall be grounded.
4. Provide a power conditioning surge arrestor in the rack for distribution of AC power from the wall receptacles indicated on the plans. The quantity of plugs shall be adequate so that no equipment in the rack shall require plugging into an AC source outside the rack.
5. Power sequencing shall be provided in the racks where shown on the drawings. All amplifiers located in the racks shall be sequenced "last on – first off". Power sequencers shall provide power conditioning and surge protection.

G. Audio System Installation Requirements:

1. The Contractor shall perform calculations for the optimal speaker tap settings to reach the desired SPL level and coverage without overloading the amplifier(s).
  - a. At a minimum, the following calculations shall be used:
    - 1) Add together all speaker taps that will be on a single channel of the amplifier. Multiply that total by 1.2, which will allow for a 20% future expansion. Multiply that number by 1.25 to ensure the amplifier never exceeds 75% of its total output. Utilize the final number to determine the minimum amplifier power requirements.
    - 2) For direct coupled systems (low impedance), allow a minimum of 10 dB headroom before any distortion occurs at the amplifier input indicator when beginning gain stage tests are set up. Increase headroom as appropriate for high impact and clarity needs, typically exceeding 12 to 15 dB during

continuous operation.

2. Connections of balanced to unbalanced equipment shall only be done through an active converter at the unbalanced side.
3. Connections of unbalanced to balanced equipment shall only be done through an active converter at the unbalanced side.
4. Connections from stereo balanced or unbalanced equipment to mono equipment of the same signal type shall only be done through a passive combiner.
5. Connections from mono balanced or unbalanced equipment to stereo equipment of the same signal type shall only be done through a passive divider.
6. The Contractor shall provide an isolation transformer for any balanced or unbalanced audio line that exhibits a hum, noise from EMI or RFI, power line noise, or ground loops.
7. The Contractor shall provide an active audio line driver for all balanced and unbalanced signals that exceed the distance limitations of the cabling.

H. Control System Installation Requirements:

1. The Contractor shall perform calculations for the required wire AWG size based on distance for system power for touch panels, keypads and other devices being powered. A minimum of a 15% overhead is required.

### 3.4 VIDEO SYSTEM TESTING AND CALIBRATION

A. All video equipment shall receive proper testing and configuration.

B. Color Space Optimization:

1. The Contractor shall set the color space of each source and display device to a uniform color space to optimize the switching speed and compatibility of a digital video system. Each device shall be set to an RGB or YCbCr color space depending on the systems primary function and compatibility of the devices.
2. If the primary function of the space is video and other digital media, the color space of each device shall be set to a YCbCr color space. If the primary function of the space is computer-based graphics and presentations, the color space of each device shall be set to an RGB color space.
3. Chroma subsampling shall be set to a consistent 4:4:4 or 4:2:2 across all devices. Set to 4:4:4 when all equipment is capable.
4. If all devices are not capable of displaying a certain color space, all devices shall be set to a common shared color space.

C. Extended Display Identification Data (EDID) Management:

1. The Contractor shall set the EDID management tables in capable equipment so all sources output the highest common EDID table of the displays (sinks).
2. For systems with capable matrix switches, the matrix shall dynamically adjust its EDID tables so any source will output the highest common EDID table of the displays (sinks) being outputted to.
3. If any source or Owner-furnished equipment (OFE) is not outputting properly, the Contractor shall provide and install an EDID Emulator and set it to the highest common EDID table of the displays (sinks) being outputted to.

D. Projectors, monitors and receivers shall be tested and adjusted for proper signal sync, convergence, brightness, contrast, and color level. The Contractor shall adjust all other parameters necessary to achieve a proper video image.

E. All video source selections shall be tested and verified.

F. All projectors and displays shall have a minimum burn-in time of 96 hours prior to any

adjustments are made and the completion of the project

- G. All projectors and displays shall have their hue/tint and color/saturation calibrated with a video signal test generator and blue lens filter after a minimum warmup time of 20 minutes. Provide all calibrated settings results for each projector and display in the final documentation.
- H. All projectors and displays shall have their brightness, contrast and sharpness calibrated with a video signal test generator after a minimum warmup time of 20 minutes. Provide all calibrated settings results for each projector and display in the final documentation.
- I. All dynamic contrast functions shall be turned off.

### **3.5 AUDIO SYSTEM TESTING AND CALIBRATION:**

- A. This Contractor shall field adjust any surface-mounted or flown loudspeaker orientation to achieve the necessary coverage pattern to the intended listening plane. Loudspeakers always face listeners and minimize coverage on walls. The contractor shall be familiar with the named and specified nominal coverage angle of all speakers above its crossover point or for speech range, (500-4,000 Hz).
- B. All speakers shall be tested for polarity prior to high work and a table of test results shall be included for A/E inspection. All loudspeakers shall be connected with uniform polarity, where a positive pressure pulse at the input corresponds to a positive driver excursion, and all drivers are uniform always moving in the same direction. Main speakers shall not be lifted or hoisted into high access areas without polarity testing.
- C. The Contractor shall make incremental adjustments on the equipment output and input tolerances to achieve matching signal levels while preserving +10 dB minimum headroom and also unity gain. Insert all broadband or high pass filters first for system protection after review of manufacturers specifications for power and bandpass.
- D. The Contractor shall utilize a Real Time Audio (RTA) spectrum analyzer with AES2 Broadband pink noise at a minimum of 1/3 octave, capable of providing detailed plots and reports.
  - 1. The Contractor shall have and own a calibrated Type 1 or Type 1.5 microphone for all measurements, that is recently calibrated within the last year.
  - 2. Calibration by ear, tablets and portable phones with integrated microphones are never acceptable. All software analysis tools require a calibrated interface and calibrated microphone. No Android devices are used for metering or calibration. IOS devices with calibrated software and interfaces may be used.
- E. Provide high quality media with full bandpass program material for critical listening. MP3 or streaming audio is not acceptable. Testing shall illustrate WAV file quality playback for impact and clarity.
- F. The Contractor shall provide graphic plots of the reference ambient noise for each space at the time of the calibration and submit with the calibration results. Test signal shall be 10dB minimum above ambient noise levels during testing.
- G. The Contractor shall use a listener sitting height of four (4) feet  $\pm$  1" for rooms where the primary function will be sitting. The Contractor shall use a listener standing height of five feet three inches (5.25')  $\pm$  1" for rooms where the primary function will be standing.

### **3.6 AUDIO SYSTEM PERFORMANCE REQUIREMENTS**

- A. The Contractor shall test and provide documents verifying all the following performance criteria. The Architect/Engineer shall be informed when the testing will take place and have the option to witness the testing and ask for additional testing for any reason.

- B. The Contractor shall develop an Audio Coverage Uniformity Measurement Location (ACUML) plan for each required space based on the project floor plans, and submit to the Architect/Engineer for review and approval prior to testing. The plan shall represent the majority of the listening area and perimeter seating in the direct field of main speakers.
- C. The tests shall be performed at the multiple locations defined on the ACUML plan representing the majority of the listening area(s). The Contractor shall indicate on the floor plan drawings where each test was performed, with the corresponding graphic plot, and submit with the final documentation for review and approval by the Architect/Engineer.
- D. The test shall be taken with AES2 Broadband pink noise at a minimum of 15 dB above the reference ambient noise level, taking caution to not overdrive and clip any component of the system beyond 0.5% Total Harmonic Distortion (THD), with a maximum system THD of 1.0%.
- E. The audio system(s) shall meet the following minimum requirements:
  1. Achieve a total average SPL of 95 dBA in the majority of seating area with additional headroom. Use dBC for levels above 95 dBA.
  2. The system's total SPL frequency response shall be within  $\pm 4$  dB from 500 Hz to 8000 Hz. All efforts shall be made to equalize the system's frequency response possible throughout the system's entire 100 Hz to 16kHz spectrum.
  3. All vocal microphones shall have high and low pass filters set to minimize rumble, pop and hiss. The high pass filter cutoff frequency shall be set between 125 and 160 Hz, with a 12 dB per octave slope, minimum. The low pass filter cutoff frequency shall be set at 12,000 Hz, with a 6 dB per octave slope. Adjust frequency and slope as required to maximize performance for both male and female voices.
  4. The subwoofer/speaker low/high crossover points shall be a Butterworth (BW) filter set at 80 Hz with a 24 dB per octave slope. This crossover point shall be adjusted as needed to achieve a smooth frequency response. The subwoofer high-pass filter shall be set to manufacturer's recommended half-power point or 40 Hz, whichever is higher.
  5. Achieve a minimum RaSTI value of 0.63.

### **3.7 DSP-BASED AUDIO PROCESSOR PROGRAMMING**

- A. Full system programming shall be provided for the system. Programming shall be performed by a factory trained and certified programmer or an employee of the equipment manufacturer.
- B. DSP pathfile with initial settings shall be provided by the Contractor for review by the Architect/Engineer before installation.
- C. The IP-based audio (IEEE AVB, Dante, etc.) and components shall be on a dedicated Virtual LAN (VLAN) for the A/V systems. These components shall be on a dedicated subnetwork of the VLAN. The Contractor shall coordinate these requirements with the Owner prior to installation.
- D. A parametric EQ shall be provided after each crossover point or as approved in the DSP pathfile during shop submittal review. These shall be utilized to set the speaker output as defined in the Audio System Calibration section within this specification. These equalizers should not be made available to the user to adjust.
- E. Levelers, compressor/limiters, duckers, gates and delays shall be preset during testing and commissioning and are not available for user adjustment following commissioning.
  1. Adjust delays for time of flight plus 8 to 10 ms, typical.
- F. Provide each microphone input with high-pass filter, 5-band parametric EQ, auto-leveler and volume module. Provide line level inputs with high-pass filter, 3-band parametric EQ, compressor/limiter, and volume module.



- G. Acoustic Echo Cancellation (AEC) shall be provided for each conference microphone input.
- H. A broadband pink noise generator shall be provided with a selectable on/off control button within the DSP pathfile. The noise shall be routable through all processing EQs and speaker outputs during testing.
- I. Provide volume meters with labeling for each input and each output.
- J. Provide with user control software to be installed on Owner-provided and installed computer.
- K. The Contractor shall utilize the latest version of the programming software.
- L. The Contractor shall ensure that all components are updated to the latest firmware at the completion of the project.

### **3.8 DSP-BASED AUDIO PROCESSOR CONTROL SOFTWARE PROGRAMMING**

- A. Full system software programming shall be provided for system. Programming shall be performed by a factory-trained and certified programmer or an employee of equipment manufacturer.
- B. The Contractor shall schedule a series of meetings with the Owner and Architect/Engineer to define and determine the exact page layout requirements prior to the final configuration of the audio system. An Owner sign-off of the final layouts shall be required.
- C. Contractor shall use the latest version of the software.
- D. At a minimum, there shall be password-protected pages for zone combining, input/output volume control with meters, speaker output volume control with meters, signal routing, signal processing (EQ's, feedback suppression, etc.), and supervision/maintenance for all spaces and combined zones.
- E. A 15% programming dollar allowance shall be included for Owner and Architect/Engineer comments on additional system functionality as construction progresses. This shall be shown as a separate line item in the bid (include hours).

### **3.9 MULTIMEDIA CONTROL SYSTEM INTEGRATION AND PROGRAMMING**

- A. Programming and Integration for Control Systems:
  1. Full system programming shall be provided for the system. Programming shall be performed by a factory trained and certified programmer or an employee of the equipment manufacturer.
  2. The Contractor shall schedule a series of meetings with the Owner and Architect/Engineer to define and determine the exact integration requirements of the control system prior to the installation of the control system and components. An Owner sign-off of the final configuration shall be required.
  3. This section only defines the minimum requirements. The programmer shall provide complete programming for a fully functional system.
  4. The Contractor shall utilize the latest version of the programming software.
  5. The Contractor shall ensure that all components are updated to the latest firmware at the completion of the project.
  6. The IP-based control system and controlled components shall be on a dedicated Virtual LAN (VLAN) for the A/V systems. These components shall be on a dedicated subnetwork of the VLAN. The Contractor shall coordinate these requirements with the Owner prior to installation.
  7. Integration and programming of the following pieces of equipment shall be provided, with the following minimum features and functions:

- a. All equipment shall include on/off control, except for equipment that must remain active for system functionality.
- b. Integration of HDCP (High-bandwidth Digital Content Protection) and DPCP (Display Port Content Protection) protected content and sources:
  - 1) No protected sources or content shall be allowed to be selected to route through non-protected devices and displays. A warning shall be displayed stating this information to the user.
- c. DSP Audio Processor Integration:
  - 1) The Contractor shall provide bi-directional RS-232 or Ethernet control system connections and programming with the following minimum functions:
    - a) On/off control of all microphones.
    - b) Volume and mute control of all microphones and input sources.
    - c) Volume and mute control of all outputs.
    - d) Independent volume and mute control of all assisted listening outputs.
    - e) On/off and reset control of feedback eliminators and suppressors.
    - f) Advanced routing of audio signals.
    - g) Audio conferencing dialer keypad with speed dials.
    - h) Audio conferencing CallerID display on touchpanel and/or workstation.
    - i) Acoustic Echo Cancelation (AEC) control.
- d. Projector Integration:
  - 1) The projectors shall be integrated into the A/V control system via Ethernet control. Provide with the following minimum functions:
    - a) On/off control.
    - b) Lamp status feedback.
    - c) Filter status feedback.
    - d) Source switching control.
    - e) Video mute.
    - f) Auto image.
- e. Display Integration:
  - 1) The displays shall be integrated into the A/V control system via Ethernet control. Provide with the following minimum functions:
    - a) On/off control.
    - b) Display status feedback.
    - c) Source switching control.
- f. Motorized Projection Screen Integration:
  - 1) Screens shall be integrated into the A/V control system via Ethernet control utilizing DaLite Ethernet interface box.
    - a) Up/down and stop control shall be provided.
- g. Pan/Tilt/Zoom (PTZ) Camera Integration:
  - 1) The Contractor shall provide bi-directional Ethernet control system connections and programming with the following minimum functions:

- a) Provide full pan, tilt and zoom control.
- b) Provide presets for fixed camera positions, contractor shall coordinate with the Owner for desired preset positions.

h. Uninterruptible Power Supply (UPS) Integration:

- 1) The Contractor shall provide bi-directional Ethernet control system connections and programming with the following minimum functions:
  - a) The control system shall provide monitoring and readouts for the following: Power mode, battery maintenance status, battery charge status, battery time remaining, internal temperature, current line voltage, min/max voltages, and output voltage/load.
  - b) The control system shall provide a pop-up warning if any status item exceeds or falls below its threshold.
  - c) Upon loss of power or sustained under voltage for more than thirty (30) seconds, the control system shall begin a shutdown sequence of projectors and other heat-sensitive, active-cooled equipment.

i. Power Sequencer Integration:

- 1) The Contractor shall provide contact closure based control or Ethernet control system connections and programming with the following minimum functions:
  - a) Power on/off control.
  - b) On/off status via +12VDC output from the sequencer to the I/O input of the control system processor.

B. Programming and Configuration for Touch Panels:

- 1. This section only defines the minimum requirements. The programmer shall provide complete touch panel layouts and programming for a fully functional system.
- 2. The Contractor shall schedule a series of meetings with the Owner and Architect/Engineer to define and determine the exact touch panel layout requirements prior to the purchase and installation of the touch panels. An Owner sign-off of the final layouts shall be required.
  - a. Some tabs, pages, buttons and functions may be required to have a password at the Owner's discretion. This shall be coordinated during the meetings.
- 3. Contractor logos are not allowed on the touch panels. The Contractor shall coordinate with the Owner on desired logos to be displayed.
- 4. All programming for interface and control of all devices shown on the drawings shall be provided. Programming shall be provided for the following minimum functionality:
  - a. The main screen shall include graphical buttons for the primary room functions.
    - 1) Upon selection of the graphical button, all the required functions shall be displayed on the screen. All required equipment shall turn on.
  - b. Master System On/Off Control:
    - 1) When the master system off button is selected, all capable components within the system shall be turned off or placed on standby, except for equipment that is required to remain on for the system to function like the control system processor.

- c. The main screen shall include graphical buttons for the selection of individual source selections.
  - 1) Upon selection of the graphical button for a source selection, all functional controls for the pieces of equipment, as well as all status indicators, shall be provided in graphical format on the screen.
  - 2) Rooms with multiple independent outputs and displays shall have a source routing matrix to allow any input to be routed to any output.
- d. The main screen shall include a button for advanced equipment status and monitoring.
  - 1) Upon selection of the graphical button, the page shall display the on/off status of all monitored equipment, projector lamp hours, projector filter status, and all other features listed within this section that require monitoring
- e. The main screen shall include a button for microphone volume control and muting.
  - 1) Upon selection of the graphical button, it shall display the individual volume level of each wired and wireless microphone, with a mute for each.
  - 2) Rooms with multiple independent audio outputs and zones shall have a source routing matrix to allow any input to be routed to any output or zone.
- f. At all times, on all screens, a button shall be provided to return to the main screen, except for modal pop-ups.
- g. A master volume control and mute shall be provided at all times on all screens, except for modal pop-ups.
- h. A master video mute shall be provided at all times on all screens, except for modal pop-ups and audio-only functions.
- i. A modal countdown timer shall be displayed showing the warmup and cooldown time of the projector. All functions shall be locked out while the projector is in cooldown mode.
- j. All unused hard buttons shall not be labeled. A blank touch panel bezel shall be provided if no hard buttons are used.

C. Touch Panel Layout Principles, Considerations and Guidelines:

1. Icons and Buttons:

- a. Icons shall not be used solely as a button but can be embedded in a button.
- b. Icons shall appear to be flat and unpressable.
- c. Status bars or text windows for time, date, room number, and similar information shall appear to be slightly depressed into the screen and appear to be unpressable.
- d. Buttons shall appear to be pressable by appearing to come off the screen with beveled edges, lighting gradients, and shadows. When pressed, the button shall appear to be depressed into the screen.
  - 1) Buttons that are momentary shall change color when pressed, appear to depress, then pop back up and revert to the original button color and state.
  - 2) Buttons that are not momentary shall change color when pressed, appear to depress, remain depressed, then pop back up, and revert to the original button color and state when pressed again.
- e. Buttons and icons shall appear to be lit from the top left corner of the screen.
- f. Buttons shall be grouped together according to general function.
- g. Button size shall be based on the ratio of Phi (1:1.618) and be sized appropriately based on the screen area and dpi (pixel pitch).

- h. Maintain a minimum of 5 to 10 pixels between buttons on small to medium touch panels, and a minimum of 10 to 15 pixels between buttons on medium to large touch panels.
  - i. Telephone dialer keypads shall be based on the ITU-T E.161/ANSI TI-703 standard telephone layout and include the a-z letters below each appropriate number.
  - j. TV and radio tuner keypads shall be based on the ITU-T E.161/ANSI TI-703 standard telephone layout, except for the asterisk (\*) being replaced by a dot (.) and the pound (#) being replaced with Enter.
  - k. IP-address keypads shall be based on the standard computer keyboard 10-key numeric keypad typically found on the right side of the keyboard.
  - l. Buttons such as Power, Play, Stop, Record, Rewind, Previous, Forward, Eject, Return, Next, Up, Down, Left, Right, Plus, Minus, etc. shall use standard industry symbols. Record shall always be a solid red circle.
2. Text and Fonts:
- a. The Contractor shall use a standard sans-serif bold Arial or Calibri font style unless the Owner dictates otherwise.
  - b. Words shall have the first letter capitalized and the rest of the word lower case. No words shall be all capitals or all lower case. Follow standard grammatically correct sentence structure where the first word is capitalized and the rest of the sentence is lower case, followed by the appropriate punctuation mark with accurate syntax and correct verbs.
  - c. All font size in a single group or cluster shall maintain the same font size. Headers to a group or cluster shall have a slightly enlarged font size. and footers shall have a slightly smaller font size in comparison to the group font size to maintain a visual hierarchy.
3. Color Considerations:
- a. Colors shall be selected so that, when converted to monochrome, all text, buttons, icons, groups, clusters, borders, etc. are clearly visible to accommodate all color blind or color-impaired individuals and ADA requirements.
  - b. Background colors shall be cool low saturation colors such as grey, blue, or green and their analogous colors, and be a gradient from top down or top left to bottom right.
  - c. Base colors shall be analogous to the background color but be of a higher saturation to stand out more clearly.
  - d. Button colors shall be analogous to the background color, stand out clearly from the base colors, and be of a higher saturation cool color, gray, or a low saturation black.
  - e. Icon, symbols, and text color shall be a neutral white or black, or a low saturation grey, and shall clearly stand out from the background or button it is placed on.
  - f. Buttons for modal acknowledgement, exit or return, or other modal action shall be a warm color such as red or yellow and their analogous colors.
  - g. Buttons, icons, symbols or text for emergency or urgent notifications shall be bright red.
4. Pages and Background:
- a. Groups and clusters shall have clearly defined borders, with spacing between adjacent groups.
  - b. Modal pop-up windows or pages shall be required when a command requires user input before it is executed or when a button has multiple nested elements to control, such as microphone volumes, zone control, lighting and environment control, advanced system controls, etc.

- 1) The modal pop-up pages shall dim and grey out the background and buttons, overlay the main page, and have a clear back or exit button to bring the user back into the active page the user was on before the modal pop-up.
  - 2) A model pop-up timer page shall appear when a projector is being turned on or off for the appropriate warmup or cooldown time. No additional commands shall be allowed during this time.
  - 3) Model pop-ups shall not replace or completely overlay the background.
- c. Images or pictures shall never be used as backgrounds to any page other than a master start page, if appropriate.
5. Medium to Large Format Touch Panel Layout Guideline Template:
- a. IMAGEClient Logo - Static Window
  - b. A/V Source Selection - Static Window
  - c. Display Power, Screen Controls, Light Controls, Shade Controls, and other Environmental Controls - Static Window
  - d. Controls for Selected Source and Status or Home Page - Dynamic Window
  - e. Master Volume and Mute, Video Mute, and Microphone Volume - Static Window
  - f. Home Button - Static Window
  - g. Date, Time, and Room Number - Static Window
  - h. Master System Off - Static Window
6. Small Format Touch Panel Layout Guideline Template:
- a. A/V Source Selection and Source Control and Status After Selection - Dynamic Window
  - b. Home Button - Static Window
  - c. Date, Time, and Room Number - Static Window
  - d. Master System Off - Static Window
7. Small Format Room Scheduling Touch Layout Guideline Template
- a. Room Schedule and Scheduling Control - Dynamic Window
  - b. Chime Button - Static Window
  - c. Date, Time, and Room Number - Static Window

### **3.10 SYSTEM COMMISSIONING**

- A. Contractor shall notify Architect/Engineer and Owner prior to conducting final system commissioning.
- B. System verification testing is part of the commissioning process. Verification testing shall be performed by the Contractor and witnessed and documented by the Commissioning Agent. Refer to Section 01 09 00 - General Commissioning for system verification tests and commissioning requirements.
- C. Contractor shall demonstrate system performance of all equipment and adjust settings as directed by the Architect/Engineer and/or Owner.
  1. All system settings, software options and other parameters shall be simulated and tested by the Contractor

### **3.11 FIELD QUALITY CONTROL**

- A. Where these specifications require a product or assembly without the use of a brand or trade name, provide a product that meets the requirements of the specifications, as supplied and warranted by the system vendor. If the product or assembly is not available from the system vendor, provide product or assembly as recommended by the system vendor.

- B. Periodic observations will be performed during construction to verify compliance with the requirements of the specifications. These services do not relieve the Contractor of responsibility for compliance with the Contract Documents.

### **3.12 FIELD SERVICES**

- A. The installer shall conduct a planning meeting with the Owner. The purpose of this meeting shall be to determine all equipment settings that are considered preferences (where proper system operation does not depend on the setting).
- B. The installer shall include labor for all planning and all programming activities required to implement the Owner's preferences for equipment settings.
- C. It shall be the responsibility of the Contractor/installer to provide a complete, functional system as described by the design documents. These responsibilities include:
  - 1. Complete hardware setup, installation and wiring and software configuration.
  - 2. Complete programming of software in accordance with the Owner's desires determined by the planning meeting.
  - 3. Complete system diagnostic verification.
  - 4. Complete system commissioning.

### **3.13 SYSTEM ACCEPTANCE**

- A. The Contractor shall submit for review a formal acceptance and system checkout procedure. The system checkout procedures shall include all system components and software. The Contractor shall perform the tests and settings and document all results.

### **3.14 SYSTEM DOCUMENTATION**

- A. Complete documentation shall be provided for the system. The documentation shall describe:
  - 1. All operational parameters of the system.
  - 2. Complete documentation of programming and features.
  - 3. Complete operating instructions for all hardware and software.
- B. The following sections shall be provided in the system documentation:
  - 1. User Manual: A step-by-step guide and instructions detailing all system user functions.
  - 2. Technical Manual: A comprehensive document providing all system operations, troubleshooting flowcharts, functional system layout, wiring diagrams, block diagrams and schematic diagrams.
  - 3. Maintenance Manual: A comprehensive document on all aspects of physical maintenance of the systems, including cleaning of the displays, bulb changes, filter cleaning, filter changing and UPS maintenance.

### **3.15 SYSTEM TRAINING**

- A. All labor and materials required for on-site system training shall be provided. Training shall be conducted at the project site using the project equipment.
  - 1. Provide two-week advanced notice of training to the Owner and Architect/Engineer.
  - 2. The Architect/Engineer shall be presented with the option to attend the training.
  - 3. Provide a training outline agenda describing the subject matter and the recommended audience for each topic.
- B. At a minimum, the following training shall be conducted:

1. User Manual: A course detailing the system functions and operations that a daily user will encounter.
2. Technical User: Provide configuration training on all aspects of the system(s), including equipment and software.
3. Maintenance User: Provide training on all aspects of physical maintenance of the systems, including cleaning of the displays, bulb changes, filter cleaning and filter changing.

C. Minimum on-site training times shall be:

1. Technical user: One (1) day.

**END OF SECTION**



## **SECTION 28 05 00 - BASIC ELECTRONIC SAFETY AND SECURITY SYSTEM REQUIREMENTS**

### **PART 1 - GENERAL**

#### **1.1 SECTION INCLUDES**

- A. Basic Safety and Security System Requirements (herein referred to Security) specifically applicable to Division 28 sections, in addition to Division 1 - General Requirements.
- B. All materials and installation methods shall conform to the applicable standards, guidelines and codes referenced herein and within each specification section.

#### **1.2 SCOPE OF WORK**

- A. This Specification and the accompanying drawings govern the work involved in furnishing, installing, testing and placing into satisfactory operation the security systems as shown on the drawings and specified herein.
- B. Each Contractor shall provide all new materials as indicated in the schedules on the drawings, and/or in these specifications, and all items required to make the portion of the security systems a finished and working system.
- C. Description of systems include but are not limited to the following:
  - 1. Electronic access control system
  - 2. Electronic intrusion detection system
  - 3. Video surveillance
  - 4. Fire detection and alarm.
  - 5. Low voltage security wiring (less than +120VAC) as specified and required for proper system control and communications.
  - 6. All associated electrical backboxes, conduit, miscellaneous cabling, and power supplies required for proper system installation and operation as defined in the "Suggested Matrix of Scope Responsibility".
  - 7. Firestopping of penetrations of fire-rated construction as described in Section 28 05 03.

#### **1.3 DIVISION OF WORK BETWEEN ELECTRICAL AND SECURITY CONTRACTORS**

- A. Division of work is the responsibility of the Prime Contractor. Any scope of work described in the contract document shall be sufficient for including said requirement in the project. The Prime Contractor shall be solely responsible for determining the appropriate subcontractor for the described scope. In no case shall the project be assessed an additional cost for scope that is described in the contract documents. The following division of responsibility is a guideline based on typical industry practice.
- B. Definitions:
  - 1. "Electrical Contractor" as referred to herein refers to the Contractors listed in Division 26 of this Specification.
  - 2. "Electrical Contractor" shall also refer to the Contractor listed in Division 28 of this specification when the "Suggested Matrix of Scope Responsibility" indicates the work shall be provided by the EC. Refer to the Contract Documents for the "Suggested Matrix of Scope Responsibility".
  - 3. "Security Contractor" as referred to herein refers to the Contractors listed in Division 28 of this Specification.
  - 4. Low Voltage Security Wiring: The wiring (less than 120VAC) associated with the Security Systems, used for analog and/or digital signals between equipment.
- C. General:

1. The purpose of these Specifications is to outline typical Electrical and Security Contractor's work responsibilities as related to security systems including back boxes, conduit, cable tray, power wiring and low voltage security wiring. The prime contractor is responsible for all divisions of work.
2. The exact wiring requirements for much of the equipment cannot be determined until the systems have been purchased and submittals are approved. Therefore, only known wiring, conduits, raceways, and electrical power as related to such items, is shown on the Security Drawings. Other wiring, conduits, raceways, junction boxes, and electrical power not shown on the Security Drawings but required for the successful operation of the systems shall be the responsibility of the Security Contractor and included in the Contractor's bid.
3. Where the Electrical Contractor is required to install conduit, conduit sleeves and/or power connections in support of Security systems, the final installation shall not begin until a coordination meeting between the Electrical Contractor and the Security Contractor has convened to determine the exact location and requirements of the installation.
4. Where the Electrical Contractor is required to install cable tray that will contain Low Voltage Security Wiring, the installation shall not begin until the Security Contractor has completed a coordination review of the cable tray shop drawing.
5. This Contractor shall establish Electrical and Security utility elevations prior to fabrication and installation. The Security Contractor shall cooperate with the Electrical Contractor and the determined elevations in accordance with the guidelines below. This Contractor shall coordinate utility elevations with other trades. When a conflict arises, priority shall be as follows:
  - a. Lighting Fixtures
  - b. Gravity Flow Piping, including Steam and Condensate
  - c. Sheet Metal
  - d. Electrical Busduct
  - e. Cable Trays, including 12" access space
  - f. Sprinkler Piping and other Piping
  - g. Conduit and Wireway
  - h. Open Cabling

D. Electrical Contractor's Responsibility:

1. Assumes all responsibility for all required conduit and power connections when shown on the "Suggested Matrix of Scope Responsibility" to be provided by the Electrical Contractor.
2. Assumes all responsibility for providing and installing cable tray.
3. Responsible for Security Systems grounding and bonding.
4. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.

E. Security Contractor's Responsibility:

1. Assumes all responsibility for the low voltage security wiring of all systems, including cable support where open cable is specified.
2. Assumes all responsibility for all required backboxes, conduit and power connections not specifically shown as being provided by the Electrical Contractor on the "Suggested Matrix of Scope Responsibility."
3. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other contractors to determine a viable layout.

## 1.4 COORDINATION DRAWINGS

### A. Definitions:

1. Coordination Drawings: A compilation of the pertinent layout and system drawings that show the sizes and locations, including elevations, of system components and required access areas to ensure that no two objects will occupy the same space.
  - a. Mechanical trades shall include, but are not limited to, mechanical equipment, ductwork, fire protection systems, plumbing piping, medical gas systems, hydronic piping, steam and steam condensate piping, and any item that may impact coordination with other disciplines.
  - b. Electrical trades shall include, but are not limited to, electrical equipment, conduit 1.5" and larger, conduit racks, cable trays, pull boxes, transformers, raceway, busway, lighting, ceiling-mounted devices, and any item that may impact coordination with other disciplines.
  - c. Technology trades shall include, but are not limited to, technology equipment, racks, conduit 1.5" and larger, conduit racks, cable trays, ladder rack, pull boxes, raceway, ceiling-mounted devices, and any item that may impact coordination with other disciplines.
  - d. Maintenance clearances and code-required dedicated space shall be included.
  - e. The coordination drawings shall include all underground, underfloor, in-floor, in chase, and vertical trade items.
2. Spaces with open/cloud ceiling architecture shall indicate the overhead utilities and locate equipment as required to maintain clearance above lights. The intent for the installation is to maintain a maximum allowable vertical clearance and an organized/clean manner in the horizontal. Notify Architect/Engineer of the maximum clearance which can be maintained. Failure to comply will result in modifications with no cost to Owner.
  - a. In cloud ceiling architecture, when open cabling/wire and/or cable tray crosses gaps between ceiling clouds and/or walls, cabling is to transition to conduits to span the gaps in order to conceal cabling from below.
3. The contractors shall use the coordination process to identify the proper sequence of installation of all utilities above ceilings and in other congested areas, to ensure an orderly and coordinated end result, and to provide adequate access for service and maintenance.

### B. Participation:

1. The contractors and subcontractors responsible for work defined above shall participate in the coordination drawing process.
2. One contractor shall be designated as the Coordinating Contractor for purposes of preparing a complete set of composite electronic CAD coordination drawings that include all applicable trades, and for coordinating the activities related to this process. The Coordinating Contractor for this project shall be the Mechanical Contractor.
  - a. The Coordinating Contractor shall utilize personnel familiar with requirements of this project and skilled as draftspersons/CAD operators, competent to prepare the required coordination drawings.
3. Electronic CAD drawings shall be submitted to the Coordinating Contractor for addition of work by other trades. IMEG will provide electronic file copies of applicable drawings for contractor's use if the contractor signs and returns an "Electronic File Transfer" waiver provided by IMEG. IMEG will not consider blatant reproductions of original file copies an acceptable alternative for coordination drawings.

C. Drawing Requirements:

1. The file format and file naming convention shall be coordinated with and agreed to by all contractors participating in the coordination process and the Owner.
  - a. Scale of drawings:
    - 1) General plans: 1/4 Inch = 1'-0" (minimum).
    - 2) Mechanical, electrical, communication rooms, and including the surrounding areas within 10 feet: 1/2 Inch = 1'-0" (minimum).
    - 3) Shafts and risers: 1/2 Inch = 1'-0" (minimum).
    - 4) Sections of shafts and mechanical and electrical equipment rooms: 1/4 Inch = 1'-0" (minimum).
    - 5) Sections of congested areas: 1/2 Inch = 1'-0" (minimum).
2. Ductwork layout drawings shall be the baseline system for other components. Ductwork layout drawings shall be modified to accommodate other components as the coordination process progresses.
3. There may be more drawings required for risers, top and bottom levels of mechanical rooms, and shafts.
4. The minimum quantity of drawings will be established at the first coordination meeting and sent to the Architect/Engineer for review. Additional drawings may be required if other areas of congestion are discovered during the coordination process.

D. General:

1. Coordination drawing files shall be made available to the Architect/Engineer and Owner's Representative. The Architect/Engineer will only review identified conflicts and give an opinion, but will not perform as a coordinator.
2. A plotted set of coordination drawings shall be available at the project site.
3. Coordination drawings are not shop drawings and shall not be submitted as such.
4. The contract drawings are schematic in nature and do not show every fitting and appurtenance for each utility. Each contractor is expected to have included in the bid sufficient fittings, material, and labor to allow for adjustments in routing of utilities made necessary by the coordination process and to provide a complete and functional system.
5. The contractors will not be allowed additional costs or time extensions due to participation in the coordination process.
6. The contractors will not be allowed additional costs or time extensions for additional fittings, reroutings or changes of duct size, that are essentially equivalent sizes to those shown on the drawings and determined necessary through the coordination process.
7. The Architect/Engineer reserves the right to determine space priority of equipment in the event of spatial conflicts or interference between equipment, piping, conduit, ducts, and equipment provided by the trades.
8. Changes to the contract documents that are necessary for systems installation and coordination shall be brought to the attention of the Architect/Engineer.
9. Access panels shall preferably occur only in gypsum board walls or plaster ceilings where indicated on the drawings.
  - a. Access to mechanical, electrical, technology, and other items located above the ceiling shall be through accessible lay-in ceiling tile areas.
  - b. Potential layout changes shall be made to avoid additional access panels.
  - c. Additional access panels shall not be allowed without written approval from the Architect/Engineer at the coordination drawing stage.
  - d. Providing additional access panels shall be considered after other alternatives are reviewed and discarded by the Architect/Engineer and the Owner's Representative.
  - e. When additional access panels are required, they shall be provided without additional cost to the Owner.

10. Complete the coordination drawing process and obtain signoff of the drawings by all contractors prior to installing any of the components.
11. Conflicts that result after the coordination drawings are signed off shall be the responsibility of the contractor or subcontractor who did not properly identify their work requirements, or installed their work without proper coordination.
12. Updated coordination drawings that reflect as-built conditions may be used as record documents.

## 1.5 QUALITY ASSURANCE

### A. Qualifications:

1. Only products of reputable manufacturers as determined by the Architect/Engineer will be acceptable.
2. Each Contractor and their subcontractors shall employ only workers who are skilled in their respective trades and fully trained. All workers involved in the installation, termination, testing, and placing into operation electronic security devices shall be individually trained by the manufacturer.
3. The Contractor shall be experienced in all aspects of this work and shall be required to demonstrate direct experience on recent systems of similar type and size.
4. The Contractor shall own and maintain tools and equipment necessary for successful installation and testing of electronic security devices and have personnel adequately trained in the use of such tools and equipment.
5. A resume of qualification shall be submitted with the Contractor's bid indicating the following:
  - a. A list of recently completed projects of similar type and size with contact names and telephone numbers for each.
6. Conform to all requirements of the City of South Dakota Codes, Laws, Ordinances and other regulations having jurisdiction.
7. Conform to all published standards of Northern State University.
8. In the event there are no local codes having jurisdiction over this job, the current issue of the National Electrical Code shall be followed.
9. If there is a discrepancy between the codes and regulations having jurisdiction over this installation, and these specifications, Architect/Engineer shall determine the method or equipment used.
10. If the Contractor notes, at the time of bidding, that any parts of the drawings or specifications do not comply with the codes or regulations, Contractor shall inform the Architect/Engineer in writing, requesting a clarification. If there is insufficient time to follow this procedure, Contractor shall submit with the proposal a separate price to make the system comply with the codes and regulations.
11. Verify the installation environment prior to purchasing or installing any cable. Cable installed in a plenum environment shall be appropriately rated. Bring all discrepancies between the contract documents and installation conditions to the attention of the Architect/Engineer prior to purchase or installation.
12. All changes to the system made after the letting of the contract, in order to comply with the applicable codes or the requirements of the Inspector, shall be made by the Contractor without cost to the Owner.

### B. Permits, Fees, Taxes, Inspections:

1. Procure all applicable permits and licenses.
2. Abide by all applicable laws, regulations, ordinances, and other rules of the State or Political Subdivision wherein the work is done, or as required by any duly constituted public authority.
3. Pay all applicable charges for such permits or licenses that may be required.
4. Pay all applicable fees and taxes imposed by the State, Municipal and/or other regulatory

bodies.

5. Pay all charges arising out of required inspections due to codes, permits, licenses or as otherwise may be required by an authorized body.
6. Pay all charges arising out of required contract document reviews associated with the project and as initiated by the Owner or authorized independent agency/consultant.
7. All equipment, and materials shall be as approved or listed by the following: (Unless approval or listing is not applicable to an item by all acceptable manufacturers.)
  - a. Factory Mutual
  - b. Underwriters' Laboratories, Inc.

C. Examination of Drawings:

1. The drawings for the Security Systems work are diagrammatic, intended to convey the scope of the work and to indicate the general arrangements and locations of equipment etc., and the approximate sizes of equipment.
2. Contractor shall determine the exact locations of equipment and the exact routing of cabling to best fit the layout of the job. Scaling of the drawings will not be sufficient or accurate for determining this layout. Where a specific route is required, such route will be indicated on the drawings.
3. Where job conditions require reasonable changes in indicated arrangements and locations, such changes shall be made by the Contractor at no additional cost to the Owner.
4. If an item is either shown on the drawings, called for in the specifications or required for proper operation of the system, it shall be considered sufficient for including same in this contract.
5. The determination of quantities of material and equipment required shall be made by the Contractor from the drawings. Schedules on the drawings and in the specifications are completed as an aid to the Contractor but where discrepancies arise, the greater number shall govern.
6. Where words "provide", "install", or "furnish" are used on the drawings or in the specifications, it shall be taken to mean, to furnish, install and terminate completely ready for operation, the items mentioned.

D. Electronic Media/Files:

1. Construction drawings for this project have been prepared utilizing Revit.
2. Contractors and Subcontractors may request electronic media files of the contract drawings and/or copies of the specifications. Specifications will be provided in PDF format.
3. Upon request for electronic media, the Contractor shall complete and return a signed "Electronic File Transmittal" form provided by IMEG. If the information requested includes floor plans prepared by others, the Contractor will be responsible for obtaining approval from the appropriate Design Professional for use of that part of the document.
4. The electronic contract documents can be used for preparation of shop drawings and as-built drawings only. The information may not be used in whole or in part for any other project.
5. The drawings prepared by IMEG for bidding purposes may not be used directly for ductwork layout drawings or coordination drawings.
6. The use of these CAD documents by the Contractor does not relieve them from their responsibility for coordination of work with other trades and verification of space available for the installation.
7. The information is provided to expedite the project and assist the Contractor with no guarantee by IMEG as to the accuracy or correctness of the information provided. IMEG accepts no responsibility or liability for the Contractor's use of these documents.

E. Field Measurements:

1. Before ordering any materials, this Contractor shall verify all pertinent dimensions at the job site and be responsible for their accuracy.

## 1.6 SUBMITTALS

- A. Submittals shall be required for the following items, and for additional items where required elsewhere in the specifications or on the drawings.

1. Submittals list:

<b>Referenced Section</b>	<b>Submittal Item</b>	<b>Coordination Drawings</b>
28 05 03	Through-Penetration Firestopping	
28 13 00	Electronic Access Control	
28 23 00	Video Surveillance	Yes

- B. General Submittal Procedures: In addition to provisions of Division 1, the following are required:

1. Transmittal: Each transmittal shall include the following:

- a. Date
- b. Project title and number
- c. Contractor's name and address
- d. Division of work (e.g., plumbing, heating, ventilating, etc.)
- e. Description of items submitted and relevant specification number
- f. Notations of deviations from the contract documents
- g. Other pertinent data

2. Submittal Cover Sheet: Each submittal shall include a cover sheet containing:

- a. Date
- b. Project title and number
- c. Architect/Engineer
- d. Contractor and subcontractors' names and addresses
- e. Supplier and manufacturer's names and addresses
- f. Division of work (e.g., plumbing, heating, ventilating, etc.)
- g. Description of item submitted (using project nomenclature) and relevant specification number
- h. Notations of deviations from the contract documents
- i. Other pertinent data
- j. Provide space for Contractor's review stamps

3. Composition:

- a. Submittals shall be submitted using specification sections and the project nomenclature for each item.
- b. Individual submittal packages shall be prepared for items in each specification section. All items within a single specification section shall be packaged together where possible. An individual submittal may contain items from multiple specifications sections if the items are intimately linked (e.g., pumps and motors).
- c. All sets shall contain an index of the items enclosed with a general topic description on the cover.

4. Content: Submittals shall include all fabrication, erection, layout, and setting drawings; manufacturers' standard drawings; schedules; descriptive literature, catalogs and brochures; performance and test data; wiring and control diagrams; dimensions; shipping and operating weights; shipping splits; service clearances; and all other drawings and descriptive data of materials of construction as may be required to show that the materials, equipment or systems and the location thereof conform to the requirements of the contract documents.

5. Contractor's Approval Stamp:
  - a. The Contractor shall thoroughly review and approve all shop drawings before submitting them to the Architect/Engineer. The Contractor shall stamp, date and sign each submittal certifying it has been reviewed.
  - b. Unstamped submittals will be rejected.
  - c. The Contractor's review shall include, but not be limited to, verification of the following:
    - 1) Only approved manufacturers are used.
    - 2) Addenda items have been incorporated.
    - 3) Catalog numbers and options match those specified.
    - 4) Performance data matches that specified.
    - 5) Electrical characteristics and loads match those specified.
    - 6) Equipment connection locations, sizes, capacities, etc. have been coordinated with other affected trades.
    - 7) Dimensions and service clearances are suitable for the intended location.
    - 8) Equipment dimensions are coordinated with support steel, housekeeping pads, openings, etc.
    - 9) Constructability issues are resolved (e.g., weights and dimensions are suitable for getting the item into the building and into place, sinks fit into countertops, etc.).
  - d. The Contractor shall review, stamp and approve all subcontractors' submittals as described above.
  - e. The Contractor's approval stamp is required on all submittals. Approval will indicate the Contractor's review of all material and a complete understanding of exactly what is to be furnished. Contractor shall clearly mark all deviations from the contract documents on all submittals. If deviations are not marked by the Contractor, then the item shall be required to meet all drawing and specification requirements.
6. Submittal Identification and Markings:
  - a. The Contractor shall clearly mark each item with the same nomenclature applied on the drawings or in the specifications.
  - b. The Contractor shall clearly indicate the size, finish, material, etc.
  - c. Where more than one model is shown on a manufacturer's sheet, the Contractor shall clearly indicate exactly which item and which data is intended.
  - d. All marks and identifications on the submittals shall be unambiguous.
7. Schedule submittals to expedite the project. Coordinate submission of related items.
8. Identify variations from the contract documents and product or system limitations that may be detrimental to the successful performance of the completed work.
9. Reproduction of contract documents alone is not acceptable for submittals.
10. Incomplete submittals will be rejected without review. Partial submittals will only be reviewed with prior approval from the Architect/Engineer.
11. The Architect/Engineer's responsibility shall be to review one set of shop drawing submittals for each product. If the first submittal is incomplete or does not comply with the drawings and/or specifications, the Contractor shall be responsible to bear the cost for the Architect/Engineer to recheck and handle the additional shop drawing submittals.
12. Submittals shall be reviewed and approved by the Architect/Engineer before releasing any equipment for manufacture or shipment.
13. Contractor's responsibility for errors, omissions or deviation from the contract documents in submittals is not relieved by the Architect/Engineer's approval.
14. Schedule shall allow for adequate time to perform orderly and proper review of submittals, including time for consultants and Owner if required, and resubmittals by Contractor if necessary, and to cause no delay in Work or in activities of Owner or other



contractors.

a. Allow at least two weeks for Architect's/Engineer's review and processing of each submittal.

15. Architect/Engineer reserves the right to withhold action on a submittal which, in the Architect/Engineer's opinion, requires coordination with other submittals until related submittals are received. The Architect/Engineer will notify the Contractor, in writing, when they exercise this right.

C. Electronic Submittal Procedures:

1. Distribution: Email submittals as attachments to all parties designated by the Architect/Engineer, unless a web-based submittal program is used.
2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.
3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.
4. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.

- a. Submittal file name: 28 XX XX.description.YYYYMMDD
- b. Transmittal file name: 28 XX XX.description.YYYYMMDD

5. File Size: Files shall be transmitted via a pre-approved method. Larger files may require an alternative transfer method, which shall also be pre-approved.

## 1.7 SCHEDULE OF VALUES

A. The requirements herein are in addition to the provisions of Division 1.

B. Format:

1. Use AIA Document Continuation Sheets G703 or another similar form approved by the Owner and Architect/Engineer.
2. Submit in Excel format.
3. Support values given with substantiating data.

C. Preparation:

1. Itemize work required by each specification section and list all providers. All work provided by subcontractors and major suppliers shall be listed on the Schedule of Values. List each subcontractor and supplier by company name.
2. Break down all costs into:
  - a. Material: Delivered cost of product with taxes paid.
  - b. Labor: Labor cost, excluding overhead and profit.
3. Itemize the cost for each of the following:
  - a. Overhead and profit.
  - b. Bonds.
  - c. Insurance.
  - d. General Requirements: Itemize all requirements.

4. For each line item having an installed cost of more than \$5,000, break down costs to list major products or operations under each item. At a minimum, provide material and labor cost line items for the following:

- a. Security systems:

- 1) Surveillance
- 2) Access control
- 3) Intrusion
- 4) Infant abduction

- D. Update Schedule of Values when:

1. Indicated by Architect/Engineer.
2. Change of subcontractor or supplier occurs.
3. Change of product or equipment occurs.

## **1.8 CHANGE ORDERS**

- A. A detailed material and labor takeoff shall be prepared for each change order, along with labor rates and markup percentages. Change orders shall be broken down by sheet or associated individual line item indicated in the change associated narrative, whichever provides the most detailed breakdown. Change orders with inadequate breakdown will be rejected.
- B. Itemized pricing with unit cost shall be provided from all distributors and associated subcontractors.
- C. Change order work shall not proceed until authorized.

## **1.9 EQUIPMENT SUPPLIERS' INSPECTION**

- A. The following equipment shall not be placed in operation until a representative of the manufacturer has inspected the installation and certified that the equipment is properly installed and that the equipment is ready for operation:
  1. Firestopping, including mechanical firestop systems.

## **1.10 PRODUCT DELIVERY, STORAGE, HANDLING & MAINTENANCE**

- A. Exercise care in transporting and handling to prevent damage to fixtures, equipment and materials.
- B. Store materials on the site to prevent damage.
- C. Keep fixtures, equipment and materials clean, dry and free from harmful conditions.

## **1.11 NETWORK / INTERNET CONNECTED EQUIPMENT**

- A. These specifications may require certain equipment or systems to have network, Internet and/or remote access capability ("Network Capability"). Any requirement for Network Capability shall be interpreted only as a functional capability and is not to be construed as authority to connect or enable any Network Capability. Network Capability may only be connected or enabled with the express written consent of the Owner.

## **1.12 WARRANTY**

- A. At a minimum, provide a one (1) year warranty for all equipment, materials, and workmanship. Individual specifications sections within Division 28 may require additional warranty

requirements for specific equipment or systems.

- B. The warranty period for the entire installation described in this Division of the specifications shall commence on the date of substantial completion unless a whole or partial system or any separate piece of equipment or component is put into use for the benefit of any party other than the installing contractor with prior written authorization. In this instance, the warranty period shall commence on the date when such whole system, partial system or separate piece of equipment or component is placed in operation and accepted in writing by the Owner or their representative.
- C. Warranty requirements shall extend to correction, without cost to the final user, of all work and/or equipment found to be defective or nonconforming to the contract documents. The Contractor shall bear the cost of correcting all damage resulting from such defects or nonconformance with contract documents exclusive of repairs required as a result of improper maintenance or operation, or of normal wear as determined by the Architect/Engineer.

### **1.13 INSURANCE**

- A. Contractor shall maintain insurance coverage as set forth in Division 0 of these specifications.

### **1.14 MATERIAL SUBSTITUTION**

- A. Where several manufacturers' names are given, the first named manufacturer constitutes the basis for job design and establishes the equipment quality required.
- B. Equivalent equipment manufactured by the other named manufacturers may be used. Contractor shall ensure that all items submitted by these other manufacturers meets all requirements of the drawings and specifications and fits in the allocated space. When using other listed manufacturers, the Contractor shall assume responsibility for any and all modifications necessary (including, but not limited to structural supports, electrical connections and rough-in, and regulatory agency approval, etc.) and coordinate such with other contractors. The Architect/Engineer shall make the final determination of whether a product is equivalent.
- C. Any material, article or equipment of other unnamed manufacturers which will adequately perform the services and duties imposed by the design and is of a quality equal to or better than the material, article or equipment identified by the drawings and specifications may be used if approval is secured in writing from the Architect/Engineer via addendum. The Contractor bears full responsibility for the unnamed manufacturers' equipment adequately meeting the intent of design. The Architect/Engineer may reject manufacturer at time of shop drawing submittal. The Contractor assumes all costs incurred by other trades on the project as a result of changes necessary to accommodate the offered material, equipment or installation method.
- D. Should this Contractor be unable to secure approval from the Architect/Engineer for other unnamed manufacturers as outlined above, this Contractor may list voluntary add or deduct prices for alternate materials on the bid form. These items will not be used in determining the low bidder. Should a voluntary alternate material be accepted, This Contractor shall assume all costs that may be incurred as a result of using the offered material, article or equipment necessitating extra expense on This Contractor or on the part of other Contractors whose work is affected.

## **PART 2 - PRODUCTS**

### **2.1 REFER TO INDIVIDUAL SECTIONS**

## **PART 3 - EXECUTION**

### **3.1 JOBSITE SAFETY**

- A. Neither the professional activities of the Architect/Engineer, nor the presence of the Architect/Engineer or the employees and subconsultants at a construction site, shall relieve the Contractor and any other entity of their obligations, duties and responsibilities including, but not limited to, construction means, methods, sequence, techniques or procedures necessary for performing, superintending or coordinating all portions of the work of construction in accordance with the contract documents and any health or safety precautions required by any regulatory agencies. The Architect/Engineer and personnel have no authority to exercise any control over any construction contractor or other entity or their employees in connection with their work or any health or safety precautions. The Contractor is solely responsible for jobsite safety. The Architect/Engineer and the Architect/Engineer's consultants shall be indemnified and shall be made additional insureds under the Contractor's general liability insurance policy.

### **3.2 GENERAL INSTALLATION REQUIREMENTS**

- A. Installation of all conduit and cabling shall comply with Sections 26 05 33 and 26 05 13. Additional conduit requirements described within this Division shall be supplemental to the requirement described in Section 26 05 33. Should conflicts exist between the two Divisions the more stringent (more expensive material and labor) condition shall prevail until bidding addendum or construction clarification or RFI can be submitted and responded to. In no case shall the Contractor carry the least stringent condition in the pricing.
- B. It is the Contractor's responsibility to survey the site and include all necessary costs to perform the installation as specified.
- C. The Contractor shall be responsible for identifying and reporting to the Architect/Engineer any existing conditions including but not limited to damage to walls, flooring, ceiling and furnishings prior to start of work. All damage to interior spaces caused by this Contractor shall be repaired at this Contractor's expense to pre-existing conditions, including final colors and finishes.
- D. All cables and devices installed in damp or wet locations, including any underground or underslab location, shall be listed as suitable for use in such environments. Follow manufacturer's recommended installation practices for installing cables and devices in damp or wet locations. Any cable or device that fails as a result of being installed in a damp or wet location shall be replaced at the Contractor's expense.

### **3.3 FIELD QUALITY CONTROL**

- A. General:
  - 1. Refer to specific Division 28 sections for further requirements.
  - 2. The Contractor shall conduct all tests required and applicable to the work both during and after construction of the work.
  - 3. The necessary instruments and materials required to conduct or make the tests shall be supplied by the Contractor who shall also supply competent personnel for making the tests who has been schooled in the proper testing techniques.
  - 4. In the event the results obtained in the tests are not satisfactory, Contractor shall make such adjustments, replacements and changes as are necessary and shall then repeat the test or tests which disclose faulty or defective work or equipment, and shall make such additional tests as the Architect/Engineer or code enforcing agency deems necessary.
- B. Protection of cable from foreign materials:
  - 1. It is the Contractor's responsibility to provide adequate physical protection to prevent foreign material application or contact with any cable type. Foreign material is defined as

any material that would negatively impact the validity of the manufacturer's performance warranty. This includes, but is not limited to, overspray of paint (accidental or otherwise), drywall compound, or any other surface chemical, liquid or compound that could come in contact with the cable, cable jacket or cable termination components.

2. Application of foreign materials of any kind on any cable, cable jacket or cable termination component will not be accepted. It shall be the Contractor's responsibility to replace any component containing overspray, in its entirety, at no additional cost to the project. Cleaning of the cables with harsh chemicals is not allowed. This requirement is regardless of the PASS/FAIL test results of the cable containing overspray. Should the manufacturer and warrantor of the structured cabling system desire to physically inspect the installed condition and certify the validity of the structured cabling system (via a signed and dated statement by an authorized representative of the structured cabling manufacturer), the Owner may, at their sole discretion, agree to accept said warranty in lieu of having the affected cables replaced. In the case of plenum cabling, in addition to the statement from the manufacturer, the Contractor shall also present to the Owner a letter from the local Authority Having Jurisdiction stating that they consider the plenum rating of the cable to be intact and acceptable.

### **3.4 PROJECT CLOSEOUT**

- A. Refer to the Division 1 Section: PROJECT CLOSEOUT for requirements. The following paragraphs supplement the requirements of Division 1.
- B. Final Jobsite Observation:
  1. Architect/Engineer will not perform a final jobsite observation until the project is ready. This is not dictated by schedule, but rather by completeness of the project.
  2. Refer to the end of Section 27 05 00 for a "STATEMENT INDICATING READINESS FOR FINAL JOBSITE OBSERVATION."
  3. The Contractor shall sign this form and return it to the Architect/Engineer so that the final observation can commence.
- C. Before final payment will be authorized, this Contractor must have completed the following:
  1. Submitted operation and maintenance manuals to the Architect/Engineer for review.
  2. Submitted bound copies of approved shop drawings.
  3. Record documents including edited drawings and specifications accurately reflecting field conditions, **inclusive** of all project revisions, change orders, and modifications.
  4. Submitted a report stating the instructions given to the Owner's representative complete with the number of hours spent in the instruction. The report shall bear the signature of an authorized agent of This Contractor and shall be signed by the Owner's representative as having received the instructions.
  5. Submitted testing reports for all systems requiring final testing as described herein.
  6. Submitted start-up reports on all equipment requiring a factory installation inspection and/or start.
  7. Provide spare parts, maintenance, and extra materials in quantities specified in individual specification sections. Deliver to project site; submit receipt to Architect/Engineer prior to final payment being approved.

### **3.5 OPERATION AND MAINTENANCE MANUALS**

- A. General:
  1. Provide an electronic copy of the O&M manuals as described below for Architect/Engineer's review and approval. The electronic copy shall be corrected as required to address the Architect/Engineer's comments. Once corrected, electronic copies and paper copies shall be distributed as directed by the Architect/Engineer.
  2. Approved O&M manuals shall be completed and in the Owner's possession prior to

Owner's acceptance and at least 10 days prior to instruction of operating personnel.

B. Electronic Submittal Procedures:

1. Distribution: Email the O&M manual as attachments to all parties designated by the Architect/Engineer.
2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.
3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.
4. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.
  - a. O&M file name: O&M.div28.contractor.YYYYMMDD
  - b. Transmittal file name: O&Mtransmittal.div28.contractor.YYYYMMDD
5. File Size: Files shall be transmitted via a pre-approved method. Larger files may require an alternative transfer method, which shall also be pre-approved.
6. Provide the Owner with an approved copy of the O&M manual on compact discs (CD), digital video discs (DVD), or flash drives with a permanently affixed label, printed with the title "Operation and Maintenance Instructions", title of the project and subject matter of disc/flash drive when multiple disc/flash drives are required.
7. All text shall be searchable.
8. Bookmarks shall be used, dividing information first by specification section, then systems, major equipment and finally individual items. All bookmark titles shall include the nomenclature used in the construction documents and shall be an active link to the first page of the section being referenced.

C. Operation and Maintenance Instructions shall include:

1. Title Page: Include title page with project title, Architect, Engineer, Contractor, all subcontractors, and major equipment suppliers, with addresses, telephone numbers, website addresses, email addresses and point of contacts. Website URLs and email addresses shall be active links in the electronic submittal.
2. Table of Contents: Include a table of contents describing specification section, systems, major equipment, and individual items.
3. Copies of all final approved shop drawings and submittals. Include Architect's/Engineer's shop drawing review comments. Insert the individual shop drawing directly after the Operation and Maintenance information for the item(s) in the review form.
4. Copy of final approved test and balance reports.
5. Copies of all factory inspections and/or equipment startup reports.
6. Copies of warranties.
7. Schematic wiring diagrams of the equipment that have been updated for field conditions. Field wiring shall have label numbers to match drawings.
8. Dimensional drawings of equipment.
9. Capacities and utility consumption of equipment.
10. Detailed parts lists with lists of suppliers.
11. Operating procedures for each system.
12. Maintenance schedule and procedures. Include a chart listing maintenance requirements and frequency.
13. Repair procedures for major components.
14. List of lubricants in all equipment and recommended frequency of lubrication.
15. Instruction books, cards, and manuals furnished with the equipment.

### **3.6 INSTRUCTING THE OWNER'S REPRESENTATIVE**

- A. Adequately instruct the Owner's designated representative or representatives in the maintenance, care, and operation of the complete systems installed under this contract.
- B. Provide verbal and written instructions to Owner representative or representatives by FACTORY PERSONNEL in care, maintenance, and operation of the equipment and systems.
- C. The Owner has the option to make a video recording of all instructions. Coordinate schedule of instructions to facilitate this recording.
- D. Notify Architect/Engineer of the time and place for the verbal instructions to be given to the Owner's representative so a representative can be present if desired.
- E. Refer to individual specification sections for minimum hours of instruction time for each system.
- F. Operating Instructions:
  - 1. The Contractor is responsible for all instructions to the Owner and/or Owner's operating staff on the security systems.
  - 2. If Contractor does not have Engineers and/or Technicians on staff that can adequately provide the required instructions on system operation, performance, troubleshooting, care and maintenance, the Contractor shall include in the bid an adequate amount to reimburse the Owner for the Architect/Engineer to perform these services.

### **3.7 SYSTEM STARTING AND ADJUSTING**

- A. The security systems included in the construction documents are to be complete and operating systems. The Architect/Engineer will make periodic job site observations during the construction period. The system start-up, testing, configuration, and satisfactory system performance is the responsibility of the Contractor. This shall include all calibration and adjustments of electrical equipment controls, equipment settings, software configuration, troubleshooting and verification of software, and final adjustments that may be required.
- B. All operating conditions and control sequences shall be simulated and tested during the start-up period.
- C. The Contractor, subcontractors, and equipment suppliers are expected to have skilled technicians to ensure that the system performs as designed. If the Architect/Engineer is requested to visit the job site for the purpose of trouble shooting, assisting in the satisfactory start-up, obtaining satisfactory equipment operation, resolving installation and/or workmanship problems, equipment substitution issues or unsatisfactory system performance, including call backs during the warranty period through no fault of the design; the Contractor shall reimburse the Owner on a time and material basis for services rendered at the Architect/Engineer's standard hourly rates in effect at the time the services are requested. The Contractor shall be responsible for making payment to the Owner for services required that are product, installation or workmanship related. Payment is due within 30 days after services are rendered.

### **3.8 RECORD DOCUMENTS**

- A. Refer to the Division 1 Section: PROJECT CLOSEOUT for requirements. The following paragraphs supplement the requirements of Division 1.
- B. Mark specifications to indicate approved substitutions, change orders, and actual equipment and materials used.
- C. This Contractor shall maintain at the job site, a separate and complete set of Security Drawings which shall be clearly and permanently marked and noted in complete detail any changes

made to the location and arrangement of equipment or made to the Technology Systems and wiring as a result of building construction conditions or as a result of instructions from the Architect or Engineer. All Change Orders, RFI responses, Clarifications and other supplemental instructions shall be marked on the documents. Record documents that merely reference the existence of the above items are not acceptable. Should This Contractor fail to complete Record Documents as required by this contract, This Contractor shall reimburse Architect/Engineer for all costs to develop record documents that comply with this requirement. Reimbursement shall be made at the Architect/Engineer's hourly rates in effect at the time of work.

- D. Record actual routing of all conduits sized 2" or larger.
- E. The above record of changes shall be made available for the Architect and Engineer's examination during any regular work time.
- F. Upon completion of the job, and before final payment is made, This Contractor shall give the marked-up drawings to the Architect/Engineer.

### **3.9 ADJUST AND CLEAN**

- A. Contractor shall thoroughly clean all equipment and systems prior to the Owner's final acceptance of the project.
- B. Contractor shall clean all foreign paint, grease, oil, dirt, labels, stickers, and other foreign material from equipment.
- C. Contractor shall remove all rubbish, debris, etc., accumulated during the Contractor's operations from the premises.



## STATEMENT INDICATING READINESS FOR FINAL JOBSITE OBSERVATION

To assist the contractor in a timely close-out of the project, it is crucial that the final jobsite observation is not conducted prior to the project being ready. The contractor is required to review the completion status of the project at the time the observation is scheduled. This review, and the subsequent submittal of this form to the Architect/Engineer, shall indicate the contractor's agreement that the area of the project being requested for final observation is ready as defined below. The following list represents the degree of completeness required prior to requesting a final observation:

1. All cabling pathways (cable tray, ladder rack, conduit sleeves, etc.) are installed and all cabling has been pulled through them.
2. All mechanical firestop products are installed and all other penetrations have been sealed.
3. All CCTV cameras, mounts, cabling and all headend equipment are installed, programmed and operational.
4. All access control system equipment, including card readers, conduits, cabling, electronic locks, controllers and all headend equipment, is installed, programmed and operational.

Prime Contractor: \_\_\_\_\_ By: \_\_\_\_\_

Requested Observation Date \_\_\_\_\_ Today's Date: \_\_\_\_\_

Contractor shall sign this readiness statement and transmit to Architect/Engineer at least 10 days prior to the requested date of observation.

It is understood that if the Architect/Engineer finds that the project is not complete as defined above and that the final jobsite observation cannot be completed on the requested date, the Architect/Engineer will return to the site at a later date. All additional visits to the site for the purposes of completing the final observation will be billed T&M to the Contractor at our standard hourly rates, including travel expenses or the contractor's retainage may be deducted for the same amount.

**END OF SECTION**

## SECTION 28 05 03 - THROUGH PENETRATION FIRESTOPPING

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. Through-Penetration Firestopping.

#### 1.2 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in manufacturing products specified in this Section.
- B. Installer: Individuals performing work shall be certified by the manufacturer of the system selected for installation.

#### 1.3 REFERENCES

- A. UL 263 - Fire Tests of Building Construction and Materials
- B. UL 723 - Surface Burning Characteristics of Building Materials
- C. ANSI/UL 1479 - Fire Tests of Through Penetration Firestops
- D. UL 2079 Tests for Fire Resistance of Building Joint Systems
- E. UL Fire Resistance Directory Through Penetration Firestop Systems (XHEZ)
- F. Intertek / Warnock Hersey - Directory of Listed Products
- G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials
- H. ASTM E814 - Standard Test Method for Fire Tests of Through-Penetration Firestops
- I. The Building Officials and Code Administrators National Building Code
- J. 1997 Uniform Building Code
- K. 2018 International Building Code
- L. NFPA 5000 - Building Construction Safety Code

#### 1.4 SUBMITTALS

- A. Submit under provisions of [Division 1][Section 28 05 00].
- B. Submit Firestopping Installers Certification for all installers on the project.
- C. Shop Drawings: Submit for each condition requiring firestopping. Include descriptions of the specific penetrating item, actual wall/floor construction, manufacturer's installation instructions, and UL or Intertek / Warnock Hersey Assembly number.
- D. Through-Penetration Firestop System Schedule: Indicate locations of each through-penetration firestop system, along with the following information:
  - 1. Types of penetrating items.
  - 2. Types of constructions penetrated, including fire-resistance ratings and, where applicable, thicknesses of construction penetrated.

3. Through-penetration firestop systems for each location identified by firestop design designation of qualified testing and inspecting agency.
  4. F ratings for each firestop system.
- E. Maintain a notebook on the job site at all times that contains copies of approved submittals for all through penetration firestopping to be installed. Notebook shall be made available to the Authority Having Jurisdiction at their request and turned over to the Owner at the end of construction as part of the O&M Manuals.

## **1.5 DELIVERY, STORAGE, AND HANDLING**

- A. Store, protect and handle products on site. Accept material on site in factory containers and packing. Inspect for damage. Protect from deterioration or damage due to moisture, temperature changes, contaminants, or other causes. Follow manufacturer's instructions for storage.
- B. Install material prior to expiration of product shelf life.

## **1.6 PERFORMANCE REQUIREMENTS**

- A. General: For penetrations through the following fire-resistance-rated constructions, including both empty openings and openings containing penetrating items, provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated.
  1. Fire-resistance-rated walls including fire partitions, fire barriers, and smoke barriers.
  2. Fire-resistance-rated horizontal assemblies including floors, floor/ceiling assemblies, and ceiling membranes of roof/ceiling assemblies.
- B. Rated Systems: Provide through-penetration firestop systems with the following ratings determined per UL 1479:
  1. F-Rated Systems: Provide through-penetration firestop systems with F-ratings indicated, but not less than that equaling or exceeding fire-resistance rating of constructions penetrated.
- C. For through-penetration firestop systems exposed to light, traffic, moisture, or physical damage, provide products that, after curing, do not deteriorate when exposed to these conditions both during and after construction.
- D. For through-penetration firestop systems exposed to view, provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.
- E. For through-penetration firestop systems in air plenums, provide products with flame-spread and smoke-developed indexes of less than 25 and 50, respectively, as determined per ASTM E 84.

## **1.7 MEETINGS**

- A. Pre-installation meeting: A pre-installation meeting shall be scheduled and shall include the Construction Manager, General Contractor, all Subcontractors associated with the installation of systems penetrating fire barriers, Firestopping Manufacturer's Representative, and the Owner.
  1. Review foreseeable methods related to firestopping work.
  2. Tour representative areas where firestopping is to be installed; inspect and discuss each type of condition and each type of substrate that will be encountered, and preparation to

be performed by other trades.

## **1.8 WARRANTY**

- A. Provide one year warranty on parts and labor.
- B. Warranty shall cover repair or replacement of firestop systems which fail in joint adhesion, cohesion, abrasion resistance, weather resistance, extrusion resistance, migration resistance, stain resistance, general durability, or appear to deteriorate in any manner not clearly specified by the manufacturer as an inherent quality of the material.

## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURERS**

- A. Products: Subject to compliance with requirements, provide one of the through-penetration firestop systems indicated for each application that are produced by one of the following manufacturers. All firestopping systems installed shall be provided by a single manufacturer.
  - 1. 3M; Fire Protection Products Division
  - 2. Hilti, Inc.
  - 3. RectorSeal Corporation, Metacaulk
  - 4. Tremco; Sealant/Weatherproofing Division
  - 5. Johns-Manville
  - 6. Specified Technologies Inc. (S.T.I.)
  - 7. Spec Seal Firestop Products
  - 8. AD Firebarrier Protection Systems
  - 9. Wiremold/Legrand: FlameStopper
  - 10. Dow Corning Corp.
  - 11. Fire Trak Corp.
  - 12. International Protective Coating Corp.
  - 13. HoldRite

### **2.2 THROUGH PENETRATION FIRESTOP SYSTEMS**

- A. Provide materials and systems classified by or listed by Intertek / Warnock Hersey to provide firestopping equal to time rating of construction being penetrated.
- B. All firestopping materials shall be free of asbestos, lead, PCB's, and other materials that would require hazardous waste removal.
- C. Firestopping shall be flexible to allow for normal penetrating item movement due to expansion and contraction.
- D. Firestopping systems for plumbing and wet pipe sprinkler piping shall be moisture resistant.
- E. Provide firestopping systems capable of supporting floor loads where systems are exposed to possible floor loading or traffic.
- F. Provide firestopping systems allowing continuous insulation for all insulated pipes.
- G. Provide firestopping systems classified by UL or listed by Intertek / Warnock Hersey for penetrations through all fire rated construction. Firestopping systems shall be selected from the UL or listed by Intertek / Warnock Hersey Fire Resistance Directory Category XHEZ based on substrate construction and penetrating item size and material and shall fall within the range of numbers listed:

1. Combustible Framed Floors and Chase Walls - 1 or 2 Hour Rated:

- a. F Rating = Floor/Wall Rating
- b. L Rating = Penetrations in Smoke Barriers

<b>Penetrating Item</b>	<b>UL System No.</b>
No Penetrating Item	FC 0000-0999*
Metallic Pipe or Conduit	FC 1000-1999
Non-Metallic Pipe or Conduit	FC 2000-2999
Electrical Cables	FC 3000-3999
Cable Trays	FC 4000-4999
Insulated Pipes	FC 5000-5999
Bus Duct and Misc. Electrical	FC 6000-6999
Duct without Damper and Misc. Mechanical	FC 7000-7999
Multiple Penetrations	FC 8000-8999

\*Alternate method of firestopping is patching opening to match original rated construction.

2. Non-Combustible Framed Walls - 1 or 2 Hour Rated:

- a. F Rating = Wall Rating
- b. L Rating = Penetrations in Smoke Barriers

<b>Penetrating Item</b>	<b>UL System No.</b>
No Penetrating Item	WL 0000-0999*
Metallic Pipe or Conduit	WL 1000-1999
Non-Metallic Pipe or Conduit	WL 2000-2999
Electrical Cables	WL 3000-3999
Cable Trays	WL 4000-4999
Insulated Pipes	WL 5000-5999
Bus Duct and Misc. Electrical	WL 6000-6999
Duct without Damper and Misc. Mechanical	WL 7000-7999
Multiple Penetrations	WL 8000-8999

\*Alternate method of firestopping is patching opening to match original rated construction.

3. Concrete or Masonry Floors and Walls - 1 or 2 Hour Rated:

- a. F Rating = Wall/Floor Rating
- b. L Rating = Penetrations in Smoke Barriers

<b>Penetrating Item</b>	<b>UL System No.</b>
No Penetrating Item	CAJ 0000-0999*
Metallic Pipe or Conduit	CAJ 1000-1999
Non-Metallic Pipe or Conduit	CAJ 2000-2999
Electrical Cables	CAJ 3000-3999
Cable Trays	CAJ 4000-4999
Insulated Pipes	CAJ 5000-5999
Bus Duct and Misc. Electrical	CAJ 6000-6999
Duct without Damper and Misc. Mechanical	CAJ 7000-7999
Multiple Penetrations	CAJ 8000-8999

\*Alternate method of firestopping is patching opening to match original rated construction.

H. Any opening in walls or floors not covered by the listed series of numbers shall be coordinated with the firestopping manufacturer.

I. Any openings in floors or walls not described in the UL or listed by Intertek / Warnock Hersey Fire Resistance Directory, or outlined in manufacturer's information shall be sealed in a manner agreed upon by the Firestopping Manufacturer, Owner, and the Authority Having Jurisdiction.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Ensure all surfaces that contact seal materials are free of dirt, dust, grease, oil, rust, or loose materials. Clean and repair surfaces as required. Remove laitance and form-release agents from concrete.
- B. Ensure substrate and penetrating items have been permanently installed prior to installing firestopping systems. Ensure penetrating items have been properly spaced and have proper clearance prior to installing firestopping systems.
- C. Surfaces to which sealing materials are to be installed must meet the selected UL or Intertek / Warnock Hersey system substrate criteria.
- D. Prime substrates where recommended in writing by through-penetration firestop system manufacturer. Confine primer to area of bond.

### **3.2 INSTALLATION**

- A. In existing construction, provide firestopping of openings prior to and after installation of penetrating items. Remove any existing coatings on surfaces prior to firestopping installation. Temporary firestopping shall consist of packing openings with fire resistant mineral wool for the full thickness of substrate, or an alternate method approved by the Authority Having Jurisdiction. All openings shall be temporarily firestopped immediately upon their installation and shall remain so until the permanent UL or listed by Intertek / Warnock Hersey listed firestopping system is installed.
- B. Install penetration seal materials in accordance with printed instructions of the UL or Intertek / Warnock Hersey Fire Resistance Directory and with manufacturer printed application instructions.
- C. Install dams as required to properly contain firestopping materials within openings and as required to achieve required fire resistance rating. Remove combustible damming after appropriate curing.

### **3.3 CLEANING AND PROTECTING**

- A. Clean excess fill materials adjacent to openings as Work progresses by methods and with cleaning materials that are approved in writing by through-penetration firestop system manufacturers and that do not cause damage.
- B. Provide final protection and maintain conditions during and after installation that ensure that through-penetration firestop systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, remove damaged or deteriorated through-penetration firestop systems immediately and install new materials to produce systems complying with specified requirements.

### **3.4 IDENTIFICATION**

- A. Provide and install labels adjacent to each firestopping location. Label shall be provided by the firestop system supplier and contain the following information in a contrasting color:
  - 1. The words "Warning - Through Penetration Firestop System - Do Not Disturb. Notify Building Management of Any Damage."
  - 2. Firestop System Supplier; UL or listed by Intertek / Warnock Hersey system number; date installed; contractor name and phone number; manufacturer's representative name, address, and phone number.

### **3.5 INSPECTION**

- A. All penetrations shall be inspected by the manufacturer's representative to ensure proper installation.
- B. Access to firestop systems shall be maintained for examination by the Authority Having Jurisdiction at their request.
- C. Proceed with enclosing through-penetration firestop system with other construction only after inspection reports are issued and firestop installations comply with requirements.
- D. The contractor shall allow for visual destructive review of 5% of installed firestop systems (minimum of one) to prove compliance with specifications and manufacturer's instructions and details. Destructive system removal shall be performed by the contractor and witnessed by the engineer and manufacturer's factory representative. The engineer shall have sole discretion of which firestop system installations will be reviewed. The contractor is responsible for all costs associated with this requirement including labor and material for removing and replacing the installed firestop system. If any firestop system is found to not be installed per manufacturer's specific instructions and details, all firestop systems are subject to destructive review and replacement at the engineer's discretion and the contractor's expense.

**END OF SECTION**

## SECTION 28 13 00 - ELECTRONIC ACCESS CONTROL

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. Field Control Hardware
- B. Application Software
- C. Access Control Graphical User Interface
- D. Credentials and Badging
- E. Portal Devices

#### 1.2 RELATED WORK

- A. Section 08 71 00 - Door Hardware
- B. Section 26 05 13 - Wire and Cable
- C. Section 26 05 33 - Conduits and Boxes
- D. Section 26 05 35 - Surface Raceways
- E. Section 27 05 26 - Communications Bonding
- F. Section 27 05 28 - Interior Communication Pathways
- G. Section 27 05 43 - Exterior Communication Pathways
- H. Section 27 05 53 - Identification and Administration
- I. Section 27 15 00 - Horizontal Cabling Requirements
- J. Section 28 05 00 - Basic Electronic Safety and Security System Requirements.
- K. Section 28 05 03 - Through Penetration Fire stopping.
- L. Section 28 23 00 - Video Surveillance
- M. Section 28 31 00 - Fire Detection and Alarm Systems.

#### 1.3 QUALITY ASSURANCE

- A. Manufacturer: The manufacturer shall have a minimum of ten (10) years documented experience in the development and manufacture of access control software and hardware. The software developer shall be, at a minimum, a Microsoft Silver Certified Integrator and Partner for those systems that reside in a Microsoft environment.
- B. Contractor:
  - 1. Shall be a factory-authorized installation, service and support company specializing in selected manufacturer's product, with demonstrated prior experience of a minimum of three (3) years installing, programming and supporting the selected manufacturer's system.
  - 2. Shall have been in business for a minimum of three (3) years and shall have installed a



minimum of three (3) similar or larger sized systems. Contractor shall have a minimum of two (2) service technicians who are certified in the proposed manufacturer's system.

3. Shall retain the services of a minimum of one employee with the following certification(s) or education. Should more than one certification be required, one employee may maintain multiple certifications.
  - a. A certification of RCDD from BICSI or CNIDP from CNet.
  - b. A certification of MCSA: Server: Server Infrastructure from Microsoft.
  - c. A certification of CCNA or CCNP from CISCO.

C. Material:

1. All material which is Contractor furnished shall be new, unused and free from defects.
2. Where more than one of any specified item of equipment or material is used, all such items shall be the same product from the same manufacturer.

#### 1.4 REFERENCES

- A. International Building Code
- B. NFPA 70 - National Electrical Code.
- C. The BOCA National Building Code
- D. UL 294 - Standard for Access Control Systems.
- E. UL 464 - Standard for Audible Signal Appliances.
- F. UL 1449 - Standard for Surge Protective Devices.
- G. UL 1778 - Uninterruptible Power Systems.

#### 1.5 SUBMITTALS

- A. Submit shop drawings and product data under provisions of Section 28 05 00.
- B. Product Data Submittal: Provide manufacturer's technical product specification sheet for each individual component type. Submitted data shall show the following:
  1. Compliance with each requirement of these documents. The submittal shall acknowledge each requirement of this section, item-by-item.
  2. All component options and accessories specific to this project.
  3. Electrical power consumption rating and voltage.
  4. Heat generation for all power consuming devices.
  5. Wiring requirements.
  6. Server processor(s), workstation configurations, total and available disk space, and memory size.
  7. All network bandwidth, latency and reliability requirements.
  8. Backup/archive system size and configuration.
  9. Submit two of each type of credential to be used (access card, key fob, etc.).
- C. System Drawings: Project-specific system CAD drawings shall be provided as follows:
  1. Provide a system block diagram noting system components and interconnection between components. The interconnection of components shall clearly indicate all wiring required in the system. When multiple pieces of equipment are required in the exact same configuration (e.g., multiple identical controllers), the diagram may show one device and

- refer to the others as "typical" of the device shown. The diagram shall list room numbers where each controller will be located. This block diagram shall be provided in Adobe PDF.
2. Provide a schedule of all controllers and the doors/points each controller controls. This schedule shall be provided in Adobe PDF.
  3. Provide schedules describing each system input location by an architecturally familiar reference, e.g., Door 312A. The architectural door schedule shall be used as the basis. These schedules shall be provided in Adobe PDF
- D. Submit sample format of site specific programming guides to be used for system planning/programming conference with Owner. These guides shall be provided in Adobe PDF.
- E. So that required Owner personnel are present at the planning/programming conference required in Part 3 of this section, submit meeting agenda for the conference a minimum of two weeks prior to the conference.
- F. Submit detailed description of Owner training to be conducted at project end, including specific training times. Refer to Part 3 of this section for details.
- G. IP Addresses: Contractor shall provide to Owner, in a documented transmittal and in Microsoft Excel format, the names and locations of devices which require an IP address. An authorized representative of the Owner shall furnish the addresses for the associated devices in Microsoft Excel format in a documented transmittal. Should Owner change the IP address structure after approval of the list, Owner may be responsible for additional fees involved with reprogramming.
- H. Quality Assurance:
1. Provide materials documenting experience requirements of the manufacturer and Installing Contractor. Provide documentation of the training and other applicable certifications of the Contractor.
  2. Provide system checkout test procedure to be performed at acceptance. Test procedures shall include all external alarm events.

## **1.6 SYSTEM DESCRIPTION**

- A. This section describes the furnishing, installation, programming and commissioning of a complete, turnkey access control system. The terms "access control system" and "security management system", or SMS, may be used interchangeably herein.
- B. Company, manufacturer, and product names used in this section are for identification purposes only. All trademarks and registered trademarks are the property of their respective owners.
- C. Performance Statement: This section and the accompanying access control-specific design documents are performance based, describing the minimum material quality, required features, and operational requirements of the system. These documents do not convey every wire that must be installed and every equipment connection that must be made. Based on the equipment constraints described and the performance required of the system, as presented in these documents, the vendor and the Contractor are solely responsible for determining all wiring, programming, and miscellaneous equipment required. The Contractor shall be responsible for determining quantities of materials required for a complete and operational system. Floor plan drawings and schedules have been developed to aid the Contractor in determining device quantities and installation locations, but, where discrepancies between floor plans and schedules arise, the greater number shall govern.
- D. Basic System Description:
1. The access control system shall provide the following functionality:

- a. Electronic control access to designated areas.
- b. Validation of cardholder credentials by use of personnel database, card formats, PINs. The system shall compare the time, location, and unique credentials of an attempted entry with information stored in the database.
- c. Access to designated areas will be validated only when a user's credential has a valid number for its facility and the number is valid for the current time and for the reader where it is used.
- d. The system software shall access the hardware that validates the person and monitors the security of a building by use of intelligent system controllers, reader interfaces, locks, readers, inputs and outputs. When access has been validated, a signal to the portal locking device shall be activated to enable alarm free access at that location.
- e. The system shall be configured by use of application software.
- f. The system shall monitor activities using operator monitoring software which includes graphical maps which display alarms, status and activity.
- g. The system shall differentiate and restrict administrative and operational access through use of password authentication.
- h. The system shall report on various aspects of the system by use of reports, both default and customizable. Reports shall be able to be printed.
- i. The system shall have the capability to report alarms both audibly and visually.
- j. The system shall control hardware from the monitoring station by use of manual actions and events.
- k. The system shall provide record and data management by use of journals. There shall be a full audit trail.
- l. The system shall allow for data to be imported from other products by use of database migration tools. These products may include Human Resources databases for name and/or time and attendance information, information from previous access control systems consisting of badge numbers from credentials that will be re-used, Microsoft Excel spreadsheets, or other systems as defined herein.
- m. The system shall allow access using a web interface or a mobile application for use on the iOS and Android operating systems.

E. Integrations, Software Development Kit (SDK) and Application Programming Interface (API):

- 1. The manufacturers of the systems that are integrated shall make an SDK available to other manufacturers.
- 2. Prior to the release of this section, the manufacturers of the systems that are to be integrated shall have made available to each other all APIs to perform the specific integrated functions required in this section.
- 3. The integrations shall be completed and tested, and shall have been implemented on at least one system of similar size prior to the release of this section. The integrations shall not be accomplished for the first time for this project unless written pre-approval has been granted by Owner to Contractor prior to bid deadline.
- 4. During the warranty period, should a new API or version of software be released by the SMS manufacturer or any of the manufacturers of systems or devices that are integrated, that API or version of software shall be installed in the appropriate system or device defined in this section at no charge to Owner. Should any loss of functionality in the integration be exposed through this installation, as compared to the accepted system, Contractor shall correct the functionality at no charge to Owner.
- 5. Any and all development costs for specified functionality or inter-system integrations shall be included in the Contractor's bid. No additional costs or fees for the integrations shall be charged to Owner from the time of notice to proceed through system acceptance.

**1.7 OWNER FURNISHED MATERIAL**

- A. Telephone service
- B. Data circuit / internet service

C. Active telephone service equipment, such as key system, PBX or VOIP switch equipment

D. Active computer network equipment:

1. Routers
2. Switches
3. Hubs
4. Wireless access points
5. Uninterruptible power supplies for Owner furnished products

E. Active computer equipment:

1. SMS server - refer to Part 2 for details
2. SMS workstation(s) - refer to Part 2 for details
3. SMS badging station(s) - refer to Part 2 for details
4. Uninterruptible power supplies for Owner furnished products

## **1.8 LICENSING REQUIREMENTS**

A. All user licenses required for system operation shall be included in the Contractor's bid. User licenses shall include server and workstation software, network controllers, card readers, printers, badging stations, and any other licensing that is required by the manufacturer for operation of any system component.

1. Licenses shall be provided on a one-to-one basis. One license shall be provided for each device requiring a license. In the event the manufacturer requires the purchase of a block of licenses, license blocks provided shall be no greater than what is required for the number of devices in this project. Contractor shall document the number of remaining licenses in the project record documents and Operations and Maintenance data.
2. In addition to the licensing requirements listed above, provide licensing and configuration of system administration/operation software for workstations. The workstation licenses shall be concurrent use seats, and the client software shall be able to be loaded on an unlimited number of workstations at no extra cost to the Owner. Contractor shall install client software on the same number of machines as licenses provided. As part of the training, Contractor shall demonstrate to Owner how to install client software on additional workstations.
3. Northern State University will be transitioning to Lenel S2 from the existing Transact system. The system described herein is an extension of the foregoing LenelS2 system. All licensing shall be new for each installed device. The Contractor shall not use any of the Owner's existing (spare) licenses for any new components.
4. All Contractor-furnished software shall contain a perpetual, permanent license in which no other fees beyond the single payment for the work of this section are required in order to use the proposed software indefinitely. Owner understands that, after the initial warranty period has expired, maintenance and technical support fees may be required annually, quarterly, or monthly in order to receive software updates and technical support. However, it remains the option of Owner to purchase or decline this service. If Owner chooses to discontinue or never purchase this service, the software shall continue to be legally licensed for use. All software shall be the latest version released, and all Contractor-furnished servers and workstations shall be current on all patches and updates for all software on the machines at the time of acceptance of the associated systems.
5. The SMS shall require only a single license key present on the server for the SMS to operate. The key shall be a physical device or a software key. License keys shall not be required at the client workstations.

## **1.9 PROJECT RECORD DOCUMENTS**

A. Submit documents under the provisions of Section 28 05 00.

- B. Provide final system block diagram showing any deviations from shop drawing submittal.
- C. Provide statement that system checkout test, as outlined in the shop drawing submittal, is complete and satisfactory.
- D. Provide schedules documenting:
  - 1. Controller installation locations including specific door numbers being controlled.
  - 2. All terminal block wiring, including cable numbers.
- E. Warranty: Submit written warranty and complete all Owner registration forms.
- F. Complete all operation and maintenance data manuals as described below.

### **1.10 OPERATION AND MAINTENANCE DATA**

- A. Submit documents under the provisions of Section 28 05 00.
- B. Manuals: Final copies of the manuals shall be delivered within 14 days after completing the installation test. Each manual's contents shall be identified on the cover. The manual shall include names, addresses, and telephone numbers of the contractor responsible for the installation and maintenance of the system, and the factory representatives for each item of equipment for each system. The manuals shall have a table of contents and labeled sections. The final copies delivered after completion of the installation test shall include all modifications made during installation, checkout, and acceptance testing. Manuals shall be submitted in electronic format only, Adobe PDF. The manuals shall consist of the following:
  - 1. Hardware Manual: The manual shall describe all equipment furnished including:
    - a. General description and specifications.
    - b. Installation and check out procedures.
    - c. System and equipment layout and electrical schematics to the control board and field device level. For multiple devices wired identically, only one wiring diagram is required per door configuration, to be labeled "TYPICAL".
    - d. Alignment and calibration procedures.
    - e. Manufacturers repair parts list indicating sources of supply.
  - 2. Software Manual: The software manual shall describe the functions of all software and shall include all other information necessary to enable proper loading, testing, and operation. The manual shall include:
    - a. Definition of terms and functions.
    - b. System use and application software.
    - c. Initializations, startup, and shutdown procedures.
    - d. Reports generation.
    - e. Details on forms customization and field parameters.
  - 3. Operator's Manual: The operator's manual shall fully explain all procedures and instructions for the operation of the system including:
    - a. Computers and peripherals.
    - b. Log in/Log out procedures.
    - c. Use of system, command, and applications software.
    - d. Recovery and restart procedures.
    - e. Graphic alarm presentation.
    - f. Use of report generator and generation of reports.
    - g. Data entry.
    - h. Operator commands.

- i. Alarm messages.
  - j. System permissions functions and requirements.
4. Maintenance Manual: The maintenance manual shall include descriptions of maintenance for all equipment including inspection, cleaning, periodic preventive maintenance, fault diagnosis, and repair or replacement of defective components.

## 1.11 WARRANTY

- A. Unless otherwise noted, provide warranty for one (1) year after date of Substantial Completion for all materials and labor.
- B. Onsite Work During Warranty Period: This work shall be included in the Contractor's bid and performed during regular working hours, Monday through Friday.
- 1. Inspections: The Contractor shall perform two minor inspections at six-month intervals (or more often if required by the manufacturer), and two major inspections offset equally between the minor inspections to effect quarterly inspection of alternating magnitude.
  - 2. Minor Inspections: These inspections shall include:
    - a. Visual checks and operational tests of all equipment, field hardware, and electrical and mechanical controls.
    - b. Mechanical adjustments if required on any mechanical or electromechanical devices.
  - 3. Major Inspections: These inspections shall include all work described under paragraph Minor Inspections and the following work:
    - a. Clean all equipment, including exterior surfaces and accessible and serviceable interior surfaces.
    - b. Perform diagnostics on all equipment.
    - c. Check, test, and calibrate (if required) all sensors.
    - d. Run all system software diagnostics and correct all diagnosed problems.
- C. Operation: Upon the completion of any scheduled adjustments or repairs, Contractor shall verify operation of the SMS.
- D. Service: The Owner will initiate service calls when the SMS is not functioning properly. If requested by the Owner, the Contractor shall respond or remain at the site after normal business hours, and the Owner shall reimburse the Contractor for the incremental cost difference between premium labor rates and standard labor rates. This reimbursement applies to premium labor rates that do not exceed time-and-one-half rates after normal business hours and double-time rates for Sundays and holidays. The Owner shall be furnished with telephone number(s) where service personnel can be reached 24/7/365. Qualified service personnel shall be at the site within 24hours after receiving a request for service.
- E. Records, Logs and Work Requests: Contractor shall keep records and logs of each task completed under and outside of warranty. These logs shall be maintained in Microsoft Word or Excel. The log shall include the model and serial number identifying the component involved, its location, date and time the call was received, specific nature of trouble, names of service personnel assigned to the task, description of work performed, the amount and nature of the material used, and the time and date of commencement and completion of the work. Complete logs shall be kept and shall be available for review on site, demonstrating that planned and systematic adjustments and repairs have been accomplished for the SMS. The Contractor shall deliver a record of the work performed within three (3) business days after work is completed. Defective items that have been replaced shall be given to the Owner. Should the replacement item be a temporary replacement until the removed item is repaired, Contractor shall retain possession of the defective item for repair and subsequent re-installation.

- F. System Modifications: Modifications by the Contractor are allowed after system acceptance. Contractor shall make recommendations for system modification in writing to the Owner. No system modifications shall be made without prior, written approval of the Owner. Any modifications made to the system shall be incorporated into the Operations and Maintenance Manuals, and other documentation affected. The Owner shall be provided with electronic restorable versions of all configurations prior to the modifications being made.
- G. Software: At no charge, the Contractor shall provide to Owner all updates released by the manufacturer during the period of the warranty and verify operation of the system upon installation. These updates include system software updates, patches, bug fixes and revisions, as well as firmware updates. These updates shall be accomplished in a timely manner, fully coordinated with SMS administrators and operators, shall include training for the new changes/features, and shall be incorporated into the Operations and Maintenance Manuals and software documentation.
- H. Refer to individual product sections for further warranty requirements of individual system components.

## 1.12 ANNUAL SERVICE CONTRACT

- A. Provide annual cost for extended service and maintenance agreement after the first year for the access control system according to the following terms:
  - 1. The term of the warranty shall begin on the system acceptance date and shall continue for one (1) year. The extended service and maintenance warranty shall begin following this first year if accepted by the Owner. The term shall be automatically renewed for successive one-year periods unless canceled in writing by the Owner with Contractor confirmed receipt, up to the date of expiration. The service and maintenance agreement shall include the following basic services to the Owner, including all necessary parts, labor and service equipment:
    - a. Repair or replace any security equipment item that fails to perform as initially installed, as specified, or as determined per the manufacturer's performance criteria.
    - b. Perform preventive maintenance on the security equipment during the 6<sup>th</sup> month and 12<sup>th</sup> month of the service contract. This preventive maintenance shall include cleaning, realignment, inspection, and testing of security devices. The Owner shall receive a written report of these inspections that identifies the security system's status and, if required, a list of all necessary repairs or replacements.
    - c. Provide maintenance on the SMS system software. At no charge, the Contractor shall provide to Owner all updates released by the manufacturer during the period of the service contract and verify operation of the system upon installation. These updates include system software updates, patches, bug fixes and revisions, as well as firmware updates. These updates shall be accomplished in a timely manner, fully coordinated with SMS administrators and operators, shall include training for the new changes/features, and shall be incorporated into the Operations and Maintenance Manuals and software documentation. Contractor shall not be responsible for maintenance of Owner data.
  - 2. Contractor shall be compensated for any repairs or maintenance provided as a result of Owner abuse, misuse, intentional damage, accidental damage, or power fluctuations exceeding specified equipment tolerances.
  - 3. Service: Owner will initiate service calls when the SMS is not functioning properly. If requested by the Owner, the Contractor shall respond or remain at the site after normal business hours, and the Owner shall reimburse Contractor for incremental cost difference between premium labor rates and standard labor rates. This reimbursement applies to premium labor rates that do not exceed time-and-one-half rates after normal business hours and double-time rates for Sundays and holidays. The Owner shall be furnished with telephone number(s) where service personnel can be reached 24/7/365. Qualified service

personnel shall be at site within 24hours after receiving a request for service.

- B. Provide complete terms and conditions of warranty and service.
- C. The Owner will enter into a contract directly with the vendor. This specification section is not a contract between the Owner and the vendor to perform these services.

## **PART 2 - PRODUCTS**

### **2.1 ELECTRONIC ACCESS CONTROL SYSTEM MANUFACTURERS**

- A. LenelS2 OnGuard
- B. Should the access control manufacturer offer, as an option, the use of hardware by Mercury Security, the Contractor proposed solution shall utilize this hardware. Contractor shall state whether or not the software is compatible with the SCP, AP and EP families of Mercury Security hardware. For future additions or defective hardware replacements, the system shall not be "locked" to require Mercury Security hardware be purchased only from the access control software manufacturer or from the original Installing Contractor.
- C. Approval of Alternate Manufacturers:
  - 1. Contractors seeking approval for alternate manufacturers for any devices or software in this section shall submit requests for approved equals as defined by Division 1 in addition to submitting:
    - a. Bill of materials for each piece of hardware and software proposed.
    - b. Manufacturer's data sheet for each piece of equipment proposed.
    - c. Line-by-line typewritten statement of compliance or non-compliance comparing Part 2 of this section with the published specifications of the proposed alternate products. This compliance statement shall be signed by an officer of the local contractor branch office that proposes to install the alternate product and either an officer of the manufacturer or an officer of the manufacturer's representative.
  - 2. Refer to the project drawings for manufacturer and model numbers for the Basis of Design products.

### **2.2 FIELD CONTROL HARDWARE**

- A. Interior Control Panels:
  - 1. Control boards, power distribution and terminals shall be enclosed in a NEMA 1 rated enclosure that is key lockable. Contractor shall not furnish padlock. All enclosures that are part of this project shall be keyed alike. Contractor shall furnish and install a mechanically fastened tamper switch on the interior of the enclosure.
  - 2. Control boards are allowed to be in an enclosure separate from the power supplies/power distribution. Should they be in separate enclosures, the interface wiring shall be in rigid metallic conduit, RMC, with Myers hubs at both ends of the conduit.
  - 3. Control panels shall be rack mountable in an enclosure specifically for rack mounting. Control boards and power supplies shall be located in the enclosure. The enclosure shall have screw or compression terminals on the rear panel for connection of field devices.
  - 4. Intra-enclosure wiring shall be dressed using tie wraps and/or covered plastic wire way. Hook-up wires for identical purposes shall have the same color insulation. For example, if one input pair utilizes green and white insulated conductors, all similar inputs shall use green and white insulated conductors. The same color scheme shall be followed for all access control panels that are part of this project.
  - 5. Cabling from field devices such as readers, door position switches, request-to-exit



devices and locking devices shall not be directly terminated to the control boards and power supplies. The field devices shall be terminated to terminals located on the left side, right side or both sides of the enclosure back panel. Intra-enclosure wiring shall be routed from the terminals to the control boards and power distribution. Quantity and functional sequence of the terminals shall be identical portal to portal.

6. All devices inside the enclosure, less cabling and batteries, shall be mechanically fastened to a removable solid or perforated metal back panel with either:
  - a. Metal or plastic standoffs
  - b. DIN rail
7. Hook and loop fasteners, double sided tape or adhesives are not allowed to attach devices to the back panel. Mounting devices to the interior of the door shall only be allowed when the following two (2) conditions are met:
  - a. The access control hardware manufacturer offers prefabricated enclosures with devices mounted to the interior of the door.
  - b. Only the same devices that the access control manufacturer mounts to the interior of the door are allowed to be mounted in a different enclosure, and those devices shall be mounted in an identical manner.
8. 120V 20A input power shall be hard wired to a circuit breaker disconnect and to one duplex receptacle on the interior of the enclosure. Should devices in the enclosures require plug-in transformers/power supplies, the receptacle shall be utilized. One (1) power strip with integrated circuit breaker shall be located in the bottom of the enclosure as needed.
9. Power to the locking devices shall be provided by a power distribution board with no fewer than four (4) outputs. Each lock shall be individually protected. The power distribution board shall:
  - a. Provide protection with fuses or positive temperature coefficient (PTC) devices.
  - b. Provide control so that each output is individually selectable as latching or non-latching with fire alarm activation.
  - c. Provide control so that each output shall have Fail Safe and Fail Secure terminals.
  - d. Provide a fire alarm input with associated trigger LED.
  - e. Provide an individual LED per output to indicate when an input has been triggered and the associated output has been activated.
  - f. Accept a dry, closed contact input to activate the individual lock outputs.
  - g. Provide a dry, Form C relay that energizes on activation of the fire alarm input. This output may then be used as a fire alarm input to other power distribution boards in the same or a different enclosure, or may provide input to another device such as a multi-pole relay.
10. A minimum of four (4) 12V 7 AH rechargeable, sealed, lead acid batteries shall be located in the bottom of the enclosure. Two of the batteries shall be connected in series for 24V devices, and two batteries shall be connected in parallel for 12V devices. Contractor shall provide additional batteries as needed to power all devices for a minimum of <Insert> hours. Connections to the batteries shall be made with appropriate terminals crimped on the connecting conductors. Batteries shall be clearly labeled in a permanent manner with the date of installation.
11. Power to control boards, readers and auxiliary devices such as request-to-exit motion detectors shall be provided by a power distribution board with no fewer than four (4) outputs. All devices powered by the same voltage at an individual portal shall be protected by the same fuse or PTC unless current requirements dictate otherwise. Individual fuses or PTCs may protect more than one control board.
12. All access control panels, when populated with control boards and power supplies, shall have the following capacities:

- a. Control of a minimum of two (2) portals.
  - b. Spare capacity of a minimum of one (1) access control portal, two (2) auxiliary inputs and two (2) auxiliary outputs greater than the requirements of the project at the time of system specification.
  - c. Five (5) spare fuses of each type used, to be in their original packaging, to be located in each power supply enclosure.
  - d. 50% spare current capacity on all power supplies located in unconditioned spaces and 40% spare capacity for those in conditioned spaces. Lower spare capacities are allowable based on prior approval of Contractor-provided power calculations.
13. Locations where enclosures may be mounted are shown on the plans. Final location, with approval of Owner's representative, shall be selected by Contractor based on distribution of controlled portals and devices.
  14. At time of Substantial Completion, Contractor shall furnish a schematic diagram of intra-enclosure wiring and a complete bill of materials for the enclosures and the devices located within. This documentation shall include a schedule of fuses and the device(s) that each fuse protects. This documentation shall be placed by Contractor in a Contractor-furnished print pocket located on the inside of the enclosure door.

B. Exterior Control Panels:

1. Control panels, power distribution and terminals shall be located in a NEMA 4X stainless steel enclosure that is pad-lockable. Contractor shall not furnish padlock. Enclosures shall have a tamper switch mechanically attached to the interior of the enclosure.
2. Control boards and power supplies shall be in the same enclosure.
3. Intra-enclosure wiring shall be dressed using tie wraps and/or covered plastic wire way. Hook-up wires for identical purposes shall have the same color insulation. For example, if one input pair utilizes green and white insulated conductors, all similar inputs shall use green and white insulated conductors. The same color scheme shall be followed for all access control panels which are part of this project.
4. All devices inside of the enclosure shall be mechanically attached to a removable solid or perforated metal back panel. Hook and loop fasteners, double sided tape or adhesives are not allowed in order to attach devices to the back panel. Mounting devices to the interior of the door is not allowed.
5. 120V 20A input power shall be hardwired to a circuit breaker disconnect and to one (1) duplex receptacle located within the enclosure. Should devices require plug-in transformers/power supplies, the receptacle shall be utilized. One (1) power strip with integrated circuit breaker shall be located in the bottom of the enclosure as needed.
6. Power to devices and gate activation relays shall be provided by a power supply and power distribution board with no fewer than four (4) outputs. The power distribution board shall provide protection with fuses or positive temperature coefficient (PTC) devices.
7. Activation of gate operator inputs shall be via an ice cube, plug-in, DPDT, DIN rail-mounted relay, located on the inside of the access control enclosure. The relay shall have a manual check button and an indicator LED.
8. Devices inside of enclosure shall be rated for the temperatures to which they will be exposed. Contractor shall furnish and install a heater and ventilation rated for use in the enclosure to meet the temperature ratings of the devices in the enclosure.
9. All access control panels, when populated with power supplies and control boards, shall have the following capacities:
  - a. Control of a minimum of two (2) access control portals.
  - b. Spare capacity of a minimum of one (1) access control portal, one (1) auxiliary input and one (1) auxiliary output greater than the requirements of the project at time of system acceptance.
  - c. Five (5) spare fuses of each type used, to be in their original packaging, to be located in the enclosure.
  - d. 50% spare current capacity on all power supplies located in unconditioned spaces and 40% spare capacity for those in conditioned spaces. Lower spare capacities

are allowable based on prior approval of Contractor provided power calculations.

10. All strands of fiber that are routed to the enclosure shall be terminated with landed patch panel style connectors. Refer to Section 27 15 00 for fiber connector type.
11. All cables that enter the enclosure shall be in rigid metal conduit, RMC, or liquid tight flexible conduit, with Myers hubs at both ends of the conduit. Conduits shall enter the enclosure only from the bottom.
12. At time of Substantial Completion, Contractor shall furnish a schematic diagram of intra-enclosure wiring and a complete bill of materials for the enclosure and the devices located within. This documentation shall be placed by Contractor in a Contractor-furnished print pocket located on the inside of the enclosure door.

C. Intelligent System Controllers (ISC):

1. The controller shall communicate with the host via an on board 10/100/1000 Base T Ethernet port.
2. The controllers shall be a distributed architecture with full peer-to-peer networking capability. Parent/Child controller configurations are not acceptable. All controllers in the system shall be capable of operating in a standalone mode if communication is lost with the server or main controller. In no case shall a controller depend on communication with an upstream controller for proper standalone operation.
3. The communications bus shall be supervised for wiring integrity. If a communication failure is detected, the system shall report the loss. All controllers unable to receive communication shall operate as standalone devices including grant/deny decisions, complete with event buffers. All events shall be uploaded to the server upon restoration of communications.
4. Controllers shall be AES 128-bit symmetrical block encryption devices conforming to FIPS-197.
5. Controllers shall support a minimum of SHA-2 authentication security.
6. The controllers shall utilize flash memory or similar technology, allowing program updates to be downloaded from the server. Program storage shall be in ROM.
7. The controllers shall have the capacity for [ 15,000]<Insert> cardholders and [ 45,000]<Insert> transactions. All access decisions involving these cardholders shall be made at the lowest controller level without communication to the server.
8. Handle all non-host related access control monitoring and decision making.
9. LED indicators for power, fault and communications.
10. Provide for local and global input/output linking:
  - a. The SMS shall support a global linkage feature whereby any input/output/event shall be linked to any other input/output/event in the SMS. Input/output linkages shall be able to span across intelligent system controllers.
  - b. System administrators shall be able to create global input/output function lists, each consisting of a sequence of actions to be performed, such as changing card reader modes, activating outputs, and opening or closing anti-pass back areas. Each function list may include up to six actions.
11. Reporting of transactions and status information to the server.
12. Interface with standard reader technologies without special interface hardware, additional logic panels or other integrators. Supported technologies shall include:
  - a. 13.56 MHz Contactless Smart with or without biometrics or keypad
  - b. 13.56 MHz Multi-technology Smart
  - c. Proximity, with or without keypad
  - d. Magnetic stripe, with or without keypad
  - e. Wiegand
  - f. Bar code
  - g. Keypad
  - h. Biometric, with Wiegand output

D. Reader Interface Module (RIM):

1. Reader interface modules are not shown on the plans. Refer to the installation section of this specification for allowable equipment mounting locations. It is the responsibility of the Contractor to determine the number and configuration of reader interface modules required based on the inherent characteristics of each product line and the requirements and restrictions described in this document.
2. RIM shall interface with and accept data from TTL, Wiegand and RS-485 type readers and door hardware.
3. RIM shall provide a minimum of three (3) inputs per portal for portal position, request to exit and auxiliary input.
4. RIM shall provide a minimum of two (2) outputs per portal for locking device and auxiliary output. Each output shall be Form C and shall be rated at 3A at 28VDC.
5. RIM shall communicate to controller by RS-485.

E. Input Control Module (ICM):

1. The input control module shall provide supervised and non-supervised alarm input zones and monitor/report line fault conditions, alarm conditions, power faults and tampers.
2. Input control modules are not shown on the plans. Refer to the installation section of this specification for allowable equipment mounting locations. It is the responsibility of the Contractor to determine the number and configuration of input control modules required, based on the inherent characteristics of each product line and the requirements and restrictions described in this document.
3. UL 294 and 1076 listed.
4. Each input configurable for normally open or normally closed.
5. Each input configurable for timing.
6. Each input configurable for end of line resistance.
7. Status LEDs for communication to the host, heartbeat and input status.
8. Communications line supervision.
9. AES 128 bit encryption.
10. 2-wire RS485 communications.
11. No fewer than eight (8) inputs per board/control module.
12. Alarm Masking: The ability to mask the alarm input on a time zone basis.
13. Activate Output: The ability for any input to activate any output.
14. Configuration of Debounce Time: The ability to control the amount of time that an input state change must remain consistent in order for it to be considered a real change of state.
15. Elevator control support for number of floors shown on the drawings.
16. Global Linkage: The ability to link outputs with inputs that are attached to any ICM/output control module (OCM).
17. Checkpoint: The ability to configure an input as a designated stop on one or more guard tours.
18. Entry/Exit Delay: The ability to set up entry/exit delays for inputs that are attached to any ICM. This shall include:
  - a. Non-Latched Entry: When an input activates, the alarm will not be reported until the entry delay expires. If the input is still active when the entry delay expires, the alarm will be reported. If the input is not active when the entry delay expires, then the alarm will not report.
  - b. Latched Entry: When an input activates, the alarm will not be reported until the entry delay expires. If the input is still active when the entry delay expires and the alarm has not been masked, the alarm will be reported. If the input has been masked when the entry delay expires, then the alarm will not report.
  - c. Exit Delay: When an input activates, the alarm will not be reported (operates as if masked) until the exit delay expires. If the input is still active when the exit delay expires, the alarm will be reported. If the input is not active when the exit delay expires, the alarm will not be reported.

F. Output Control Module (OCM) and Functionality:

1. Output control modules are not shown on the plans. Refer to the installation section of this specification for allowable equipment mounting locations. It is the responsibility of the Contractor to determine the number and configuration of output control modules required, based on the inherent characteristics of each product line and the requirements and restrictions described in this document.
2. The output control module(s) shall provide Form C relay contacts for load switching, rated at 3A at 28VDC.
3. Each relay shall support "On" "Off" and "Pulse."
4. Outputs can be pulsed from 0.1 seconds to 24 hours.
5. Status LEDs for communication to the host, heartbeat and relay status.
6. 2-wire RS485 communications.
7. No fewer than eight (8) outputs per board/control module.
8. Communications line supervision.

## 2.3 APPLICATION SOFTWARE

A. General Performance:

1. The application software, in conjunction with the associated hardware, shall have the following features, functionality and capabilities. The functions that are to be implemented shall be determined in the planning conference between Contractor and Owner referenced in Part 3 of this section.
2. All Users:
  - a. All users shall be capable of being authenticated against Active Directory using LDAP before being granted system access. Should the Owner not use Active Directory, the system shall provide a built-in login and credential management tool to permit rules-based access rights on a per-user basis.
  - b. The access rights shall be selectable on a per-user basis. In addition, user groups shall be capable of being assigned whereby each user group has a common set of access rights. Users shall be capable of being assigned to these user groups by the system administrator.
3. Operators:
  - a. Operator Groups: A minimum of 32 operator groups, allowing specific system module privileges to be accessed with each module being granted specific views, edit and execute privileges.
  - b. Operator Levels: System access shall require a valid operator name and password, governing a specific operator's level of access to each menu item.
  - c. The SMS shall allow a system operator to login over another system operator who is already logged into the same client workstation without the need to reboot the system. This process shall log the first system operator off alarm monitoring and log the new system operator on, changing any permission necessary for that system operator.
4. Logs, Status, Maintenance, Diagnostics:
  - a. Historical Log: The system shall allow event history to be written to the hard disk in an archive format. At a minimum, the system shall support 500,000 transactions. Warning messages shall be generated at a user defined level of capacity. The system shall have the ability to offload the archive files to removable media automatically or manually.
  - b. System Status: The system shall query the status of any or all of the system's access control points, inputs and outputs.
  - c. System Maintenance/Diagnostics: The system shall provide for remote diagnostic

capabilities. In addition, online diagnostics and communications maintenance shall be able to be activated from the operator interface.

5. Administrator:

- a. The SMS shall provide system administrators with the ability to segment their access control SMS field hardware devices into various zones or areas where alarm monitoring client workstations will monitor. These zones shall be assigned an alphanumeric name using up to a minimum of 64 characters.
- b. The SMS shall allow other devices such as card readers, input and output modules and intelligent system controllers to be automatically part of the monitoring zone when an intelligent system controller is selected, and it shall allow the system administrator to define which devices such as card readers, etc. belong to that monitor zone.
- c. Updating of monitor zones shall take place in real time and without requiring operators to re-login.

6. General:

- a. Elevator control support for the number of floors and cabs shown on the drawings.
- b. The SMS shall use an open architecture where all data must reside on a single database and must be accessible in real time to every SMS workstation or web-based client connected to the network. The system database shall be used to create and maintain the cardholder database. A screen designer module shall allow the creation and editing of custom database tables and data entry screens.
- c. The SMS shall be able to connect to and interface bi-directionally with external data sources using all of the following methods:
  - 1) ASCII with support for XML-formatted text exchange of data activated both manually and automatically.
  - 2) ASCII with support for XML-formatted text exchange of data using a direct table interface activated both manually and automatically.
  - 3) Real time exchange of data via Active Directory/LDAP utilizing an API supported by the SMS manufacturer. The live exchange of data shall permit exposure of SMS events and transactions to other data sources in real time and allow for receipt of data into the SMS, permitting this data to be acted upon and trigger linked events in the SMS in real time.
- d. Security: Access privileges within the application software shall be permitted by use of a password protection system. The cardholder database shall have the following password security levels.
  - 1) A minimum of six (6) unique operator access levels
  - 2) Ability to view only the database fields
  - 3) Ability to restrict operator viewing to any of the individual database screens within a record
  - 4) Ability to restrict operator viewing to any of the database partitions
- e. Cardholder Configurations: Each cardholder shall be capable of having up to five (5) access levels actively assigned to their account.
- f. The system shall have cardholder identifications for "Visitor" and "Escort", with an associated optional validity period assignable with an activation and deactivation date.
- g. The cardholder database screen shall have the following data associated with each cardholder:
  - 1) Last edit by operator with edited date and time
  - 2) Last date/time card was used

- 3) Last reader giving valid access
  - 4) Last reader denying access
  - 5) Anti-pass back status
- h. The system shall provide advanced query capability with the following search criteria: equal to, not equal to, greater than, greater than or equal to, less than, less than or equal to, like, is empty, is not empty, is between, and, or, not.
  - i. Access Control Configuration: The configuration application shall be password protected, restricting what each individual may edit or display inside the configuration application.
  - j. Text descriptions of access points such as doors.
7. Time Zones:
- a. The SMS shall be capable of creating and storing up to 255 time zones. Each time zone shall have a minimum of six (6) intervals. Each interval shall be assignable to any day of the week.
  - b. Each time zone shall be assignable to an alphanumeric name. Time zones shall be applied to access levels, card reader modes, alarm inputs, alarm outputs, and alarm masking and logging functions. Time zones shall be allowed to belong to any or all access levels so that the time zone only has to be defined once.
8. Access Levels:
- a. The SMS shall be capable of defining a minimum of multiple access levels per cardholder.
9. Temporary Access Levels:
- a. The SMS shall be capable of assigning temporary access levels inclusive of the assignable access levels.
10. Access Groups:
- a. The SMS shall be capable of assigning access groups.
  - b. Each access group shall be assignable to an alphanumeric name.
11. Precision Access Levels:
- a. The SMS shall be capable of assigning precision access levels in addition to the access levels, with the ability to assign unlimited card reader and time zone combinations. Precision access levels provide capability of assigning a unique access level on a per card basis.
  - b. Each precision access level shall be assignable to an alphanumeric name.
12. Holidays:
- a. The SMS shall provide holiday assignments using an embedded calendar. Access rights, card reader modes, and alarm masking schedules must be able to be altered when the current date is designated as a holiday.
  - b. Dates for Daylight Saving Time changes shall be definable and shall take effect automatically.
  - c. The SMS shall support holiday ranges that allow a single holiday to span across multiple calendar days.
13. Database Segmentation:
- a. The SMS shall be required to support data segmentation whereby each segment

shall have its own set of cardholders, field hardware, and system parameters (time zones, access levels, etc.).

- b. This project will require that the database be segmented into Owner defined quantity segments by the Contractor.

14. Field Hardware Communications:

- a. The SMS shall support communications with the intelligent system controllers (ISCs) by the following protocols:

- 1) RS-232
- 2) RS-485
- 3) TCP/IP
- 4) Open Supervised Device Protocol (OSDP)

- b. Upon loss of communications between the SMS server and the ISC, an alarm shall be created with a time stamp. Upon re-established communication, the SMS and the ISC shall automatically re-synchronize from the point of communication loss without operator intervention.

15. Dual Path Field Hardware Communication:

- a. The SMS shall support dual path communications between the SMS server and the ISCs. This shall allow for a redundant communication path in the event the primary path fails. The secondary path shall support all primary path protocols.
- b. In the event of a communication failure of the primary path, the ISC shall initiate a switchover to the secondary path. During this fail switchover period, the ISC shall periodically check to see if the primary path has been re-established and will automatically switch back upon a successful connection. Alarms shall be generated upon loss or restoration of communications.

16. Area Control:

- a. Area control shall be a security method of preventing a person from passing their credential to another person for dual entry into a single location using one card. The SMS shall support the following area control features.
- b. Global Hard Anti-Pass Back:
  - 1) The Global Hard Anti-Pass Back feature shall require that a credential always be used to enter and exit an area. The controlled areas shall have both entry and exit card readers at all portals. Entry and exit readers shall be able to span across multiple ISCs. Areas shall be logically defined under the SMS, and area control shall not be required at all areas. Global Hard Anti-Pass Back shall work in the following manner:
    - a) A cardholder must present his/her credential at the entry card reader of the area that the person wishes to enter. Once access has been granted into the area, the cardholder cannot present the credential to another entry card reader within the same area without first presenting his/her credential to the respective exit card reader of that area. Should a cardholder attempt to use any other card reader in the same area besides the occupied area's exit card reader once access has been granted to that area, the cardholder shall be denied access and an alarm shall be reported to the alarm monitoring client workstation. Nested control areas (areas inside areas) shall be definable with a minimum of 64 entry and exit card readers. It shall be possible to have an area within an area and/or multiple areas that are



independent of each other in which Global Hard Anti-Pass Back rules shall apply.

c. Global Soft Anti-Pass Back:

- 1) The Global Soft Anti-Pass Back feature shall require that a credential be used to enter and exit an area. The controlled areas shall have both entry and exit card readers at all portals. Entry and exit readers shall be able to span across multiple ISCs. Areas shall be logically defined under the SMS, and area control shall not be required at all areas. Global Soft Anti-Pass Back shall work in the following manner:
  - a) A cardholder must present his/her credential at the entry card reader of the area that the person wishes to enter. Once access has been granted into the area, the cardholder cannot present the credential to another entry card reader within the same area without first presenting his/her credential to the respective exit card reader of that area. Should a cardholder attempt to use any other card reader in the same area besides the occupied area's exit card reader once access has been granted to that area, the cardholder shall be allowed access (if that cardholder has the appropriate access level to access the new area), and an alarm shall be reported to the alarm monitoring client workstation. It shall be possible to have an area within an area and/or multiple areas that are independent of each other.

d. The following summary criteria shall apply under Global Hard or Soft Anti-Pass Back:

- 1) Initially all card holders are reset to Area 0.
- 2) Any cardholder shall enter a controlled area any time after Time 0 by presenting a credential to a SMS entry card reader.
- 3) A cardholder shall not exit the controlled area unless he/she has entered the area presenting a credential to the SMS entry card reader.
- 4) A cardholder shall not enter the controlled area a second time unless the cardholder has exited that area previously.
- 5) A cardholder shall be able to enter through any entry card reader and exit through any exit card reader of a single controlled area.
- 6) These options shall include a "forgiveness" feature that will allow the system administrator to reactively reset the anti-pass back of all cardholders to Area 0, either through a manual override or a time zone command.
- 7) The SMS shall provide an anti-pass back exempt option for privileged or VIP cardholders. Cardholders with this option will not have anti-pass back rules applied to them.
- 8) The SMS shall also have a "forgiveness" feature that will allow the system administrator to proactively assign an automatic reset to an individual cardholder. This shall allow the system administrator to reset the anti-pass back of an individual cardholder to Area 0 automatically for a defined number of times.

e. Timed Anti-Pass Back:

- 1) Timed Anti-Pass Back shall allow the system administrator to decide how long after a cardholder has presented their credential that they will have to wait before the same credential will be accepted again at the same card reader. This helps prevent multiple swipes by an individual to allow access to others through turnstile doors.

f. Two-Person Control:

- 1) Two-Person Rule shall be provided to restrict access to certain areas unless there are two (2) cardholders present. This restricts individuals from being alone in restricted or highly secure areas. When an area is configured for Two-Person Rule, the following criteria shall prevail:
  - a) The card reader shall grant access only if two valid cardholders (with authorized access levels) swipe their credentials one after the other. In the event a second authorized card is not presented within 10 seconds of the first authorized credential, the card reader shall reset and the first card will have to be swiped again.
  - b) Once two people occupy an area, individual access shall be granted.
  - c) Individual exit shall be permitted until an area is occupied by only two cardholders, at which point the Two-Person Rule applies for exit.

g. Occupancy Limit:

- 1) Occupancy Limit shall restrict the number of cardholders that shall be present in an area at any given time. The Occupancy Limit area shall be able to be defined by the system administrator up to the limits of the cardholder capacity of the system. Once the occupancy limit has been reached, a cardholder must swipe out of the exit card reader before the next cardholder may enter. Each area for which Occupancy Limit is enabled shall be definable with up to 64 entry/exit card readers. Multiple Occupancy Limit areas shall be definable.

h. Mustering:

- 1) The SMS shall support Mustering functionality. The Mustering function shall provide an automatic capability for registering cardholders that are on site during an incident. Designated exit and entry card readers shall be used to enter and leave hazardous locations and safe locations. When an incident occurs, a muster report shall be generated that consists of a listing of all personnel that are within the hazardous locations, as well as all personnel that have registered in a safe location.

i. Alarm Masking Groups:

- 1) The SMS shall support a group alarm masking feature whereby system administrators shall be able to create groups of alarm inputs that enable them to mask or unmask multiple input control module inputs and card reader inputs simultaneously.
- 2) The following events shall have the ability to be part of an alarm masking group:
  - a) Input Control Module Events
  - b) Alarm Input Active
  - c) Card Reader Events
  - d) Auxiliary Input Active
  - e) Denied Count Exceeded
  - f) Door Contact Tamper
  - g) Door Forced Open
  - h) Door Held Open
  - i) Card Reader Input Tamper
- 3) Alarm Masking Groups shall be able to be masked as a group or as individual points.
- 4) Alarm Masking Groups must support the ability to be masked multiple times. Alarm Masking Groups shall be able to be masked and/or unmasked via

alarm monitoring commands by guards, via card reader keypad function keys, or via global linkage commands.

- 5) The SMS shall support "2-man control" for masking Alarm Masking Groups.
- 6) The SMS shall support an Alarm Masking Group status change (masked to unmasked or unmasked to masked) action to be linked to a function list that is capable of performing many system actions, such as activating a relay output. The SMS shall support a minimum of 64 Alarm Masking Groups per intelligent system controller. with a minimum of 200 alarm inputs per Alarm Masking Group.

j. Cardholder Escort Control:

- 1) The SMS shall support comprehensive escort functionality based upon access levels. Access levels shall include options for "Escort Required", "Designated Escort", "Not an Escort" and "Does not require an Escort." Contractor shall integrate escort level and designation into badge design in cooperation with Owner.
- 2) The escort feature shall be capable of one-to-one and one-to-many Escort to Escorted functionality.

k. Cardholder Use Limits:

- 1) The SMS shall support a Cardholder Use Limit feature that shall allow system administrators to specify the maximum number of times that a cardholder may use their credential at card readers in the SMS.

l. Extended Individual Strike Times:

- 1) The SMS shall support Extended Individual Strike Times that allows a card reader's strike to be active for an extended period of time beyond the pre-determined standard strike time on a per cardholder basis. The extended strike time shall be user definable up to 255 seconds. Extended strike times shall be set on a card reader by card reader basis.

m. Extended Individual Door Held Open Times:

- 1) The SMS shall support Extended Individual Door Held Open Times that allow a card reader's door to be held open for an extended period of time beyond the pre-determined standard held open time on a per cardholder basis. The extended held open time shall be user definable up to eight (8) hours. Extended held open times shall be set on a card reader by card reader basis.

n. Extended, On Demand, Door Held Open Times:

- 1) The SMS shall support Extended, On Demand, Door Held Times via a command keypad located in the field. The Extended Held Open command configuration shall consist of a command key sequence that shall be from three to six keys used to enter the number of minutes to extend the door held open time (up to 999 minutes) and a pre-alarm time (from 0 to 30 minutes).
- 2) Only those cardholders having command authority at a given card reader configured for 'Allow User Commands' shall have the ability to execute the Extended Held Open command at that card reader. The Extended Held Open command shall be available after a valid cardholder has received an access grant at the card reader. The cardholder shall have a period of 15 seconds after the access grant to enter the extended held open command sequence.

- o. Graphical System Overview Tree:
  - 1) A Graphical System Overview Tree shall display a graphical representation of all field hardware including hardware from other systems which are interfaced. System administrators shall be able to modify a device that is depicted on the Graphical System Overview Tree or see its properties by double clicking on the icon, and the SMS shall bring them to the appropriate form.
  
- p. Pre-Alarm:
  - 1) The SMS shall support a Pre-Alarm feature at the card reader. The pre-alarm will sound a tone at the card reader prior to the door held open alarm. The pre-alarm setting shall be configurable for up the maximum allowable door hold open time.
  
- q. Alarm/Event Logging:
  - 1) All alarms and events in the SMS shall, by default, always be recorded in the database. The SMS shall give system administrators the ability to select, on a time-zone basis, the times that they require the SMS to log specific events to the database.
  - 2) System administrators shall have the option for particular alarm/events to be set to log or not to log on any individual reader and/or input.
  
- r. Scheduling Utility:
  - 1) The SMS shall provide an integral Scheduling Utility. The Scheduling Utility shall allow system administrators to schedule actions to occur on a one-time or a recurring basis. Recurring schedules shall be configured to begin immediately, last indefinitely, or have optional start and end dates.
  - 2) The Scheduling Utility shall be available from both the system administration and alarm monitoring modules.
    - a) The types of actions that shall be schedulable include, but are not limited to:
    - b) Action Group
    - c) Event Archiving/Purging
    - d) Arm/Disarm Area
    - e) Start of Guard Tour
    - f) Execution of Scripts
    - g) Activate, Deactivate, Pulse Device Output and Device Output Groups
    - h) Global Anti-Pass back Reset
    - i) Download Firmware to equipment.
    - j) Download Database to ISCs
    - k) Execute Function List
    - l) Mask/Unmask Inputs, Input Groups, Alarm Mask Groups, Door Forced Open or Held Open
    - m) Open Door, Open Door Group
    - n) Change Reader Mode
    - o) Automatic Reports
    - p) Reset Use Limit
    - q) Move Bulk Credentials from an Area
    - r) Deactivate Credentials
    - s) Logout Visitors
    - t) Schedule PTZ Presets
  - 3) The Scheduling Utility shall maintain a history log in the database for actions

that it executes.

17. Multiple Card Formats:
  - a. Each ISC shall support a minimum of eight (8) access control card formats and, if applicable, eight (8) asset formats.
18. Card Reader Cipher Mode:
  - a. The SMS shall support a Card Reader Cipher Mode that shall allow authorized cardholders to enter their credential ID by typing it into a card reader keypad, thus emulating the presentation of the credential to the card reader.
19. Denied Access Attempts Counter:
  - a. The SMS shall support a Denied Access Attempts Count on a per card reader basis. The "Denied Attempts Count" value shall be configurable from 0 to 255. The following access denial types shall cause the current denied count to be incremented:
    - 1) Unknown PIN entry at a card reader configured as 'PIN or Card' mode.
    - 2) Invalid cipher entry at a card reader in Cipher Mode.
    - 3) Invalid PIN entered for a given card at a card reader configured as 'Card and PIN' mode.
    - 4) Non-matching biometric presented for a given card at a card reader in Biometric Verify mode.
20. Card Reader Time Zone Overrides:
  - a. The SMS shall allow for the pre-defined default card reader settings to be overridden or temporarily changed on a time-zone basis. At the beginning of the selected time zone, the selected card reader's operational mode shall be modified from its default mode to any one of the following modes: Locked, Unlocked, Facility Code, Card Only, Card or PIN, Card and PIN, Card and Biometric, Card or PIN and Biometric, and/or Card and PIN and Biometric. The aforementioned options shall be available depending on the type of card reader used.
  - b. Each card reader shall have the ability to have multiple time zone setting overrides assigned to them as required by the system administrator.
21. Alarm/Event Routing:
  - a. The SMS shall be capable of allowing system administrators to route alarms and events to various alarm monitoring client workstations on the network. The SMS shall allow any alarm or event to be routed to one or multiple client workstations on the network regardless of where the alarm is generated in the field. Alarms shall be routed to client workstations on a device-by-device level.
  - b. The SMS shall be capable of automatic re-routing of an alarm from workstation X to workstation Y if the alarm is not responded to within a user definable time period.
  - c. The SMS shall implement network synchronization such that in the event that an alarm is routed to multiple client workstations, once the first client workstation acknowledges the alarm, the alarm shall be cleared from all other client workstations. As such, alarms that are routed to an Alarm Monitoring client workstation that does not have a System Operator logged in shall be queued so that all unacknowledged alarms will report to that client workstation once a System Operator has logged into the SMS. Alarms/Events shall be routed based on default settings or time zone control.
22. Alarm Attributes:

- a. The system administrator shall have the ability to configure how the SMS handles the annunciation of alarms on an individual basis. Each alarm and/or event shall have the option(s) to:
  - 1) Display at one or more alarm monitoring client workstation.
  - 2) Allow higher priority alarms to be displayed on the alarm monitoring client workstation ahead of lower priority alarms.
  - 3) Require the field device that generated the alarm to be restored to its normal state before the alarm is cleared.
  - 4) Print the alarm to the local event printer.
  - 5) Have a customized voice message annunciate at the client workstation.
  - 6) Have the alarm breakthrough to the alarm monitoring window should the system operator be working in another application
  - 7) Allow system operators to change the journal entry once the alarm has been acknowledged.
  - 8) Ensure that the alarm will not be able to be deleted from the alarm monitoring window upon acknowledgment.
  - 9) Display text and audio instructions outlining the procedures to follow when responding to the alarm.
  - 10) Automatically call-up associated maps.
  - 11) Automatically call up the associated cardholder record.
  - 12) Automatically call up the associated cardholder photo using the video verification function.
  - 13) Require a password to view the alarm.
  - 14) Require a password to acknowledge the alarm.
  - 15) Require acknowledgment to clear.
  - 16) Allow mandatory journal entry upon acknowledgment.
  - 17) Use pre-defined journal entries for alarms.
  - 18) Select the option for journal entry based upon the specific alarm.
  - 19) Send surveillance interface commands to the surveillance system.
  - 20) Automatically send an e-mail message.
  - 21) Automatically send an alphanumeric page.
  - 22) Have the alarm appear on the alarm monitoring window with a flashing colored coded bar across the alarm for high priority alarms.
  - 23) Have the alarm, when acknowledged, display an alternative flashing color coded bar across the alarm than for the original alarm color.
  - 24) Trigger a function list(s) when the alarm is acknowledged.
  - 25) Require user logon for acknowledgment.
  - 26) Have the ability to mark an alarm as "In Progress" where the system shall silence any repeating audio notifications on the workstation where the alarm was routed, and remove the alarm sprite notification on the graphical map. Additional operators' monitoring alarms shall be notified that the alarm has been marked "In Progress".

23. Alarm-Event Mappings:

- a. The SMS attributes in Alarm Attributes shall be assignable on a 'global' basis to all devices that share an alarm description. Thus, the 'Door Forced Open' alarm attributes shall apply to any door with a card reader that is forced open in the SMS. The SMS shall have the capability to assign a unique group of alarm attributes to specific device/alarm combinations to override the global settings for specific case settings. Each device/alarm combination shall have the ability to have its own unique attribute set if the system administrator desires.

24. System Downloads:

- a. The SMS shall provide for the downloading of data to the ISCs. Downloads shall load SMS information such as time zones, access levels, alarm configurations,

- cardholder information and card reader configurations.
  - b. All ISCs on the SMS shall be capable of either full or selective downloads to individual intelligent system controllers, and bi-directionally so that alarms will still report to their respective alarm monitoring client workstations as cardholder information is being downloaded.
  - c. Information on cardholder status, credential status, time zones or access levels shall download in real time as they are added, modified, or deleted from the SMS.
  
- 25. Portal Configuration Options:
  - a. The SMS shall include the following options for each portal on the system:
    - 1) Allow user commands such as manual door unlock
    - 2) Rename auxiliary inputs
    - 3) Rename auxiliary outputs
    - 4) Independently supervise REX and DPS
    - 5) Configure REX and DPS as Normally Open or Normally Closed
    - 6) Deny if duress
    - 7) Assume door used
    - 8) Alarm masking
    - 9) Activate outputs
    - 10) Two card control
    - 11) Checkpoint
    - 12) Do not activate strike on REX
    - 13) The ability to allow system administrators to determine on a time-zone basis to log or not to log on a card reader by card reader basis
    - 14) Access grants
    - 15) Access denied
    - 16) Card reader status alarms
    - 17) The SMS shall allow for user definable door strike functionality for each card reader in the SMS
    - 18) The SMS shall allow for each card reader to be selected as either an 'In' reader, 'Out' reader, or 'None' to allow for ease of reporting time and attendance basic 'Time In' and 'Time Out' data.
    - 19) Enforce Use Limit: This option shall enable card use limits at the card reader. limiting the number of times that cardholders may use their credential to gain access at the card reader
    - 20) Supervise Door: Sets the SMS so that the card reader door contact is wired as a supervised input
  
- 26. The SMS shall allow for one or more access points in a specified area to be armed and disarmed directly from a control keypad.
- 27. Real-Time, Live Video User Verification:
  - a. The SMS shall have the capability of interfacing to a surveillance system and displaying a live video image next to a stored cardholder image record. This feature shall be system configurable.
  
- 28. Traces:
  - a. The SMS shall allow for a live or historical trace on any ISC, ICM, alarm input, credential (cardholder), intrusion detection device, monitor zone, or card reader. If applicable, the SMS shall allow for a trace on any asset, intercom, or camera. Multiple traces may be run simultaneously. The SMS shall allow system operators to filter alarm types from the history trace window. Alarms that shall be filtered from the trace window are access granted alarms, access denied alarms, system alarms, duress alarms, and area control alarms.
  - b. Destination Assurance: The system shall provide the ability to alert the system

operator when a cardholder does not reach a required location and present their credential after entering at a designated checkpoint in a designated period of time.

29. Real-Time, Dynamic Graphical Maps:

- a. The SMS shall support graphical maps that display device and group status, function lists[ **and video cameras**] dynamically in real time. The maps may be configured to appear on command or when specified alarms are selected for acknowledgment. Map device icons shall have the ability to dynamically change shape and/or color to reflect the current state of the device.
- b. The SMS shall support all map formats listed below:
  - 1) Adobe Photoshop (.psd)
  - 2) AutoCAD DXF (.dxf)
  - 3) Encapsulated Post Script (.eps)
  - 4) JPEG (.jpg)
  - 5) TIFF (.tif)
  - 6) Windows Metafile (.wmf, .emf)
  - 7) Windows Bitmap (.bmp, .dib)
- c. The SMS shall support map hierarchies or maps within maps. There shall be no limit to the number of maps that shall be nested hierarchically with each other. Multiple maps may be displayed simultaneously.
- d. The SMS shall support user defined icons for field hardware devices. The SMS shall also give system operators the ability to affect the mode of card readers, open doors, start a trace on a device, mask/unmask alarm inputs, and activate/deactivate/pulse an output from the map icons.
- e. The graphical maps shall have the ability to be printed to a local printer.

## 2.4 ACCESS CONTROL GRAPHICAL USER INTERFACE (GUI)

- A. A workstation based custom GUI shall be provided for complete display of real time system activity.
- B. The GUI shall provide the following features:
  1. Display in real-time, the status of devices by dynamically changing shape or color to indicate status.
  2. Acknowledge alarm conditions.
  3. Perform manual operations on all monitor and control points.
  4. Perform graphic editing functions.
  5. Customization of icons color or shape based on status.
- C. Graphical representations shall be made of the following activity:
  1. Cardholder Activity: Access granted (including duress), access denied, lost card used, stolen card used, inactive card used, unescorted visitor.
  2. Input Point Activity: Input condition (normal, abnormal, cut, short, shunt, unshunt).
  3. Output Point Activity: On status (automatic, by operator, by link), off status (automatic, by operator, by link), access level on, access level off.
  4. Door Activity: Auto unlock, auto lock, closed, opened, forced open, left open, door switch cut, door switch shorted, REX status (cut, shorted, normal, abnormal), input unlock, operator lock, operator unlock.
  5. Controller Activity: Controller on-line, controller off-line, controller communications normal, communications cut.
  6. System Activity: System error, workstation start, workstation stop, printer off-line, printer unavailable, printer overflow, unknown card.
  7. Regional Group Activity: Occupancy restriction (high limit, low limit), anti-pass back



(entry, exit), policy violation, escort left, number of escorts, numbers of users, number of visitors.

- D. The GUI shall display custom graphical screens, developed by the SMS vendor with electronic maps provided by Owner.
- E. The system shall have the ability to automatically call up specific maps. Each input point shall be linked to a primary map.
- F. Graphical editing software shall be included, allowing the Owner to create and edit the graphical screens.
- G. Graphics screens shall be developed using a minimum of eight (8) colors from a palette of 64 available.
- H. The system shall operate on a Windows workstation as provided and recommended by the SMS vendor.

## 2.5 CREDENTIALS AND BADGING

- A. Badging Station:
  - 1. Provisioning:
    - a. **[The workstation(s) shall be furnished by the Contractor and shall meet the specifications defined by the SMS software manufacturer to meet or exceed the functionality and performance specifications of the system and integrations defined in this and related sections. Contractor shall coordinate with Owner for possible requirements to utilize a specific manufacturer. Contractor-furnished workstation(s) shall have a three (3) year limited warranty.][The workstation(s) shall be furnished by the Owner and shall meet the specifications defined by the SMS software manufacturer to meet or exceed the functionality and performance specifications of the system and integrations defined in this and related sections. Contractor shall furnish specifications to the Owner in writing as part of the submittals.]**
  - 2. Software:
    - a. General:
      - 1) The SMS shall support a credential design module that is integral to the SMS source code with the ability to create and maintain credential designs. Features shall include the ability to support:
        - a) Complete credential design and layout tools
        - b) Chroma key
        - c) Image import
        - d) Ghosting
        - e) Signature capture
        - f) Barcodes
        - g) Smart chip support
    - b. Licensing
      - 1) Required badging/credential management licensing shall be furnished.
  - 3. Hardware:

- a. Desktop configuration.
  - b. Provide workstation with performance requirements that meet manufacturer recommendation.
  - c. One (1) minimum 19" flat screen LCD monitor
  - d. Printer:
    - 1) Printer manufacturer shall be:
      - a) HID Fargo DTC1250e
    - 2) The SMS shall support a printer with industry standard and Microsoft certified drivers. The printer shall support:
      - a) Double sided printing at a resolution of no less than 300 dpi, full color on the front, monochrome on the back
      - b) Edge to edge printing
      - c) High speed printing per card of a minimum of 7 seconds for monochrome and 35 seconds for YMCKO
      - d) Holographic overlay
      - e) Inline magnetic stripe encoding
      - f) Inline Contactless Smart card encoding
      - g) An input feeder/hopper with a minimum capacity of 100 cards and an output stacker/hopper with a minimum capacity of 30 cards
  - e. Images:
    - 1) Camera:
      - a) The badging station shall be compatible with flash lighting and USB connected cameras, allowing the capture of a cardholder image at a minimum resolution of 3 mega pixels.
      - b) SMS image capture, storage, and hardware compression techniques must be in compliance with the ANSI standard or JPEG (Joint Photographic Experts Group).
      - c) The SMS shall provide the ability to capture a cardholder's image through the use of any industry standard scanner or digital camera that utilizes a TWAIN interface. Images shall be able to be scanned at up to 16.7 million colors for a true color scanned image. When using a digital camera that supports multiple resolutions, the system shall allow the operator to select the desired resolution.
      - d) Include required USB interface box, camera, camera power supply, integral or external integrated flash, tripod and 4' x 4' wall mounted white backdrop.
    - 2) Image Import:
      - a) The SMS shall allow system operators to have the ability to import a cardholder's image at the time of enrollment.
4. Badge Design:
- a. Provide training and work in conjunction with Owner for development of four (4) badge designs.
5. Supplies:
- a. Print Ribbons:

- 1) Print ribbons shall be provided to print 100) badges, plus one spare ribbon of the same type and capacity.
- b. Cleaning Kits:
  - 1) One cleaning kit shall be provided for every ribbon provided.
- c. Lanyards and Sleeves:
  - 1) Lanyards and badge sleeves shall be furnished by Owner.
- d. Badge Quantities:
  - 1) Badge quantities and types shall be as defined below.

B. Credentials:

1. Multi-Technology Cards: 13.56 MHz radio frequency identification electronics, passive design. Card shall meet ISO 15693 and ISO 14443B2 standards.
  - a. Maximum Dimensions: CR 79: 3.313" x 2.063" x 0.04", CR 80: 3.375" x 2.125" x 0.04".
  - b. Construction to be of PVC or polyester laminate
  - c. Each card shall contain a unique serial number.
  - d. Cards shall contain options for various memory capacities of 2k, 16k or 32k with a fixed number of application areas or areas which are sized by dynamic allocation.
  - e. Each application area shall contain a unique authentication key. The card and reader shall require matching keys in order to function together. All RF communication between card and reader shall be encrypted using a secure algorithm.
  - f. The card shall be protected with DES or 3DES encryption algorithms.
  - g. The cards shall be provided with custom keys uniquely matched to individual sites/customers to allow a non-interchangeable, high level of security through the use of formatting programs such as HID iClass Elite or Corporate 1000.
  - h. Cards shall be encoded with bit lengths that are compatible with all other components of the SMS.
  - i. Application areas shall be reserved for future applications as Owner requires.
  - j. Cards shall support programming and updating of custom applications after issue.
  - k. Cards shall be capable of having a photo and/or other graphical images printed directly on the surface of the card.
  - l. Provide optional slot punch-outs on the short and long edge of the card.
  - m. Provide multi-technology cards. Cards shall be individually numbered with sequential matching of internal and external numbers.
  - n. Cards shall be provided with a lifetime warranty.
2. Contactless Smart Fobs: 13.56 MHz radio frequency identification, passive design.
3. Contactless Smart Fobs: 125 kHz radio frequency identification, passive design.
4. Adhesive Tags: 13.56 MHz radio frequency identification, passive design
5. Adhesive Tags: 125 kHz radio frequency identification, passive design.
  - a. Fobs:
    - 1) Maximum Dimensions: 2" x 1.25" x 0.4". Constructed of molded and ultrasonically sealed polycarbonate body. The molded body shall contain a hole for attachment to a keychain.
    - 2) Supports attachment to keychain.
    - 3) Meets ISO 15693 and 14443B2 standards.
    - 4) Read range shall not be affected by body shielding or environmental conditions.

- b. Adhesive Disk:
  - 1) Maximum Dimensions: 1.4" diameter
- c. Each credential shall contain a unique serial number.
- d. Credential shall contain at least three memory capacities from 2k, 4k, 8k, 16k or 32k with associated allocation areas.
- e. Each application area shall contain a unique authentication key. The credential and reader shall require matching keys in order to function together. All RF communication between the credential and reader shall be encrypted using a secure algorithm.

C. Credential Management:

1. The SMS shall support a Credential Management and Enrollment module that is integral to the SMS source code with the ability to create and maintain the cardholder database. Features shall include the ability to:
  - a. Add, modify and delete records based upon permissions
  - b. Capture photo images, biometric information and signatures
  - c. Print credentials
  - d. Boolean search on any single or multiple fields
  - e. Customization of screen layout and field names
  - f. Advanced customization of fields, field names and screen tabs (pages) with optional Forms Designing and Editing module
  - g. Determine single or multiple active credentials
  - h. Assign access levels and access groups
  - i. Bulk assignment/modification/deletion of access levels
  - j. Bulk deletion of cardholder records.
2. The SMS shall support the following bar codes:
  - a. Code 3 of 9 (3:1)
  - b. Code 93
  - c. UPCA
  - d. EAN 13
  - e. EAN 8
  - f. Code 128 A
  - g. Code 128 B
  - h. Code 128 C
  - i. Codabar
  - j. PostNET (Zip + 4 Postal)
  - k. Code 3 of 9 (2:1)
  - l. Interleaved 2 of 5 (2:1)
  - m. PDF-417 (2D)
  - n. Code 128 Auto
  - o. UCC-128
  - p. MSI Plessey
  - q. Extended Code 3 of 9
  - r. Extended Code 93
  - s. 2D Aztec

## 2.6 PORTAL DEVICES

A. Credential Readers:

1. Manufacturers:

- a. HID Multiclass SE
  - b. Pre-approved equal
2. Multi-Technology:
- a. Compatible with 125 kHz proximity, 13.56 MHz Contactless Smart card, MIFARE, DESFire EV1.
  - b. Backwards compatibility with legacy 13.56 MHz Contactless Smart cards and 125 kHz proximity access control formats, including 26, 32, 35, 37 bit as well as HID Corporate 1000 format.
3. Card readers manufactured specifically for non-access control applications shall not be acceptable.
4. FIPS 201 compliant.
5. Provide compatibility with most access control systems by providing card data outputs in Wiegand and Clock/Data.
6. Allow the firmware to be updated in the field without the need to remove the reader from the wall.
7. Secure mounting methods using tamper resistant screws.
8. An audio beeper that provides various tones to signify access granted, access denied, power up and diagnostics.
9. Tri-color LED or three (3) LEDs for visual notification of various conditions.
10. ISO1443A, 1443B and 15693 compliant.
11. The ability to transmit an alarm from an integrated tamper switch.
12. Support dual authentication of identity through the combined use of access badge and personal identification number (PIN) on an integrated 12 key keypad.
13. PBT polymer or UL94 polycarbonate.
14. Read Range:
- a. Using 125 kHz cards or 13.56 MHz Contactless Smart cards, minimum operational read range shall not be less than one (1) inch after the readers have been installed in their permanent locations.
15. Operational voltage of 5-16 VDC, with operating temperature range of -31° F to 150° F, and rated for outdoor use with a minimum rating of IP55.
16. Readers and credentials shall be compatible with each other and shall be from the same manufacturer.
17. Available in sizes to be mounted to a standard single gang box or to a mullion. Maximum sizes:
- a. Single gang box mount, with or without keypad: 5.1" x 3.1" x 1.1"
  - b. Mullion mount: 6.0" x 1.9" x 0.9"
18. Lifetime warranty against defects in material and workmanship.
- B. Request-To-Exit Motion Detector:
1. Manufacturers:
- a. Bosch DS 160 Series
  - b. Pre-approved equal
  - c. Refer to drawings for approved manufacturers.
2. Door monitor with sounder alert. Sounder alert shall have adjustable volume.
3. Adjustable latch time.
4. Selectable fail safe/fail secure.
5. Activation LED.
6. 12 or 24 VDC operation.

7. Sequential logic input.
8. Two (2) Form C contacts.
9. Tamper switch.
10. Field of view masking.

C. Request-To-Exit Button:

1. Manufacturers:
  - a. Dynalock 6290 Series
  - b. Seco-Larm SD7213 Series
  - c. RCI 991 Series
  - d. Pre-approved equal
  - e. Refer to drawings for approved manufacturers.
2. 0-60 second adjustable pneumatic action.
3. Contacts shall be one of the following:
  - a. DPDT
  - b. SPDT double break with isolated common
  - c. DPST
  - d. Normally closed SPST with normally open SPST
4. One and one-half inches (1-1/2") to two inches (2") red mushroom button.
5. Stainless steel or aluminum plate labeled "EXIT" or "PUSH TO EXIT".
6. Available in mullion mount.

D. Door Position Switch:

1. Manufacturers:
  - a. GE
  - b. GRI
  - c. Honeywell
  - d. Pre-approved equal
2. Interior or Perimeter Door:
  - a. One (1) inch or 0.75 (3/4) inch diameter, recessed
  - b. DPDT contacts
  - c. 0.75" to 1.25" (3/4" to 1-1/4") gap for wood door
  - d. Maximum 0.375" to 0.625" (3/8" to 5/8") gap for steel door
  - e. Basis of Design: UTC/GE/Sentrol 1076D

E. Cable:

1. Composite cable is allowed, although sufficient conductors may not be available in composite cables for all portal configurations. Contractor shall be responsible for additional required cables beyond one composite cable to each portal to meet functional requirements of the system.
  - a. Reader: 18 AWG, 3 pair, stranded, overall shield. Shield shall be grounded at control panel end only.
  - b. Request to Exit Motion Detector: 22 AWG, 4 conductor, stranded.
  - c. Door Position Switch: 22 AWG, 2 conductor, stranded.
  - d. Request to Exit Button: 22 AWG, 4 conductor, stranded.
  - e. Lock: Minimum 18 AWG, 4 conductor, stranded.

- 1) Lock may require heavier gauge cable depending on door hardware solution power requirements. Contractor shall coordinate with door hardware provider for higher current devices and shall adjust the gauge of the lock cable accordingly.

f. Auxiliary Devices: Refer to plans for requirements.

F. Locks and Door Hardware:

1. Electric/electronic locks shall be furnished and installed by the door hardware provider.
2. Access Control Contractor shall interface with and terminate cables to locks.
3. Access Control Contractor shall coordinate with door hardware provider for specified sequences of operation at the various portals.
4. Electrified cylindrical and electrified mortise locks shall have an integrated request-to-exit device.
5. Electric strikes shall have an integrated latch bolt monitor, and the dead latch shall be seated properly so that the strike cannot be defeated by manipulation.
6. Magnetic locks shall have a magnetic bond sensor.
7. Refer to architectural specifications and/or the architectural door schedule.

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION**

- A. Comply with the manufacturer's instructions and recommendations for installation of all products.
- B. Provide all system wiring between all components as shown on the project drawings or as directed by the manufacturer, whichever is the more stringent requirement.
- C. Network controllers shall be installed centralized in the nearest telecommunications room(s). Mount controllers to the structural walls in a location coordinated with other utilities. Coordinate exact location with Owner prior to installation. Provide dedicated +120 VAC power circuit to the controllers using #12 AWG wiring from the nearest electrical power distribution panel board.
- D. Provide wiring and connection to all electrified locking hardware devices. Complete programming and testing of all electrified locking hardware devices.
- E. Install all credential readers in accordance with manufacturer's instructions where shown on floor plans, in accordance with the Americans with Disabilities Act (ADA) requirements. Provide wiring and connection to all credential readers. Complete programming, adjustment, and testing of all credential readers.
- F. Provide wiring and connection to all hardware request-to-exit devices that are integral to electrified door hardware. Provide wiring and connection to all request-to-exit motion detectors. Complete programming and testing of all integrated request-to-exit devices. Where possible, avoid false activation by persons passing by but not exiting.
- G. Install all request-to-exit motion detectors in accordance with manufacturer's instructions directly above the door frame, centered on the door opening. Adjust sensitivity to permit operation on motion of persons within 2'-0" of door. Avoid false activation by persons passing by where possible.
- H. Install all request-to-exit pushbuttons in accordance with manufacturer's instructions where shown on floor plans, in accordance with the Americans with Disabilities Act (ADA) requirements. Provide wiring and connection to all request-to-exit pushbuttons. Complete programming, adjustment and testing of all request-to-exit pushbuttons.

- I. Install all door alarm contacts in accordance with manufacturer's instructions either recessed in the door header or surface mounted as required. Provide wiring and connection to door alarm contact devices. Complete programming, adjustment and testing of all door alarm contacts.
- J. Install all duress switches in accordance with manufacturer's instructions, surface mounted under counter in locations shown on plans. Verify exact mounting location with Owner prior to cable rough-in or installation. For hard wired devices, provide wiring and connection to duress switch devices. For wireless duress switch devices, mount receivers in accessible locations. Complete programming, adjustment and testing of all duress switch devices. Wireless testing shall include signal reception when transmitter is in all sections of the area in which it will be used in normal operations.
- K. Install, wire, configure, adjust, program and test all access control system servers, workstations, badging workstations and other user interfaces.
- L. Install, wire, configure, adjust, program, and test all specified interfaces and integrations between access control and other systems. Contractor shall provide all cabling, wiring, terminations, components, devices, accessories, hardware, software and other material and accessories necessary to complete all specified interfaces and integrations and make them fully operational.
- M. All low voltage access control cabling shall be routed with other low voltage cabling and shall route through cable tray and non-continuous cable support pathways to the fullest extent possible.
- N. Electronic access control system cabling shall not be spliced.
- O. Flexible conduit is not allowed except with prior approval. Refer to Section 26 05 33 for conduit requirements. Refer to Section 27 05 28 for cable hanger and support requirements.
- P. Each cable shall be appropriately identified, as defined on the record documents, at each end's termination point using pressure sensitive label strips.
- Q. The conductor color code used in terminating system cabling at system devices shall remain consistent from device to device for each unique device type throughout the project.
- R. Install and tighten all connectors in accordance with manufacturer's instructions using the appropriately designed tools recommended by the manufacturer for that purpose. Do not strip or damage connectors, terminals, or equipment by over tightening termination fasteners.
- S. Grounding and Bonding Requirements:
  - 1. Provide a minimum of 6AWG bonding conductor from each electronic access control system control panel, power supply and surge suppression device to the nearest telecommunications grounding busbar. Actual bonding conductor size is determined by its length; refer to Section 27 05 26 for grounding and bonding conductor sizing criteria.
  - 2. Cables containing shields shall not have the shields grounded at conduits, boxes, racks, etc. Ground the shield only at the control panel end.
- T. Coordinate installation of all devices with other trades and utilities in the vicinity.
- U. Cabling shall be plenum rated when installed outside conduit in plenum ceilings.

### **3.2 FIELD QUALITY CONTROL**

- A. Where these specifications require a product or assembly without the use of a brand or trade name, provide a product that meets the requirements of the specifications as supplied and warranted by the system manufacturer. If the product or assembly is not available from the system vendor, provide product or assembly as recommended by the system manufacturer.



- B. Periodic observations will be performed during construction to verify compliance with the requirements of the specifications. These services do not relieve the Contractor of responsibility for compliance with the contract documents.
- C. Furnish products listed and classified by Underwriters Laboratories, Inc. (UL) as suitable for purpose specified and indicated.

### **3.3 MANUFACTURER AND INTEGRATOR COMBINED FIELD SERVICES**

- A. Installation shall be performed by a factory-trained and certified Contractor.
- B. The Contractor shall provide a comprehensive, site-specific customer planning guide for the system. The Contractor shall conduct conference(s) with the Owner prior to any installation to discuss the programming and configuration options of the system and the planning guide.
- C. The Contractor shall include labor for all planning and all programming activities required to implement the Owner's access policies for each system point and each operator and administrator. Any software programmable access policy, within the bounds of the hardware specified, shall be included.
- D. It shall be the responsibility of the Contractor to provide a complete, functional system as described by the design documents. These responsibilities include:
  1. Complete hardware setup, installation, wiring and software configuration of the system server, all workstations and all peripheral hardware.
  2. Complete programming of all operator software in accordance with the Owner's access policies determined by the planning guide conference(s).
  3. Manual data entry of 200cardholders based on a printed roster provided by the Owner.
  4. Configuration of the network software for operation of the system. Templates shall be established representative of all user access right levels.
  5. Programming of all cardholder database screens including cardholder information screens, report templates, queries, etc. Encoding of 200credentials shall be included.
  6. Programming of all custom graphic GUI screens including devices.
  7. Complete system diagnostic verification.
- E. The SMS Installation Contractor shall be present at meetings to coordinate all door hardware requirements with the door hardware vendor.

### **3.4 SYSTEM DOCUMENTATION**

- A. Complete documentation shall be provided for the system. The documentation shall describe:
  1. All operational parameters of the system
  2. Complete documentation of programming and access policies
  3. Complete operating instructions for all hardware and software
- B. The following sections shall be provided in the system documentation:
  1. System Administrator Manual: Provides an overview and a step-by-step guide and instructions detailing all system administrator responsibilities and functions.
  2. User Manual: A step-by-step guide and instructions detailing all system user functions.
  3. Alarm Monitoring Manual: A step-by-step guide and instructions detailing all alarm monitoring system functions and responsibilities.
  4. Technical Maintenance Manual: A comprehensive document providing all maintenance actions, system testing schedules, troubleshooting flowcharts, functional system layout, wiring diagrams, block diagrams and schematic diagrams.
  5. Refer to Part 1 for details.

### **3.5 SYSTEM TRAINING**

- A. All labor and materials required for on-site system training by a certified representative of the system manufacturer shall be provided. Training shall be conducted at the project site using the project equipment.
- B. Coordinate training days and times with Owner.
- C. Provide a training outline agenda describing the subject matter and the recommended audience for each topic.
- D. At a minimum, the following training shall be conducted:
  - 1. System Administrators: A course detailing the system functions, configurations and operations. Provide training on all aspects of the system including data import/export, report, cardholder management, system workstation and server configuration and maintenance, software and hardware configuration and peripheral hardware operation.
  - 2. Operators: A course detailing the operational features of all aspects of the user interface. Topics shall include alarm monitoring functions, reports, error handling, alarm handling, output relay control, operation of integrated systems interface, and general overview of the report hardware.
  - 3. GUI Editing: Conduct detailed training on using the GUI editing software. Topics shall include the editing of existing graphical maps and the creation of new graphical maps.
- E. Minimum on-site training times shall be:
  - 1. System Administrators: Eight (8) hours.
  - 2. Operators: Eight (8) hours.
  - 3. GUI Editing: Eight (8) hours.
  - 4. Integrations : Eight (8) hours.
  - 5. Badging System: Eight (8) hours.
  - 6. Four (4) additional hours of training each quarter for the 12-month period of the project warranty shall be provided. A minimum of half of this additional training shall be on site; the remainder may be support by telephone or email. Contractor shall document this training, including dates performed, trainer and Owner representative(s) present. Each phone call or email shall be documented as a minimum of 15 minutes duration.
  - 7. Operators and administrators are present 24 hours a day, 7 days a week. Contractor shall coordinate with Owner to provide training for all appropriate personnel, which may require Contractor to be present on site during non-business hours. Therefore, the hours in any or all categories defined above may be divided among the various shifts.

### **3.6 SYSTEM ACCEPTANCE**

- A. The SMS vendor shall submit for review a formal acceptance and system checkout program. The system checkout procedures shall include all system components, software and functionality. The Contractor shall perform the tests and document all results under the supervision of the manufacturer's systems engineer.
- B. All operational scenarios, as defined by the customer planning guide, shall be tested to simulate the actual use of the system in the normal operating environment. The successful completion of these operational scenarios shall be documented.
- C. The system shall not be accepted until all requirements of system documentation and training have been completed.

**END OF SECTION**

## SECTION 28 31 01 - FIRE ALARM AND DETECTION SYSTEMS

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. Fire alarm and detection systems.
- B. One-way emergency communications system with voice notification within-building, coverage.
- C. Contacts: Automatic Building Controls, Inc. - Monte Dumke (605) 359-1175

#### 1.2 RELATED WORK

- A. Section 26 05 53 - Electrical Identification: Refer to electrical identification for color and identification labeling requirements.

#### 1.3 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in smoke detection and fire alarm systems with ten years' experience.
- B. Installer: A factory-authorized Electrical or Security Contractor licensed with the State and local jurisdiction with five years' experience in the design, installation, and maintenance of fire alarm systems by that manufacturer.
- C. Qualifications: The person managing/overseeing the preparation of shop drawings and the system installation/programming/testing shall be trained and certified by the system manufacturer and shall be Fire Alarm Certified by NICET, minimum Level 3. This person's name and certification number shall appear on the start-up and testing reports.

#### 1.4 REFERENCES

- A. ASME A17.1 - Safety Code for Elevators and Escalators
- B. NFPA 70 - National Electrical Code (NEC)
- C. NFPA 72 - National Fire Alarm and Signaling Code
- D. NFPA 101 - Life Safety Code
- E. UL 2017 - General Purpose Signaling Devices and Systems
- F. UL 217 / 268 - Standard for Smoke Alarms / Smoke Detectors for Fire Alarm Systems

#### 1.5 SUBMITTALS

- A. Submit shop drawings and product data under provisions of Section 26 05 00 and as noted below.
  - 1. Failure to comply with all the following and all the provisions in 26 05 00 will result in the shop drawing submittal being rejected without review.
  - 2. Failure to submit the fire alarm without all requirements fulfilled in a single comprehensive submittal will be grounds to require a complete resubmittal.
- B. Provide product catalog data sheets as shop drawings.

1. Provide a product catalog data sheet for each item shown on the Electrical Symbols List and for each piece of equipment that is not shown on the drawings, but required for the operation of the system.
2. Where a particular Electrical Symbols List item has one or more variations (such as those denoted by subscripts, etc.) a separate additional product catalog data sheet shall be provided for each variation that requires a different part number to be ordered. The corresponding Electrical Symbols List symbol shall be shown on the top of each sheet.
3. Where multiple items and options are shown on one data sheet, the part number and options of the item to be used shall be clearly denoted.

C. Submit CAD Floor Plans as Shop Drawings:

1. The complete layout of the entire system, device addresses, auxiliary equipment, and manufacturer's wiring requirements shall be shown.
2. Indicate the precise routing of notification appliance circuits under the provisions of circuit survivability. Refer to "Wiring" under Part 3 - Execution of this specification section for requirements.
3. A legend or key shall be provided to show which symbols shown on the submittal floor plans correspond with symbols shown on the Contract Documents.

D. About all fire alarm circuits, provide the following: manufacturer's wiring requirements (manufacturer, type, size, etc.) and voltage drop calculations.

E. Provide installation and maintenance manuals under provisions of Section 26 05 00.

F. Submit manufacturer's certificate that system meets or exceeds specified requirements.

G. Provide information on the system batteries as follows: total battery capacity, total capacity used by all devices on this project, total available future capacity.

H. Voice Alarm Communication System: Submit equipment rack or console layout, grounding schematic, amplifier power calculations, and wiring diagram.

I. Incident Commander Display: Submit sample display screen layouts and list of functions for Authority Having Jurisdiction (AHJ) review and coordination.

J. Emergency Communication System: Submit equipment rack or console layout, grounding schematic, amplifier power calculations, and wiring diagram.

K. Submit photocopy proof of NICET certification of the person overseeing the preparation of drawings and installation/testing.

L. When required to comply with local or state regulatory reviews, the fire alarm submittal shall have a NICET Certification of the state in which the project is completed. NOTE: The Architect/Engineer cannot stamp and seal submittal drawings not prepared under their supervision.

## 1.6 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Provide quantity equal to 2 percent (2%) of amount of each type installed, but no less than two (2) units of each type.
  - a. Smoke and heat detectors, manual pull stations, duct smoke detectors, monitor modules, control modules and relays.
  - b. Notification Appliances: Speakers, speaker strobes, and strobes.

2. Keys: The installing contractor shall collect all equipment spare keys provided with each lockable or resettable device/cabinet minimum of one (1) set each and shall turn over to the Owner upon completion.
3. All spare parts shall be housed in metal cabinet labeled "Fire Alarm Spare Parts."
4. Portable Firefighter Emergency Handset Phones: Provide . Locate in the.

#### **1.7 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver products to site under provisions of Section 26 05 00.
- B. Store and protect products under provisions of Section 26 05 00.

#### **1.8 REGULATORY REQUIREMENTS**

- A. System: UL or FM Global listed.
- B. Conform to requirements of NFPA 101.
- C. Conform to requirements of Americans with Disabilities Act (ADA).
- D. Conform to UL 864 Fire Alarm, UL 1076 Security, UL2017 General Signaling, and UL 2572 Mass Notification Communications.

#### **1.9 SYSTEM DESCRIPTION**

- A. Performance Statement: This specification section and the accompanying fire alarm specific design documents describe the minimum material quality, required features, and operational requirements of the system. These documents do not convey every wire that must be installed and every equipment connection that must be made. Based on the equipment described and the performance required of the system, as presented in these documents, the Vendor and the Contractor are solely responsible for determining all wiring, programming and miscellaneous equipment required for a complete and operational system.
- B. This section of the specifications includes the furnishing, installation and connection of the microprocessor controlled, intelligent reporting, fire alarm equipment required to form a complete coordinated system that is ready for operation. It shall include, but is not limited to, alarm initiating devices, emergency communication systems, control panels, auxiliary control devices, annunciators, power supplies, and wiring as indicated on the drawings and specified herein.
- C. Graham Hall - Existing Fire Alarm System: Graham Hall fire alarm system requires to be separated from Lincoln Hall prior to demolition of Lincoln hall. Utilize the existing fire alarm headend from Briscoe Hall and relocate to room in Graham Hall as shown and provide all items, components, devices, hardware, software, programming, expansion components, conduit, wiring etc. needed for a complete and operational system. This includes, but is not limited to, additional power supplies, initiating devices and circuits, signaling devices and circuits, monitoring devices and circuits, auxiliary control and related devices such as, door holders and their control, smoke damper control, fan shutdown, etc. The Graham Fire alarm system shall be dedicated to Graham Hall and tied into the existing campus Johnson Control system for alarm and supervisory signals. The existing fire alarm system shall be interfaced with the new fire alarm system relocated panel such that the existing fire alarm system's functionality, integrity and annunciation shall be equivalent to pre-construction conditions, unless noted otherwise. The functionality and integrity shall be maintained during construction. The entire system shall be able to be completely reset from any single reset location point. The entire system shall be annunciated at any annunciation location.
- D. Graham Hall - The contractor shall include field verifying and tracing all fire alarm wiring that serves Graham Hall from Lincoln Hall; intercepting the wiring and making any and all connections to the Graham Hall.

- E. Extending the existing Siemens Fire Alarm System: The existing control panel shall remain and shall be operational throughout construction. The system shall only be disabled to make new connections and to modify the programming. A fire watch shall be provided for all areas affected during outages. All system outages must be scheduled with the Owner at least one week prior. Individual devices may be disabled as needed based on construction activities to reduce the potential for false alarms, but all devices must be operational when the Contractor is not physically on site. New initiating devices may be connected to the existing signaling line circuits where capacity is available. Provide additional signaling line circuits as needed based on existing and new device quantity, including replacement of existing panel components. Provide new notification circuits to serve the new devices, including all necessary power supplies, amplifiers, batteries, and 120-volt input circuits. All new devices shall be programmed to provide the same sequence of operation as the existing devices of the same type, unless noted otherwise.
- F. Lincoln Hall - new building fire alarm will be an addressable system with voice.
- G. Fire Alarm System: NFPA 72; Automatic and manual fire alarm system, non-coded, analog-addressable with automatic sensitivity control of certain detectors, multiplexed signal transmission.
- H. Voice Communication: The facility shall have an emergency voice alarm communication system. The digitized recorded voice message shall notify occupants that a fire condition has been reported. Emergency manual voice override shall be provided.
- I. Emergency Communication System (ECS): A system capable of reproduction of prerecorded, synthesized, or live messages with voice intelligibility to indicate the existence of an emergency situation and communicating information necessary to facilitate an appropriate response and action. The system shall provide alerting in the building.
- J. System Supervision: Provide electrically supervised system, with supervised Signal Line Circuit (SLC) and Notification Appliance Circuit (NAC). Occurrence of single ground or open condition in initiating or signaling circuit places circuit in TROUBLE mode. Component or power supply failure places system in TROUBLE mode.
- K. Alarm Reset: Key-accessible RESET function resets alarm system out of ALARM if alarm initiating circuits have cleared.
- L. Lamp Test: Manual LAMP TEST function causes alarm indication at each zone at fire alarm control panel and at annunciator panels.
- M. Drawings: Only device layouts and some equipment have been shown on the contract drawings. Wiring and additional equipment to make a complete and functioning system has not been shown, but shall be submitted on the shop drawings.

#### **1.10 PROJECT RECORD DOCUMENTS**

- A. Submit documents under the provisions of Section 26 05 00.
- B. Include location of end-of-line devices.
- C. Provide a CAD drawing of each area of the building (minimum scale of 1/16" = 1'-0") showing each device on the project and its address. The devices shall be shown in their installed location and shall be labeled with the same nomenclature as is used in the fire alarm panel programming.
- D. Submit test results of sound pressure level (dBA) and intelligibility (STI) with the rooms tested designated on the floor plan. Notification devices shall have the tap wattage designated.

### **1.11 OPERATION AND MAINTENANCE DATA**

- A. Submit data under provisions of Section 26 05 00.
- B. Include operating instructions, and maintenance and repair procedures.
- C. Include results of testing of all devices and functions.
- D. Include manufacturer's representative's letter stating that system is operational.
- E. Include the CAD floor plan drawings.
- F. Include shop drawings as reviewed by the Architect/Engineer and the local Authority Having Jurisdiction.

### **1.12 WARRANTY**

- A. Provide one (1) year warranty on all materials and labor from Date of Substantial Completion.
- B. Warranty requirements shall include furnishing and installing all software upgrades issued by the manufacturer during the one (1) year warranty period.

### **1.13 ANNUAL INSPECTION/TESTING AND SERVICE CONTRACT**

- A. Provide cost to furnish service, inspect, and test all devices of the fire alarm system per the requirement of NFPA for one (1) year, starting one year after the Date of Substantial Completion. Submit written reports of inspection testing per NFPA 72, Chapter 14.
- B. Provide an alternate cost for a complete inspection/testing and service/maintenance contract for the fire alarm system for one (1) year two (2) years, starting one year after the Date of Substantial Completion. Submit sample contract terms and conditions for review with shop drawings.
- C. The Owner may enter into a contract directly with the vendor after shop drawing submittals. This specification is not a contract between the Owner and the vendor to perform these services.

## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURERS**

- A. Siemens Fire Safety

### **2.2 FIRE ALARM CONTROL PANEL (FAP)**

- A. Control Panel: Modular, power-limited electronic design. Provide surface wall-mounted enclosure as shown on plans. Enclosure shall be minimum 0.060 steel with provisions for electrical conduit connections into the sides and top. The door shall provide a key lock and shall include a glass or other transparent opening for viewing of all indicators.
- B. Each Signaling Line Circuit (SLC loop) shall not be loaded over 80% of the maximum device capacity. For example, in the minimum system capacity column listed below, if the fire alarm manufacturer's system capacity of analog sensors per loop is 99 devices, then no more than 79 devices shall be wired on that loop. The minimum system capacity shall be as follows:
  - 1. Minimum Total Addressable Points: 250

2. Minimum Total SLC Loops (including board, ready for field connections): 4
  3. Panel Expansion Capability, Minimum Total SLC Loops: 10
  4. Minimum Node Capacity for Network System: 100
- C. Signal Line Circuit (SLC) and Notification Appliance Circuit (NAC) Boards:
1. Class X. All devices shall have built in class X isolation.
  2. Each board shall communicate directly with each addressable analog sensor and binary input to determine normal, alarm, or trouble conditions. Analog signals would be used for automatic test and determination of maintenance requirements.
  3. Each board shall contain its own microprocessor and shall be provided to monitor addressable inputs and to control addressable outputs (addressable relays). The board shall communicate and provide power to all devices on its loop over a single pair of wires, except where 4-wire devices require a separate power circuit.
- D. Central Processing Unit:
1. The central processing unit (CPU) shall communicate with the monitor and control all other modules in the panel. Removal, disconnection or failure of any control panel module shall be detected and reported to the CPU.
  2. The CPU shall execute all control-by-event programs for specific action to be taken if a designated situation is detected in the system. A real-time system clock for time annotations on the display and printer shall be included.
  3. All power for the unit shall be supervised and supplied by the FAP.
- E. Display:
1. The board shall provide all controls and indicators used by the system operator and may also be used to program all control panel parameters.
  2. The board shall provide an alphanumeric array for display of custom alphanumeric labels for all addressable points. It shall also provide indicators for AC Power, System Alarm, System Trouble, Display Trouble and Signal Silence.
  3. Displayed descriptions of addressable points shall include actual room names/numbers selected by the Owner. This information shall be obtained prior to programming. Room names/numbers shown on floor plans shall not be used.
  4. The board shall provide a touch key-pad with control capability to command all system functions and entry of any alphanumeric information. Twenty different passwords with four levels of security shall be supported to prevent unauthorized manual control or programming.
- F. Memory: The CPU and display interface board shall be augmented by non-volatile field programmable memory. EPROM memory will also be allowed provided the memory is burned in with minimum expansion capability equal to the total system capacity of the panel. Memory shall not be lost upon primary and secondary power failure.
- G. Serial Interface Board: The board shall provide interfaces to a printer, LCD display and other monitoring devices through RS-232 connections. The minimum operational distance between the board and the peripheral devices shall be 500 feet. Up to three (3) RS-232 outputs shall be supported.
- H. Power Supply:
1. Input power shall be 120 VAC, 60 Hertz. Output power shall be as noted on the device specifications and drawings. Each component of the fire alarm system requiring 120 VAC input power shall be served from a dedicated branch circuit. Provide two #12 conductors and one #12 ground in 3/4" conduit to a dedicated 20A/1P circuit breaker with a red handle and a manufacturer's standard handle lock-on device. Identify/label breaker and



- branch circuit in accordance with NFPA requirements and Specification Section 26 05 53.
2. Adequate to supply 125% of all control panel and peripheral power needs as well as 125% of power required for all external audio-visual devices. The power supply may be increased as needed by adding additional modular expansion power supplies. Over-current protections shall be provided on all power outputs.
  3. All power supplies shall be designed and installed to meet UL and NFPA requirements for power-limited operation on all external initiating and indicating circuits.
  4. The power supply shall provide integral charger for use with internal batteries. Battery capacity shall be sufficient for operation of the entire system for 24 hours in a non-alarm state followed by alarm mode for 15 minutes, plus 25% spare capacity for future devices.

I. Surge Protection:

1. All fire alarm control panels, NAC panels, etc. shall be provided with a surge protection device (SPD). The SPD shall be UL listed to Standard 1449 Rev 3. The unit should be clearly labeled in accordance with Identification Section 26 05 53. The SPD shall have thermal fuses to protect against fire in short circuit conditions. The unit shall provide visual indication that the unit is protecting and functioning.
2. Any communications or signaling circuits associated with the fire alarm system, which leave or enter a facility, shall be provided with a surge protection device. The devices shall be as recommended by the fire alarm system manufacturer.

J. Dual Digital Communicator:

1. Provide dual phone line interface capable of fire alarm notification to the local fire department, fire protection agency, or monitoring service. Communicator shall report in SIA and most major communication formats, with the capability of transmitting each device address point in a format compatible with the central station receiver.
2. Monitoring fees and initial connection charges are not part of this project.
3. Communicator shall be fully supervised and shall operate on loop start phase lines ahead of the building PBX system.
4. Communicator shall be FCC registered. Contractor shall provide two RJ31X jacks. Contractor to provide connection of communicators to Owner's telephone system as shown on the drawings.
5. Approvals: UL listed - UL 864/NFPA 72, FM approved.
6. The communicator shall be provided integral to the fire alarm panel as furnished by the fire alarm panel manufacturer. If the panel construction requires a separate unit, the unit shall be as manufactured by Silent Knight, Ademco, or fire alarm panel manufacturer approved equal.

K. IP-GSM Digital Cellular Fire Communicator:

1. Provide digital internet / cellular phone interface capable of fire alarm notification to the local fire department, fire protection agency, or monitoring service. Monitoring fees and initial connection charges are not part of this project.
2. Contractor to provide connection of communicator to Owner's Ethernet 10/100 Base network connection. Wiring shall be in 1" conduit.
3. Communicator shall convert fire alarm control panel phone outputs into Ethernet packets and transmit to GSM networks in area including 2G, 3G, and 4G.
4. Communication shall include system status including individual addressable device status, power loss, low battery and earth fault, and 24-hour test signal.

## 2.3 Fire Alarm Pathway Class and Survivability Level

A. Pathway Class:

1. Pathway Class X: Circuits capable of transmitting an alarm signal during an open or a non-simultaneous single ground fault on a circuit conductor wiring system. Wiring of

outgoing and return conductors shall be physically separated by a minimum of 50 feet or by a 2-hour rated enclosure.

2. Pathway Class B: Circuits NOT capable of transmitting an alarm beyond the location of the fault condition. Wiring of outgoing and return conductors is permitted to be run in the same conduit or cable.
3. Pathway Class: SLC for addressable devices with less than 50 devices can be Class A or B, and more than 50 devices shall be Class X.

B. Pathway Survivability Level:

1. Pathway Survivability Level 0: Circuits have no requirements for pathway survivability beyond the requirements of the code.
2. Pathway Survivability Level 1: Circuits are protected by an automatic sprinkler system and installed in metal raceways.
3. Pathway Survivability Level 2: Pathway survivability includes one or more of the following:
  - a. Listed 2-hour fire-rated circuit integrity (CI) or fire-resistive cable.
  - b. Pathway installed in a 2-hour fire-rated enclosure or assembly.
4. Pathway Survivability Level 3: Circuits protected by an automatic sprinkler system and one or more of the following:
  - a. Listed 2-hour fire-rated circuit integrity (CI) or fire-resistive cable.
  - b. Pathway installed in a 2-hour fire-rated enclosure or assembly.
5. Shared Pathway Designation Level 1: Physical segregation of life safety and non-life safety data is not required. Life safety data shall be the priority.
6. Shared Pathway Designation Level 2: Provide physical segregation of all life safety and non-life safety data.
7. Shared Pathway Designation Level 3: Provide pathways with equipment dedicated to the life safety system.

C. Interconnection of Multiple Fire Alarm Panels:

1. The pathways of interconnected fire alarm panels or systems shall be as follows:
2. Pathway Class X: Circuits with redundant pathways capable of transmitting an alarm signal during an open or a non-simultaneous single ground fault on a circuit conductor wiring system. Wiring of outgoing and return conductors shall be physically separated by a minimum of 50 feet or by a 2-hour rated enclosure.
3. Pathway Survivability Level 2: Pathway survivability includes one or more of the following:
  - a. Listed 2-hour fire-rated circuit integrity (CI) or fire-resistive cable.
  - b. Pathway installed in a 2-hour fire-rated enclosure or assembly.
4. Pathway Survivability Level 3: Circuits protected by an automatic sprinkler system and one or more of the following:
  - a. Listed 2-hour fire-rated circuit integrity (CI) or fire-resistive cable.
  - b. Pathway installed in a 2-hour fire-rated enclosure or assembly.

## 2.4 SIGNALING LINE CIRCUIT DEVICES

- A. Combination Devices: Subscripts identify combination type devices when applicable. Contractor shall provide the combination device or provide multiple device(s) to meet the functionality when the manufacturer does not offer the required functionality with a single device.

B. Signal Line Device(s):

1. All devices must have built in isolation for Class X circuits.
2. Subscripts: Subscripts are used to define the device type, installation, and identify the device with a specific sequence of operation.
  - a. Device type as follows:
    - 1) W = Weather Proof
    - 2) WG = Wire guard is required
    - 3) Candela Ratings:
      - a) ## = 15 Candela, 30 Candela; 75 Candela; 110 Candela; 177 Candela
      - b) CD = NICET designer shall select Candela rating as required to provide full coverage of the space.
  - b. Sequence of operation as follows:
    - 1) A = Atrium
    - 2) CA = Clean Agent System
    - 3) CR = Computer Room
    - 4) E = Elevator Recall
    - 5) D = HVAC Control
    - 6) DH = Door Hold Release
    - 7) DIPS = Dual Interlock Pre-Action System
    - 8) FD = Fire Door Release
    - 9) MP = Medical Procedure Room
    - 10) S = Sleeping / Patient Room
    - 11) SW = Stairwell

C. Smoke Detectors:

1. Subscripts are used to define the device type, installation, and identify the device with a specific sequence of operation.
  - a. Device types as follows:
    - 1) Blank = Photoelectric
    - 2) AT = Attic (located in)
    - 3) BR = Beam Receiver
    - 4) BT = Beam Transmitter
    - 5) CO = Combination Smoke / Carbon Monoxide
    - 6) COH = Combination Smoke / Carbon Monoxide / Heat
    - 7) COS = Combination Smoke / Carbon Monoxide / Strobe
    - 8) H = Combination Smoke / Heat Detectors
    - 9) ION = Ionization Type
    - 10) ID = In-Duct Detector
    - 11) SA = Stand Alone with Sounder
    - 12) SB = Sounder Base
    - 13) SV = Stand Alone with Sounder and 177 Candela Strobe
2. Analog Photoelectric Type Sensor: Shall use the photoelectric principle to measure smoke density and send data to the control panel representing the analog level of smoke density measured.
3. (CO) Combination Smoke / Carbon Monoxide:

- a. Multi-criteria sensor for photoelectrical smoke sensing and carbon monoxide (CO) detection. Carbon monoxide electrolytic sensing module shall provide toxic gas sensing to UL2034 and UL2075 standards.
  - b. The combined photoelectric smoke detection CO module shall have separate sensors that adjust the detection profile in response to the input from the sensors.
  - c. The combined photoelectric smoke detection / CO module shall have selectable modes of operation for OSHA compliant toxic gas sensing, enhanced fire sensing, and nuisance alarm reduction mode.
  - d. The detector shall use only one address on the SLC.
  - e. CO sensor cartridge element shall be field replaceable.
4. (COH) Combination Smoke / Carbon Monoxide/Heat Detector:
- a. Multi-criteria sensor for photoelectrical smoke sensing, heat and carbon monoxide (CO) detection. Carbon monoxide electrolytic sensing module shall provide toxic gas sensing to UL2034 and UL2075 standards.
  - b. The combined photoelectric smoke detection / heat / CO module shall have separate sensors that adjust the detection profile in response to the input from the sensors.
  - c. The combined photoelectric smoke detection / CO module shall have selectable modes of operation for OSHA compliant toxic gas sensing, enhanced fire sensing, and nuisance alarm reduction mode.
  - d. The detector shall use only one address on the SLC.
  - e. CO sensor cartridge element shall be field replaceable.
5. (COS) Combination Smoke / Carbon Monoxide/ Strobe Detector:
- a. Multi-criteria sensor for photoelectrical smoke sensing, carbon monoxide (CO) detection, and 177 Candela strobe. Carbon monoxide electrolytic sensing module shall provide toxic gas sensing to UL2034 and UL2075 standards.
  - b. The combined photoelectric smoke detection / heat / CO module shall have separate sensors that adjust the detection profile in response to the input from the sensors.
  - c. The combined photoelectric smoke detection / CO module shall have selectable modes of operation for OSHA compliant toxic gas sensing, enhanced fire sensing, and nuisance alarm reduction mode.
  - d. The detector shall use only one address on the SLC.
  - e. CO sensor cartridge element shall be field replaceable.
6. (H) Combination Smoke / Heat Detector:
- a. Multi-criteria sensor for photoelectrical smoke sensing and rate of rise heat detection. Carbon monoxide electrolytic sensing module shall provide toxic gas sensing to UL2034 and UL2075 standards.
  - b. The detector shall use only one address on the SLC
7. (ION) Analog Ionization Type Sensor: Shall use the dual chamber ionization principle to measure smoke density and send data to the control panel representing the analog level of smoke density measured.
8. (SB) Analog Photoelectric Type Sensor with Sounder Base
9. Each smoke detector shall connect directly to an SLC loop, unless listed as stand alone.
10. Each detector shall be mounted, where shown on the drawings, on a twist-lock base with all mounting hardware provided. Provide a two-piece head/base design.
11. Each detector shall have a manual switching means to set the internal identifying code (address) of that detector, which the control panel shall use to identify its address with the type of sensor connected.
12. Dual alarm and power indicators shall be provided that flash under normal conditions and remain continuous under alarm or trouble conditions. Remote indicator terminals shall be

provided. Provide a remote LED indicator device if detector is not visible from a floor standing position.

13. A test means shall be provided to simulate an alarm condition.
14. Where operation is noted as required below 32°F and/or above 120°F, a conventional device shall be installed with a unique monitor module located in the nearest available location with maintained temperatures between 32°F and 120°F.

D. Duct Smoke Detectors, Sampling Tube Type:

1. Subscripts are used to define the device type, installation, and identify the device with a specific sequence of operation.
  - a. Device types as follows:
    - 1) # = Equipment or system
  - b. Duct-type smoke detectors shall use the same analog photoelectric sensor technology, with the same features specified for standard smoke detectors, except with additional features as specified below.
  - c. Provide sampling tubes and mounting hardware to match the duct to which it is attached. Where the detector housing is larger than the duct height, Contractor shall fabricate a mounting bracket for the detector and attach according to the fire alarm manufacturer's recommendations.
  - d. Provide a remote alarm LED indicator device (FA-241) or (FA-242) if detector is not visible from a floor-standing position. If detector is located above a suspended ceiling, mount remote indicator in ceiling directly below detector with a white single-gang faceplate labeled: Duct Smoke Detector.

E. Manual Pull Stations:

1. Manual pull station, addressable, single action with plastic breakrod, reset key lock, semi-flush mount, red high abuse plastic or cast metal construction with white lettering. Provided with all necessary mounting hardware.
2. Manual stations shall connect directly to an SLC loop. Stations shall provide address setting means using rotary decimal or DIP switches.
3. Where operation is noted as required below 32°F and/or above 120°F, a conventional device shall be installed with a unique monitor module located in the nearest available location, with maintained temperatures between 32°F and 120°F.

F. Manual Pull Stations with Cover:

1. Manual pull station, addressable, double action with plastic breakrod, reset key lock, semi-flush mount, red high abuse plastic or cast metal construction with white lettering. Provide device with clear Lexan tamper resistant cover with integral 9V battery powered alarm that sounds when shield is lifted. Provided with all necessary mounting hardware.
2. Manual stations shall connect directly to an SLC loop. Stations shall provide address setting means using rotary decimal or DIP switches.
3. Where operation is noted as required below 32°F and/or above 120°F, a conventional device shall be installed with a unique monitor module located in the nearest available location, with maintained temperatures between 32°F and 120°F.

G. Heat Detectors:

1. Subscripts are used to define the device type, installation, and identify the device with a specific sequence of operation.
  - a. Device types as follows:

- 1) Blank = Combination Rate of Rise / Fixed Temp
  - 2) AT = Attic (located in)
  - 3) F = Fixed Temp
  - 4) RC = Rate Compensated
2. Combination rate of rise and 135°F fixed temperature analog thermal type sensor. Factory programmed to alarm at 135°F and at 15°F per minute rate-of-rise. Sensor shall measure heat level and send data to the control panel representing the analog level of thermal measurement and rate-of-rise.
  3. (F) 200°F fixed temperature. Provide a remote addressable monitor module to interface with addressable system as shown on the plans.
  4. (RC) Rate Compensated
  5. Provide a two-piece head/base design, with a manual switching means to set the internal identifying code (address) of that detector, which the control panel shall use to identify its address with the type of sensor connected.
  6. Heat detectors shall connect directly to SLC loops. Where fixed temperature or explosion proof detectors are used, one monitor module may be used to monitor all detectors in one room/area as shown on the drawings.
  7. Detectors shall be mounted, where shown on the drawings, on a twist-lock base with all mounting hardware provided.
  8. Provide a remote LED indicator device if detector is not visible from a floor-standing position.
  9. Dual alarm and power indicators shall be provided that flash under normal conditions and remain continuous under alarm or trouble conditions. A connection for attachment of a remote indicator shall be provided.
  10. A test means shall be provided to simulate an alarm condition.
  11. Where operation is noted as required below 32°F and/or above 120°F, a conventional device shall be installed with a unique monitor module located in the nearest available location with maintained temperatures between 32°F and 120°F.

H. Monitor Modules:

1. Subscripts are used to define the device type, installation, and identify the device with a specific sequence of operation.
  - a. Device types as follows:
    - 1) Blank = Refer to Plans
    - 2) KB = Knox Box Monitor
2. Monitor Module shall connect directly to an SLC loop and receive power from a separate 24 VDC circuit. It shall interface initiating devices with the control panel using Style D or Style B circuits. Contractor Option: Use an interface module (2-wire operation) for Style B circuits connected to normally-open dry contacts, such as a flow switch.
3. The module shall be mounted in an enclosure located in an accessible service location as near as possible to the device(s) being monitored, or where shown on the drawings. All mounting hardware shall be provided.
4. The module shall supply the required power to operate the monitored device(s).
5. The module shall provide address setting means using rotary decimal or DIP switches.

I. Addressable Control Module:

1. Subscripts are used to define the device type, installation, and identify the device with a specific sequence of operation
  - a. Device types as follows:
    - 1) Blank = Refer to Plans

- 2) DH = Door Hold Open
- 3) PD = Hold Open Override

- 2. Relay that represents an addressable control point used primarily for the control of auxiliary devices as indicated on the drawings. Contractor to provide additional child relay(s), as required, rated for the electrical load being controlled (Contractor to match voltage, amps, etc.).
- 3. Relay shall connect directly to an SLC loop and receive power from a separate 24 VDC circuit.
- 4. The relay shall be mounted in an enclosure located in an accessible service location as near as possible to the device(s) being controlled, unless otherwise shown on the drawings. All mounting hardware shall be provided.
- 5. The relay shall supply 24 VDC power to the device(s) being controlled, unless otherwise indicated on the drawings.

J. Isolation Module:

- 1. Provide fault isolation modules or isolator detector base capable of isolating and removing the fault from Class A or Class X addressable loop data circuits while allowing the remaining data loop to continue operation. Provide isolation modules or bases between every device.

## 2.5 NOTIFICATION APPLIANCE DEVICES

A. Combination Devices: Subscripts identify combination type devices when applicable. Contractor shall provide the combination device or provide multiple device(s) to meet the functionality when the manufacturer does not offer the required functionality with a single device.

B. Notification Appliance Device(s):

- 1. Subscripts: Subscripts are used to define the device type, installation, and identify the device with a specific sequence of operation.

a. Device types as follows:

- 1) W = Weather Proof
- 2) WG = Wire guard is required
- 3) Candela Ratings:

- a) ## = 15 Candela; 30 Candela; 75 Candela; 110 Candela; 177 Candela
- b) CD = NICET designer shall select Candela rating as required to provide full coverage of the space.

C. Notification Device(s):

- 1. Wall Mounted: White housing with red lettering or pictogram.
- 2. Ceiling Mounted: White housing with red lettering or pictogram.

D. Visual Alarm Devices:

- 1. Wall or ceiling mounted, refer to plans.
- 2. High intensity (Candela rating as scheduled on the drawings) xenon strobe or equivalent under a lens. Candela rating shall be visible from exterior of the device.
- 3. The maximum pulse duration shall be 0.2 seconds with a maximum duty cycle of 40%. The flash rate shall be 1 Hz. Where more than two strobes are visible from any one location, the fire alarm visual devices shall be synchronized.
- 4. Device, housing, and backbox shall be UL listed for fire alarm/emergency applications.

5. (W) Weatherproof Visual Notification Device: High intensity strobe, square housing, 75 Candela rating, suitable for wet locations. Provide with weatherproof back box.
  - a. Mounting: Semi-flush wall.
  - b. Conduit shall not be exposed.

E. Audio (Speaker) Alarm Devices:

1. Wall or ceiling mounted, refer to plans.
2. Sound rating shall be dependent on the tap (wattage) setting. Tap settings shall be available in 3 dBA increments. A minimum of four (4) tap settings should be available to allow field adjustment of the sound output across a minimum range of 78 to 87 dBA, 400Hz to 4KHz (6 dBA cutoff) frequency range. Speakers shall operate on a 25-volt or 70-volt RMS system, unless otherwise noted on drawings.
3. Speakers shall clearly reproduce a signal consisting of a live or prerecorded human voice and with voice intelligibility.
4. Speaker, housing, and backbox shall be UL listed for fire alarm/emergency applications.
5. Wall Mounted: Speaker, square housing, flush or semi-flush mounted.
6. Ceiling Mounted: 4" speaker, round housing, flush mounted (provide tile bridge where applicable).

F. Emergency Combination Audio (Voice) and Visual Alarm Device:

1. Wall or ceiling mounted, refer to plans.
2. Combine speaker and visual components shall have a clear lens for fire alarm annunciation strobe and an amber lens for the alert strobe into a single device. Refer to the corresponding paragraphs above for requirements of each component.
3. (W) Weatherproof Voice/Visual Notification Device: Speaker with high intensity 75 Candela rated strobe. 25-volt or 70-volt VRMS with a minimum of four (4) tap settings which shall allow field adjustment of the sound output across a minimum range of 78 to 87 dBA (UL 1480), 400 Hz to 4 KHz (6dBA cutoff) frequency range.
  - a. Mounting: Semi-flush wall.
  - b. Conduit shall not be exposed.

G. Emergency Visual Alarm Device:

1. Wall or ceiling mounted, refer to plans.
2. High intensity xenon strobe or equivalent shall have a clear lens for fire alarm annunciation strobe and an amber lens for the alert strobe. Candela rating shall be visible from exterior of the device.
3. The maximum pulse duration shall be 0.2 seconds with a maximum duty cycle of 40%. The flash rate shall be 1 Hz. Where more than two strobes are visible from any one location, the fire alarm visual devices shall be synchronized.
4. Device, housing, and backbox shall be UL listed for fire alarm/emergency applications.
5. (W) Weatherproof Visual Notification Device: High intensity strobe, square housing, 75 Candela rating, suitable for wet locations. Provide with weatherproof back box.
  - a. Mounting: Semi-flush wall.
  - b. Conduit shall not be exposed.

## 2.6 DOOR HOLD-OPEN DEVICES

A. FA-270; Electromagnetic Door Holder Devices:

1. Surface wall mounted.
2. Voltage: 24VAC.
3. Holding force shall be 25 pounds minimum.



4. Provide fail-safe operation; power failure releases door.
5. Provide self-adjusting swivel catch plate with pivot points to adjust to door alignment changes.
6. Provide all hardware and wiring needed to accommodate the complete functioning door holder installation.
7. Ensure that the door hardware and trim projections are compatible with total projection of door release.
8. Provide firm anchoring for the electromagnet, such that the mounting box and device will not move independently from the wall or floor they are mounted to. This device and mounting will function as a doorstop and hold the force of the door closer mechanism.
9. Follow manufacturer's recommended installation and location instructions unless noted otherwise.
10. Electromagnetic door holder devices, housing, and back box shall be UL listed.

## **2.7 NOTIFICATION APPLIANCE CIRCUIT PANEL (NAC)**

- A. As shown on the plans or as a Contractor's option if not shown, furnish and install NAC extender panels as necessary to provide remote power supply for notification appliance circuits (NAC). Contractor shall indicate quantity and locations of each NAC on the shop drawing submittals.
- B. Each NAC shall be self-contained remote power supply with batteries, and battery charger mounted in a surface lockable cabinet. Battery capacity shall be sufficient for operation for 24 hours in a non-alarm state followed by alarm for 15 minutes, plus 25% spare capacity for future devices. Each NAC provides a minimum of up to 4 outputs, 2A continuous, or 6A full load total capacity.
- C. Power for each NAC shall be from a local 120 VAC circuit. Provide two #12 conductors and one #12 ground in 1/2" conduit to each NAC from a dedicated 20A/1P circuit breaker with a red handle and a manufacturer standard handle lock-on device. Coordinate panel and circuit number with the Architect/Engineer prior to installation.
- D. NAC extender panels may be installed only in locations coordinated with Architect/Engineer.
- E. Mounting: Surface.

## **2.8 ANNUNCIATION**

- A. Remote LCD Annunciators:
  1. Auxiliary annunciators shall indicate alarm and trouble conditions visually and audibly as shown on the drawings. Provide local TROUBLE ACKNOWLEDGE, TEST, and ALARM SILENCE capability. Minimum 80-character display.
  2. Communications and power to the annunciators shall be supervised. The annunciator shall receive power from the fire alarm control panel.
  3. A single key switch shall enable all switches on the annunciator.
  4. Mounting: Flush.
- B. Facility Management Control System (FMCS) Interface:
  1. Provide addressable relays to report the following to the FMCS via dry contact monitoring on the FMCS:
    - a. General Alarm
    - b. System Trouble
    - c. Supervisory Alarm
    - d. Other Alarms (if applicable)
  2. Provide BACnet IP interface for fire alarm panel to communicate status with the FMCS. Provide list of points and descriptions to FMCS supplier.

- a. UL listed to Standard 864. Provide RJ45 connection and cable.
- C. FA-241; Fire Alarm Remote Indicator:
- 1. Red LED type.
  - 2. Mounts flush to a single gang box.
- D. FA-242; Fire Alarm Remote Indicator and Test Switch:
- 1. Red LED type.
  - 2. Key switch test selector.
  - 3. Mounts flush to a single gang box.

## 2.9 CONNECTIONS TO AUXILIARY DEVICES PROVIDED BY OTHERS

- A. Smoke and Fire/Smoke Damper Controller:
- 1. Subscripts are used to define the device type, installation, and identify the device with a specific sequence of operation.
  - 2. Device types as follows:
    - a. + = Indicates equipment system associated with smoke or fire/smoke damper.
  - 3. Motorized type 24 VAC, furnished and installed by MC. Fire alarm control and power connections by EC. A subscript is used to identify the device with a specific air handler or zone for its sequence of operation. Refer to the Fire Alarm Operation Matrix on the drawings and the sequence of operation descriptions in this specification section for additional requirements.
  - 4. The EC provides:
    - a. Fire alarm control and power connections by EC.
    - b. Fire alarm addressable control module (FA-161) located within 5 feet of smoke damper.
    - c. Smoke detection, selected by NICET designer based on duct size, ventilation airflow, and specific field conditions. Detector shall be mounted within 5 feet of smoke damper. Approved options include:
      - 1) Smoke Detector (FA-120) (ID) In-Duct Detector. In-duct smoke detector in ducts less than 18". Detector shall be listed for use in HVAC ductwork.
      - 2) Duct Smoke Detector (FA-122). Sampling type duct detector (FA-122) in ducts 18" and larger.
    - d. Remote indicator (FA-241) or Remote Indicator with test switch (FA-242) mounted in visible location. Refer to drawings for mounting location or verify location with engineer when not shown.
    - e. The smoke damper shall close upon activation of the detector, and a supervisory signal shall be sent to the fire alarm control panel. Refer to the Fire Alarm Operation Matrix and these specifications for complete requirements.
  - 5. Provide an enclosure and equipment for interface of dampers with the fire alarm system and temperature control system.
- B. Flow Switch:
- 1. (FA-260) Connection to flow switch to monitor fire protection flow switch or discharge output contacts. Normally open dry contacts for fire alarm interface. Furnished and installed by MC; wired by EC.
  - 2. Provide a dedicated monitor switch for each sprinkler flow switch.

C. Tamper / Monitor Switch:

1. Connection to monitor switch to monitor fire protection system supervisory switches or output contacts. Normally open dry contacts for fire alarm interface. Furnished and installed by MC; wired by EC.
2. Tamper switches in the same room or system may be monitored by a single monitor switch when shown grouped on the plans.
3. Subscripts: Subscripts are used to define the device type, installation, and identify the device with a specific sequence of operation.
4. Device types as follows:
  - a. Blank = Refer to Plans
  - b. PIV = Post Indicator Valve

D. Door Hold Device:

1. Subscript: Subscripts are used to define the device type, installation, and identify the device with a specific sequence of operation.
  - a. DH - Door Hold Open
  - b. PD = Hold Open Override
2. Integral with door hardware, 24 VAC. Furnished and installed by GC. Fire alarm control and power connections by EC.
3. (PD) Hold open override connection to GC-provided power door operator. EC shall intercept the hold open switch wiring (unless specific contacts for this purpose are provided on the door) and connect addressable relay to override this switch and allow the door to close. All modifications to the power door operator shall be coordinated with the GC.

## 2.10 WIRING

- A. Fire alarm wiring/cablings shall be furnished and installed by the Contractor in accordance with manufacturer recommendations and pursuant to National Fire Codes. Cabling shall be UL listed and labeled as complying with the Electrical Code for power-limited fire alarm signal service.
- B. Fire Alarm Cable:
1. Manufacturers:
    - a. Comtran Corp.
    - b. Helix/HiTemp Cables, Inc.
    - c. Rockbestos-Suprenant Cable Corp.
    - d. West Penn Wire/CDT.
    - e. Radix.

## PART 3 - EXECUTION

### 3.1 SEQUENCES OF FIRE ALARM OPERATION

A. General:

1. Refer to the Fire Alarm Operation Matrix on the drawings for basic requirements and system operation.
2. All system output programs assigned via control-by-event equations to be activated by the particular point in alarm shall be executed, and the associated system outputs (alarm

notification appliances and/or relays) shall be activated.

B. Panel/Annunciator Alarm, Trouble, Supervisory Indication:

1. Appropriate system Alarm, Trouble, or Supervisory LED shall flash at the control panel, transponder, and annunciator locations.
2. A local signal in the control panel shall sound.
3. The LCD display shall indicate all information associated with the condition, including the name of the item, type of device and its location within the protected premises.
4. history storage equipment shall log the information associated with the fire alarm control panel (FAP) condition, along with the time and date.
5. Transmit the appropriate signal (supervisory, trouble, alarm) to the central station via the digital communicator.
6. Transmit the appropriate signal (supervisory, trouble, alarm) to the building automation system via addressable relays tied to contact monitors on the system.

C. Audible Alarms Sequence:

1. Audible alarms throughout the building shall sound.
2. Audible alarms within the floor or where the emergency signal originated floors shall sound.
3. Separate voice announcements shall be played in different fire compartments depending on proximity to the device that initiated the alarm. Refer to the requirements above for the Voice Command Center programming.

D. Visual Alarms Sequence:

1. Visual alarms throughout the building shall flash.
2. Visual alarms within the floor or fire/smoke compartment where the emergency signal originated floors shall flash.

E. Smoke Damper Control Sequence:

1. The fire alarm system shall utilize an addressable relay to open the power connection to smoke or fire/smoke dampers and allow them to close. Coordinate other requirements with damper installer.
2. Where a damper is in a main air duct, where closure of that single damper will entirely block airflow in the duct system, the smoke damper sequence shall also initiate the AHU and mechanical fan shutdown sequence for the affected unit.
3. The AHU and mechanical fan shutdown sequence shall be initiated only when ALL the dampers associated with that unit or mechanical fan are closed. Otherwise, the AHU or mechanical fan shall continue to serve other areas.
4. Smoke and fire/smoke dampers located in branch ductwork shall be closed individually or in groups, as identified on the plans.
5. All smoke and fire/smoke dampers shall be closed throughout the building.

F. AHU and Mechanical Fan Shutdown Sequence:

1. The fire alarm system shall utilize addressable relays to de-energize all AHU motor controllers and mechanical fans. Coordinate other requirements with HVAC installer.
2. The fire alarm system shall directly shut down the AHU or mechanical fan through the local HVAC control device (i.e., variable frequency drive or motor starter).
3. Where a facility has more than one AHU or mechanical fan, each shall be shutdown individually based on input from initiation devices in the area served by the unit or designated for each air distribution system.
4. All AHUs and mechanical fans shall be shutdown simultaneously throughout the building.

G. Door Holder Release Sequence:

1. The fire alarm system shall utilize an addressable relay to open the power connection to integral and magnetic door holders.
2. The fire alarm system shall utilize an addressable relay to open the 'hold' switch circuitry, integral to the power door.
3. Door holders shall release individually based on initiation devices in the vicinity of the door and noted specifically for door closure.
4. All door holders throughout the floor shall release simultaneously.

H. Elevator Recall Sequence:

1. Elevator recall sequences shall meet requirements of ASME/ANSI A17.1 and NFPA 72.
2. Upon signal from a smoke detector in the machine room, hoistway, or any elevator lobby other than the "designated level" the fire alarm shall utilize an addressable relay to signal the elevator to recall to the designated level as determined by the Authority Having Jurisdiction.
3. Upon signal from a smoke detector in the elevator lobby of the "designated level," the fire alarm system shall utilize an addressable relay to signal the elevator to recall to the "alternate level" as determined by the Authority Having Jurisdiction.
4. All elevators, throughout the building, shall be recalled simultaneously.
5. All elevators that share the same hoistway, machine room or lobby shall be recalled simultaneously. Elevators served by different machine rooms, hoistways and lobbies shall continue to operate.

I. Firefighter's Cab Visual Alarm Sequence:

1. Upon signal from a detector in the machine room or elevator hoistway, the fire alarm system shall utilize an addressable relay to signal the elevator controller to illuminate and flash the firefighters cab visual alarm.

J. Elevator Shutdown Sequence:

1. Elevator shutdown shall meet the requirements of ASME/ANSI A17.1.
2. All elevators that share the same hoistway, machine room, or lobby shall be shut down simultaneously. Elevators served by different machine rooms, hoistways, and lobbies shall continue to operate.
3. The fire alarm system shall utilize an addressable relay to energize the shunt trip of the main elevator breaker, disconnecting power to the elevator.
4. The fire alarm system shall utilize an addressable relay to de-energize the relay on the elevator power module, disconnecting power to the elevator.

### 3.2 INSTALLATION

A. Install system in accordance with manufacturer's instructions and referenced codes.

B. Fire Alarm Control Panel:

1. Install the control panel where shown on the drawings.
2. All expansion compartments, if required, shall be located at the control panel.
3. Install the voice command center and fire command center in the location as indicated on the drawings. This location should be primary fire department "attack" location. Coordinate with the local fire department prior to submitting shop drawings.
4. The fire alarm voice prerecorded messages shall be verified by the Contractor, as approved by the Owner, prior to the shop drawing submittal process.

C. Devices:

1. General:

- a. All ceiling-mounted devices shall be located where shown on the reflected ceiling and floor plans. If not shown on the reflected ceiling or reflected floor drawings, the devices shall be installed in the relative locations shown on the floor drawings in a neat and uniform pattern.
  - b. All devices shall be coordinated with luminaires, diffusers, sprinkler heads, piping and other obstructions to maintain a neat and operable installation. Mounting locations and spacing shall not exceed the requirements of NFPA 72.
  - c. Where the devices are to be installed in a grid type ceiling system, the detectors shall be centered in the ceiling tile.
  - d. The location of all fire alarm devices shall be coordinated with other devices mounted in the proximity. Where a conflict arises with other items or with architectural elements that will not allow the device to be mounted at the location or height shown, the Contractor shall notify the Architect/Engineer to coordinate a different acceptable location.
2. Per the requirements of NFPA, detector heads shall not be installed until after the final construction cleaning unless required by the local Authority Having Jurisdiction (AHJ). If detector heads must be installed prior to final cleaning (for partial occupancy, to monitor finished areas or as otherwise required by the AHJ), they shall not be installed until after the fire alarm panel is installed, with wires terminated, ready for operation. Any detector head installed prior to the final construction cleaning shall be removed and cleaned prior to closeout.
  3. Protection of Fire Alarm System:
    - a. A smoke detector shall be installed within the vicinity of the main fire alarm panel and every NAC extender panel per NFPA 72. A heat detector may be substituted when a smoke detector is not appropriate for the environment of installation.
  4. Analog Smoke and Heat Detectors:
    - a. In elevator shafts and elevator equipment rooms, provide a heat detector for elevator shutdown within 2' of every sprinkler head. Coordinate with fire protection contractor.
  5. Duct-type Analog Smoke Detectors:
    - a. Duct-type analog smoke detectors shall be installed on the duct where shown on the drawings and details. The sampling tubes shall be installed in the respective duct at the approximate location where shown on the electrical drawings to meet the operation requirements of the system.
    - b. All detectors shall be accessible.
    - c. Duct-type detectors shall be installed according to the manufacturer's instructions.
  6. In-Duct Analog Smoke Detectors:
    - a. In-duct analog smoke detectors shall be installed in the duct where shown on the drawings and details. The devices shall be installed in the respective duct at the approximate location where shown on the electrical drawings to meet the operation requirements of the system.
    - b. All detectors shall be accessible.
  7. Manual Pull Stations:
    - a. Stations shall be located where shown and at the height noted on the drawings.
  8. Addressable Relays and Monitor Modules:
    - a. Modules shall be located as near to the respective monitor or control devices as

possible, unless otherwise indicated on the drawings.

- b. All modules shall be mounted in or on a junction box in an accessible location.
- c. Where not visible from a floor standing position, a remote indicator shall be installed to allow inspection of the device status from a local floor standing location.

9. SLC Loop Isolation Modules:

- a. Isolation modules shall be installed to limit the number of addressable devices that are incapacitated by a circuit fault.
- b. Install all Isolation Modules within the fire alarm control panel, unless otherwise indicated on the drawings. Refer to the fire alarm riser diagram for requirements. Refer to the floor plans for areas served by separate isolation modules.

10. Notification Appliance Devices:

- a. Devices shall be located where shown on the drawings.
- b. Wall-mounted audio, visual and audio/visual alarm devices shall be mounted as denoted on the drawings.
- c. Where ceiling mounted visual alarm devices or combination audio/visual alarm devices are shown where the ceiling is greater than 30'-0" high, they shall be stem mounted so that the entire unit is below 30'-0". This does not apply to audio-only alarm devices.

D. Annunciators:

- 1. Remote Annunciators: The annunciators shall be located where shown on the drawings and approved by the fire marshal.

E. Wiring:

- 1. Fire alarm wiring/cabbling shall be provided by the Contractor in accordance with the manufacturer's recommendations and pursuant to National Fire Codes.
- 2. Wiring shall be installed in conduit.
- 3. Wiring shall be installed in conduit from device to above accessible ceilings. Exposed plenum-rated cable (FPLP) shall be used above accessible ceilings supported every 4 feet or run in cable trays (if applicable) maintaining a minimum of 5-inches clearance from all lighting ballasts. Fire alarm cabling shall not be installed in the same bridge rings or cable trays designated for the cabling of other systems.
- 4. All junction boxes with SLC and NAC circuits shall be identified on cover. Refer to Identification Section 26 05 13 for color and identification requirements.
- 5. Fire Alarm Power Branch Circuits: Building wiring as specified in Section 26 05 13.
- 6. Notification Appliance Circuits shall provide the features listed below. These requirements may require separate circuits for visual and audible devices.
  - a. Fire alarm temporal audible notification for all audio appliances.
  - b. Synchronization of all visual devices where two or more devices are visible from the same location.
  - c. Ability to silence audible alarm while maintaining visual device operation.
- 7. Notification Appliance Circuits shall not span floors.
- 8. Signal line circuits connecting devices shall not span floors or.
- 9. Signal line circuits connecting devices shall be provided with an isolation module at each floor separation or as otherwise shown on the drawings.
- 10. No wiring other than that directly associated with fire alarm detection, alarm or auxiliary fire protection functions shall be in fire alarm conduits. Wiring splices shall be avoided to the extent possible, and if needed, they shall be made only in junction boxes, and enclosed by plastic wire nut type connectors. Transposing or changing color coding of wires shall not be permitted. All conductors in conduit containing more than one wire shall

be labeled on each end, in all junction boxes, and at each device with "E-Z Markers" or equivalent. Conductors in cabinets shall be carefully formed and harnessed so that each drops off directly opposite to its terminal. Cabinet terminals shall be numbered and coded, and no unterminated conductors are permitted in cabinets or control panels. All controls, function switches, etc. shall be clearly labeled on all equipment panels.

- F. Fire Alarm Cabling Color Code: Provide circuit conductors with insulation color coding as follows, or using colored tape at each conductor termination and in each junction box. Where standards have been developed, these will be complied with.
  - 1. Power Branch Circuit Conductors: In accordance with Section 26 05 53.
  - 2. Signaling Line Circuit: Overall red jacket with black and red conductors.
  - 3. DC Power Supply Circuit: Overall red jacket with violet and brown conductors.
  - 4. Notification Appliance Circuit: Overall red jacket with blue and white conductors.
  - 5. Door Release Circuit: Gray conductors.
  - 6. Central Station Trip Circuit: Orange conductors.
  - 7. Central Station Fire Alarm Loop: Black and white conductors.
- G. Devices surface mounted in finished areas shall be mounted on surface backboxes furnished by fire alarm equipment supplier. Backboxes shall be painted to match device, shall be the same shape and size as the device shall not have visible knockouts.
- H. Make conduit and wiring connections to door release devices, sprinkler flow and pressure switches, sprinkler valve monitor switches, fire suppression system control panels, duct analog smoke detectors and all other system devices shown or noted on the Contract Documents or required in the manufacturer product data and shop drawings.

### 3.3 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed under provisions of Section 26 05 00.
- B. Test in accordance with NFPA 72, Chapter 14 and local fire department requirements. Submit documentation with O & M manuals in accordance with Section 14.6 of the Code.
- C. Contractor shall test and adjust the fire alarm system as follows:
  - 1. Speaker taps shall be adjusted to the lowest tap setting which achieves a sound level higher than or equal to the greatest of the following:
    - a. 70dBA.
    - b. 15 dBA above ambient levels as indicated in NFPA 72 Table A.18.4.3.
    - c. 15 dBA above measured ambient. 5 dBA above the maximum measured sound level with duration of more than 60 seconds.
    - d. As specified on the drawings.
  - 2. Sound level measurement procedure shall meet the following requirements:
    - a. All measurements shall use the 'A' weighted, dBA, sound measurement scale.
    - b. All measurements shall be taken after furnishings, wall coverings and floor coverings are in place.
    - c. All measurements shall be taken after fixed equipment (HVAC units, etc.) producing ambient noise is installed and is in operation.
    - d. Final ambient sound measurements shall be taken during occupancy and the units shall be re-adjusted at that time, if necessary.
    - e. All sound level measurements shall be taken at a height of 5' above the finished floor level.
    - f. Measurements shall be taken in every unique room. If there are multiple rooms, which have the identical dimensions and function, 10%, or a minimum of two (2)



rooms shall be tested. The results from the rooms tested shall be averaged and the remaining rooms may be adjusted per the average.

- g. Measurements shall be taken on a 20' x 20' grid and the results for all points taken shall be averaged. If the room is smaller than 20' x 20' a minimum of two measurements are required.
- h. Measurements shall be taken halfway between speakers or halfway between a speaker and the wall. No measurements shall be taken at the extreme edges of the room, nor directly under speakers.

### **3.4 MANUFACTURER FIELD SERVICES**

- A. Provide manufacturer field services under provisions of Section 26 05 00.
- B. Include services of certified technician to supervise installation, adjustments, final connections, and system testing.
- C. Note that room numbers depicted on the architectural/engineering drawings will not necessarily reflect the actual room (signage) numbers that the Owner selects. Contractor and fire alarm manufacturer shall coordinate the actual room numbers as the Owner directs to identify each device. This list shall be a part of the floor plan record drawing to be turned in at the project closeout.
- D. Include the services to train up to three of the Owner's staff in operation, maintenance, and programming of the fire alarm system at the manufacturer's factory. Airfare and lodging expenses for the Owner's staff will be by the Owner.
- E. System Occupancy Adjustments: When requested by Owner within 12 months of date of Substantial Completion, provide on-site system adjustments to suit actual occupied conditions. For this purpose, provide up to two (2) site visits, four (4) hours each visit, outside normal occupancy hours.

### **3.5 SYSTEM TRAINING**

- A. System training shall be performed under provisions of Section 26 05 00.
- B. Minimum on-site training times shall be:
  - 1. System Operators: One (1) day.

**END OF SECTION**

# SECTION 01 32 23 SURVEY AND LAYOUT DATA

## PART 1 GENERAL

### 1.01 GENERAL

- A. The requirements and provisions for engineering and layout of survey and layout data are as specified in the General Conditions and as supplemented herein.
- B. Topography and profiles showing existing ground elevations and culture were obtained by topographic survey.
- C. The Contractor shall hire the Engineer/Surveyor to furnish construction staking to prosecute the Work as described below. The Contractor shall make timely demands of the Engineer/Surveyor for such staking. The Contractor shall provide advance written notice of not less than three working days for setting stakes.
  1. Benchmarks for elevation will be provided in close proximity to site.
  2. Stakes showing sanitary sewer and storm sewer grade lines will be provided, at an offset as agreed to by the Contractor, at intervals of not less than 50 feet. Water lines will be staked for alignment at 100 ft stations. All stakes will be set an offset as agreed by the Contractor.
  3. Storm MH and bends water curb stops will be staked.
  4. Concrete curb & gutter/curbing, concrete sidewalk and pavement shall be staked at 25 foot intervals and at all changes in grade or line and will include radius stakes.
  5. The subgrade and base course for the parking lots and other areas shall be blue topped at an interval as agreed upon between the Engineer and the Contractor.
  6. The contractor shall be responsible for transferring from benchmarks, grade and line stakes all distances and elevations necessary for the execution of the work.
  7. The Contractor may request additional staking at the Pre-Construction Conference. Should the Contractor request the setting of stakes in excess of those described above, after the Pre-Construction Conference, the Contractor shall be responsible for the extra cost, which will be prorated on the basis of the total number of stakes set.
  8. **Electronic files can be made available for use with a Contractor's GPS system. Contractor will be responsible for the extra cost which Helms and Associates puts into preparing these files for their use and for any additional control points set by Helms and Associates personnel.**

- D. The Contractor shall preserve all construction stakes, reference points, and other survey points. In case of their loss or destruction, the Contractor shall be liable for and charged with the cost of their replacement and of any expense resulting from their loss or disturbance. Such surveys shall constitute instruction from the Engineer, and the Contractor shall not proceed with the Work until construction stakes have been provided.
- E. Should the Owner's representative be required to reset construction stakes, the cost for such resetting will be at the then current per diem rates. The charges for such Work will be deducted from the progress payments for the Contractor for the month in which the surveying Work is done by the Owner and thereon paid to the Owner's representative.

\* \* \* END OF SECTION \* \* \*

# **SECTION 02 01 00 MAINTENANCE OF EXISTING CONDITIONS**

## **PART 1 GENERAL**

### 1.01 RELATED DOCUMENTS

- A. The general provisions of the contract, including General and Supplementary Conditions shall apply to the Work covered in this Section.

### 1.02 SCOPE

- A. This Section describes, but is not limited to, the relationship of the Project to existing underground utilities and the Work associated with the location, adjustment, and repair of underground utilities.
- B. The information and data relative to existing underground utilities are provided to assist the Contractor with the preparation of his bid. This information should not be used by the Contractor for reference during construction of the Work.

## **PART 2 PRODUCTS - NOT USED**

## **PART 3 EXECUTION**

### 3.01 GENERAL

- A. Existing underground utilities, as shown on the drawings, are located in accordance with available data, but locations may vary and cannot be guaranteed. The exact locations shall be determined by each Contractor as the Work proceeds. Excavation work shall be done carefully so as to avoid damaging the existing utilities and Work.
- B. Each Contractor shall provide for protection, temporary removal and replacement or relocation of obstructions as required for the performance of this Work required in these contract documents.
- C. Other obstructions not shown on the plans and requiring relocation shall be exposed by the Contractor without injury; or if injured, shall be repaired by Contractor at his expense. Removal of such obstruction or its relocation shall be made by the Contractor according to the provisions of the General Conditions.

### 3.02 UTILITY CONTACT

- A. Prior to Work in a specific area affecting underground utilities, the following individuals shall be notified as appropriate:
- B. All above utilities, excepting water, may be located utilizing the South Dakota One Call Notification Center:

(Locate Phone Number)      1-800-781-7474

(Admin. Phone Number)      1-800-422-1242

C. The failure of any utility to be present for any reason, at the Pre-Construction Conference, if held, shall not relieve the Contractor of any responsibility described herein.

### 3.03 UTILITY REPAIR:

- A. When an underground utility is exposed or damaged, the Contractor shall comply with the repair requirements of the affected utility.
- B. When an underground utility is exposed, the Contractor shall compact the backfill beneath the exposed utility before completion of the backfill operation.

### 3.04 SANITARY/STORM SEWER AND WATER MAIN SEPARATION:

- A. Horizontal Separation - Sewers shall be laid at least 10 feet (3.0 m) horizontally from any existing or proposed watermain. The distance shall be measured edge to edge. In cases where it is not practical to maintain a 10 foot (3.0 m) separation, the Department may allow deviation on a case-by-case basis, if supported by data from the design engineer. Such deviation may allow installation of the sewer closer to a watermain, provided that the watermain is in a separate trench or on an undisturbed earth shelf located on one side of the sewer and at an elevation so the bottom of the watermain is at least 18 inches above the top of the sewer.
- B. If it is impossible to obtain proper horizontal separation as described above, both the watermain and sewer shall be constructed of slip-on or mechanical joint pipe complying with public water supply design standards of the Department and be pressure tested in accordance with AWWA standards to assure water tightness before backfilling.

### 3.05 Vertical Separation

- A. Sewers Crossing Under Watermains - The sewer shall be laid to provide a minimum of 18 inches from the top of the sewer to the bottom of the watermain. The crossing shall be arranged so the sewer joints will be equidistant and as far as possible from the watermain.
- B. Sewers Crossing Over Watermains - Either the watermain or the sewermain must be encased in a watertight carrier pipe that extends 10 feet (3.0 m) on both sides of the crossing, measured perpendicular to the watermain. The carrier pipe shall be PVC, ABS, or HDPE, and the ends sealed with a rubber gasket or boot.
- C. Special Conditions - When it is impossible to obtain the proper horizontal and vertical separation as stipulated above, one of the following methods shall be specified:
- D. Water Pipe - The sewer shall be designed and constructed equal to water pipe and shall be pressure tested in accordance with AWWA standards prior to backfilling to assure water tightness; or;
- E. Carrier Pipe - Either the watermain or the sewermain may be encased in a watertight carrier pipe that extends 10 feet (3.0 m) on both sides of the crossing, measured perpendicular to the watermain. The carrier pipe shall be PVC, ABS, or HDPE, and the ends sealed with a rubber gasket or boot.

### 3.06 Storm Sewer Requirements:

- A. A reinforced concrete pipe (RCP) storm sewer may cross below a watermain with a separation of less than 18 inches or at any height above a watermain provided the joints on

the RCP within 10 feet of either side of the watermain are assembled with:

- B. Preformed butyl rubber sealant meeting federal specification #SS-S-210A and AASHTO M 198, and each of these joints are encased with a minimum 2-foot wide by 6-inch thick concrete collar centered over the joint and reinforced with the equivalent steel area as that in the RCP. Encasement of the watermain will not be required when the RCP joints are collared within the 20-foot section.
- C. An O-ring that conforms to ASTM C 443 specifications. O-rings are manufactured for concrete pipe with diameters up to 18 inches.
- D. A strip of impermeable material held in place with stainless steel bands and tested to 5 psi prior to the storm sewer being put into use.
- E. There shall be at least a 10-foot horizontal separation between watermains and sanitary sewer forcemains. There shall be an 18-inch vertical separation at crossings as required in paragraphs B and C.

#### **PART 4 MEASUREMENT AND PAYMENT**

##### 4.01 METHOD OF MEASUREMENT

- A. The cost to repair any underground utilities or other obstructions damaged by the Contractor's activities shall be considered incidental Work with no separate measurement made.

##### 4.02 BASIS OF PAYMENT

- A. The cost to repair any underground utilities or other obstructions damaged by the Contractor's activities shall be considered incidental Work with no separate and payment to be made.

\* \* \* END OF SECTION \* \* \*



# SECTION 02 30 00 SUBSURFACE INVESTIGATION

## PART 1 GENERAL

### 1.01 RELATED DOCUMENTS

- A. The general provisions of the contract, including General and Supplementary Conditions and the provisions of Division I, General Requirements, apply to the work specified in this section.

### 1.02 SCOPE AND DESCRIPTION

- A. The Contractor shall accept the project site in its present condition. He shall do all clearing, demolition and relocation, excavation, filling, backfilling, and grading necessary for the construction of all structures, piping, embankments, driveways, pond piping, miscellaneous structures, and all required utility construction in accordance with these specifications and in conformity with the dimensions and finished grades as shown on the plans. Excavation shall include removal of rock, dewatering, sheeting, and shoring as necessary to provide space for the required construction procedures.
- B. Unless otherwise required, the Contractor shall return all areas disturbed by him to their original grade and seed or sod in accordance with the specifications.

### 1.03 SOIL INFORMATION

- A. **A soils investigation was completed by Soil Technologies of Mobridge, SD. The soil boring & report can be viewed at the office of Hems and Associates, NSU, Co-Op or they can be sent electronically if requested.**
- B. The samples tested are not guaranteed to be indicative of any ground except at the particular and exact location of the sample. No claim shall be made or be considered resulting from any deviations from the sample test data. This information is made available to the Contractor for his own use and is in no event considered as a part of the contract.
- C. It shall be the Contractor's responsibility to determine to his own satisfaction the location and nature of all surface and sub-surface obstacles and the soils and water conditions which will be encountered during the construction of the treatment facility associated structures and piping.
- D. Additional test borings and other exploratory operations as may be desired may be made by the Contractor at no cost to the Owner.



\*\*\* END OF SECTION \*\*\*

# SECTION 03 11 00 CONCRETE FORMWORK

## PART 1 GENERAL

### 1.01 RELATED DOCUMENTS

- A. The general provisions of the contract, including General and Supplementary Conditions, apply to the work specified in this section.
- B. Related Work specified elsewhere:
  - 1. Concrete Reinforcement - Section 03 20 00
  - 2. Concrete Joints and Water Stop - Section 03 15 00
  - 3. Cast-in-place Concrete - Section 03 30 00

### 1.02 DESCRIPTION OF WORK

- A. The extent of formwork is indicated by the concrete structures shown on the drawings.
- B. The work includes providing of the form work and shoring for cast-in-place concrete, and installation into formwork of items required such as anchor bolts, setting plates, bearing plates, anchorages, inserts, frames, nosings, and other items to be embedded in concrete (but not including reinforcing steel).

### 1.03 QUALITY ASSURANCE

- A. Examine the substrate and the conditions under which concrete formwork is to be performed. Do not proceed with the work until unsatisfactory conditions have been corrected.
- B. Codes and Standards: Unless otherwise shown or specified, design, construct, erect, maintain, and remove forms and related structures for cast-in-place concrete work in compliance with the American Concrete Institute standard ACI 34, "Recommended Practice for Concrete Formwork."
- C. Allowable Tolerances: Construct formwork to provide completed cast-in-place concrete surfaces complying with the tolerances specified in ACI 347, and as follows:
  - 1. Variation from plumb in lines and surfaces of columns, piers, walls, and arises; 1/4-inch per 10-foot, but not more than 1-inch total. For exposed corner columns, control joint grooves, and other conspicuous lines, 1/4-inch in any bay or 20 feet maximum; 1/2-inch maximum in 40 feet or more.
  - 2. Variation from level or grade in slab soffits, ceilings, beam soffits, and in arises 1/4-inch in 10 feet, 3/8-inch in any bay or 20 feet maximum and 3/4-inch in 40 feet or more. For exposed lintels, sills, parapets, horizontal grooves, and other conspicuous lines, 1/4 inch in any bay or 20 feet maximum, and 1/2-inch in 40 feet or more.
  - 3. Variation from position of the linear building lines and related columns, walls, and partitions, 1/2-inch in any bay or 20 feet maximum and 1-inch in 40 feet or more.
  - 4. Variation in sizes and locations of sleeves, floor openings, and wall openings, 1/4-inch.

5. Variation in cross sectional dimensions of columns and beams and thickness of slabs and walls, minus ¼-inch and plus ½-inch.
  6. Variations in footings plan dimensions, minus ½-inch and plus 2-inch misplacement or eccentricity, 2% of the footing width in direction of misplacement but not more than 2-inch thickness reduction, minus 5%.
  7. Variation in steps: in a flight of stairs, 1/8-inch for rise and ¼-inch for treads; in consecutive steps, 1/16-inch for rise and 1/8-inch for treads.
- D. Before concrete placement, check the lines and levels of erected formwork. Make corrections and adjustments to ensure proper size and location of concrete members and stability of forming systems.
- E. During concrete placement, check formwork and related supports to ensure that forms are not displaced and that completed work will be within specified tolerances.

## **PART 2 PRODUCTS**

### 2.01 FORM MATERIALS

- A. Unless otherwise shown or specified, construct formwork for exposed concrete surfaces with plywood, metal, metal-framed, plywood-faced, or other panel type materials acceptable to Engineer to provide continuous, straight, smooth, as-cast surfaces. Furnish in largest practicable sizes to minimize number of joints. Provide form material with sufficient thickness to withstand pressure of newly placed concrete without bow or deflection.
- B. Form concrete surfaces, which will be unexposed in the finished structure with plywood, lumber, metal, or other acceptable material. Provide lumber that is dressed on at least two edges and one side for tight fit.
- C. Form ties shall be of removable end, permanently embedded body type and shall have sufficient strength and rigidity to support and maintain the form in proper position and alignment without the use of auxiliary spreaders. Unless otherwise shown, cones shall be provided on the outer ends of each tie and the permanently embedded portion shall be at least 1-inch back from the concrete face. Form ties for water bearing walls shall be provided with water seal washers located on the permanently embedded portions of the ties at the approximate center of the wall. Permanently embedded portions of form ties that are not provided with threaded ends shall be constructed so that the removable ends are readily broken off without damage to the concrete. The type of form ties used shall be acceptable to the Engineer. Form ties fabricated on the project site and the wire ties are not acceptable.
- D. Provide commercial formulation form-coating compounds that will not bond with, stain, nor adversely affect concrete surfaces and will not impair subsequent treatment of concrete surfaces requiring bond or adhesion, nor impede the wetting of surfaces to be cured with water or curing compounds.
- E. Provide metal inserts for anchorage of materials or equipment to concrete construction not supplied by other trades and as required for the work.

## 2.02 FORMS FOR PAVEMENT, SIDEWALK, AND CURB & GUTTER

- A. Forms shall have a depth not less than the prescribed edge thickness of the pavement. Built up forms with horizontal joints shall not be used.
- B. When staked in place, forms shall withstand the pressure of the concrete and the impact and vibration of any equipment they are required to support, without significant springing, settlement, or lateral displacement.
- C. Bent, twisted, or broken forms and those with battered top surfaces shall be removed from the work. Repaired forms shall not be used until inspected and approved.
- D. The top face of any form shall not vary from a true plane by more than 1/8-inch in 10 feet, nor shall the contact face of a straight form vary from a true plane by more than 1/4-inch in 10 feet.
- E. Straight forms shall be metal having a thickness of not less than 1/4-inch and shall be furnished in sections not less than 10 feet in length. Each section shall have provisions for locking together the ends of abutting sections. Straight forms shall have a base width of at least eight inches with flange braces extending outward on the base at least 2/3 the height of the form.
- F. Flexible or curved forms of proper radius shall be used for curves of 100-foot radius or less. Flexible or curved forms shall be of an acceptable design.

## 2.03 DESIGN OF FORMWORK

- A. Design, erect, support, brace, and maintain formwork so that it will safely support vertical and lateral loads that might be applied, until such loads can be supported by the concrete structure. Carry vertical and lateral loads to ground by formwork system and in-place construction that has attained adequate strength for that purpose. Construct formwork so that concrete members and structures are of correct size, shape, alignment, elevation, and position.
- B. Design forms and false work to include assumed values of live load, dead load, weight of moving equipment operated on formwork, concrete mix, height of concrete drop, vibrator frequency, ambient temperature, foundation pressures, stresses, lateral stability, and other factors pertinent to safety of structure during construction.
- C. Provide shores and struts with positive means of adjustment capable of taking up formwork settlement during concrete placing operations, using wedges or jacks or a combination thereof. Provide trussed supports when adequate foundations for shores and struts cannot be secured.
- D. Support form facing materials by structural members spaced sufficiently close to prevent deflection. Fit forms placed in successive units for continuous surfaces to accurate alignment, free from irregularities and within allowable tolerances. Provide camber in formwork as required for anticipated deflections due to weight and pressures of fresh concrete and construction loads for long span members without intermediate supports.
- E. Provide temporary openings in wall forms, column forms and at other locations necessary to permit inspection and cleanout.

- F. Design formwork to be readily removable without impact, shock, or damage to cast-in-place concrete surfaces and adjacent materials.
- G. Provide formwork sufficiently tight to prevent leakage of cement paste during concrete placement. Solidly butt joints and provide backup material at joints as required to prevent leakage and fins.
- H. Side forms of footings may be omitted and concrete placed directly against excavation only when requested by Contractor and accepted by Engineer. When omission of forms is accepted, provide additional concrete required beyond the minimum design profiles and dimensions of the footings as detailed.

### **PART 3 EXECUTION**

#### **3.01 FORM CONSTRUCTION**

- A. Construct forms complying with ACI 347, to the exact sizes, shapes, lines, and dimensions shown and as required to obtain accurate alignment, location, grades, level and plumb work in finished structures. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required. Use selected materials to obtain required finishes.
- B. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where the slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyways, reglets, recesses, and the like, to prevent swelling and assure ease of removal.
- C. Provide temporary openings where interior area of formwork is inaccessible for cleanout, for inspection before concrete placement, and for placement of concrete. Brace temporary closures and set tightly to forms to prevent loss of concrete mortar. Locate temporary openings on forms in as inconspicuous location as possible, consistent with project requirements.
- D. Form intersecting planes to provide true, clean cut corners, with edge grain of plywood not exposed as form for concrete.
- E. Provide openings in forms to accommodate other work, including mechanical and electrical work. Accurately place and securely support items required to be built into the forms.
- F. False work:
  - 1. Erect false work and support, brace, and maintain it to safely support vertical, lateral, and asymmetrical loads applied until such loads can be supported by in-place concrete structures. Construct false work so that adjustments can be made for take-up and settlement.
  - 2. Provide wedges, jacks, or camber strips to facilitate vertical adjustments. Carefully inspect false work and formwork during and after concrete placement operations to determine abnormal deflection or signs of failure; make necessary adjustments to produce work of required dimensions.
- G. Forms for Exposed Concrete:

1. Drill forms to suit ties used and to prevent leakage of concrete mortar around tie holes. Do not splinter forms by driving ties through improperly prepared holes.
2. Do not use metal cover plates for patching holes or defects in forms.
3. Provide sharp, clean corners at intersecting planes, without visible edges or offsets. Back joints with extra studs or girts to maintain true, square intersections.
4. Use extra studs, walers, and bracing to prevent bowing of forms between studs and to avoid bowed appearance in concrete. Do not use narrow strips of form material that will produce bow.
5. Assemble forms so they may be readily removed without damage to exposed concrete surfaces.
6. Form molding shapes, recesses, and projections with smooth finish materials, and install in forms with sealed joints to prevent displacement.

#### H. Corner Treatment:

1. Form exposed corners of beams and columns to produce square, smooth, solid, unbroken lines, except as otherwise shown.
2. Form chamfers with  $\frac{3}{4}$  inch x  $\frac{3}{4}$  inch strips unless otherwise shown, accurately formed and surface to produce uniformly straight lines and tight edge joints. Extend terminal edges to the required limit and miter chamfer strips at changes in direction.
3. Unexposed corners may be formed either square or chamfered.

#### I. See Section 03 15 00 for treatment of control and construction joints. Locate as indicated.

#### J. Provide openings in concrete formwork to accommodate work of other trades, including those under separate prime contracts (if any). Size and location of openings, recesses, and chases are the responsibility of the trade requiring such items. Accurately place and securely support items to be built into forms.

#### K. Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, or other debris just before concrete is to be placed. Retighten forms immediately after concrete placement as required to eliminate mortar leaks.

### 3.02 FORM COATINGS

#### A. Coat form contact surfaces with form-coating compound before reinforcement is placed. Do not allow excess form coating material to accumulate in the forms or to come into contact with surfaces that will be bonded to fresh concrete. Apply in compliance with manufacturer's instructions.

#### B. Coat steel forms with a non-staining, rust preventative form oil or otherwise protect against rusting. Rust-stained steel formwork is not acceptable.

### 3.03 INSTALLATION OF EMBEDDED ITEMS

#### A. Set and build into the work anchorage devices and other embedded items required for other work that is attached to, or supported by, cast-in-place concrete. Use setting drawings, diagrams, instructions, and directions provided by suppliers of the items to be attached thereto.

- B. Set edge forms or bulkheads and intermediate screed strips for slabs to obtain required elevations and contours in the finished slab surface. Provide and secure units to support types of screeds required.

### 3.04 REMOVAL OF FORMS

- A. Formwork not supporting concrete, such as sides of beams, walls, columns, and similar parts of the work that may be removed after cumulatively curing at not less than 50 degrees F for 24 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form removal operations and provided that curing and protection operations are maintained.
- B. Formwork supporting weight of concrete, such as beam soffits, joists, slabs, and other structural elements may not be removed in less than 14 days and not until concrete has attained design minimum 28-day compressive strength.
- C. Form facing material may be removed 4 days after placement, only if shores and other vertical supports have been arranged to permit removal of form facing material without loosening or disturbing shores and supports.

### 3.05 RE-USE OF FORMS

- A. Cleaned and repaired surfaces of forms may be re-used in the work. Split, frayed, delaminated or otherwise damaged form facing material will not be acceptable. Apply new form coating compound material to concrete contact surfaces as specified for new formwork.
- B. When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close all joints. Align and secure joints to avoid offsets. Do not use "patched" forms for exposed concrete surfaces.

\* \* \* END OF SECTION \* \* \*

# SECTION 03 15 00 CONCRETE JOINTS AND WATERSTOPS

## PART 1 GENERAL

### 1.01 RELATED DOCUMENTS

- A. The general provisions of the contract, including General and Supplementary Conditions, apply to the work specified in this section.
- B. Related Work Described Elsewhere:
  - 1. Concrete Formwork: 03 11 00
  - 2. Concrete Reinforcement: 03 20 00
  - 3. Cast-in-place Concrete: 03 30 00

### 1.02 DESCRIPTION OF WORK

- A. The extent of each type of concrete joint and waterstop required on foundation walls is shown on the drawings.

### 1.03 SUBMITTALS

- A. Manufacturer's catalog data and installation instructions.
- B. Certificate of compliance that waterstops meet or exceed physical property requirements of referenced specification.

## PART 2 PRODUCTS

### 2.01 PREFORMED EXPANSION JOINT FILLER

- A. Preformed, non-extruding-type joint filler constructed of closed cell polyethylene foam of firm texture. Conform to ASTM D1752, Sections 3.1 to 3.4.

### 2.02 WATERSTOP

- A. Waterstop shall be extruded from virgin elastomeric PVC compound, resistant to chemical action with Portland cement, alkalis, acids, and fungi. Waterstop shall conform to Corps of Engineers CRD-C 572 and the following physical characteristics:

#### **Physical Property Value Test Method**

#### **Sheet Material:**

Tensile Strength, 2,100 psi ASTM D 412

Ultimate Elongation, 360 % ASTM D 412

Low Temperature Brittleness, -35 deg. F max ASTM D 746

Stiffness in Flexure, 750 psi min ASTM D 747

#### **Finished Waterstop:**

Tensile Strength, unaged 1750 psi min ASTM D412



Durometer Shore Hardness  $70 \pm 5$  ASTM D1706

Ultimate Elongation, unaged 350% ASTM D412

- B. All waterstop shall be No 6380 as manufactured by W.R. Meadows, Serviced/Durajoint Type No. 5 as manufactured by W.R. Grace and company, or approved equal.

### 2.03 JOINT MATERIAL

- A. All joint material in contact with potable water shall meet requirements of the SD Dept of Environment & Natural Resources and be safe for use with a drinking water supply.
- B. The backer rod shall be a non-moisture absorbing, resilient material approximately 25 percent larger in diameter than the width of the joint to be sealed. The backer rod shall be compatible with the sealant and no bond or reaction shall occur between the rod and the sealant.
- C. Hot Poured Elastic Joint Sealer: The sealant shall conform to the requirements of ASTM D3405. The manufacturer shall furnish a certificate of compliance for the material.
- D. Low Modulus Silicone Sealant: Low modulus silicone sealant shall be furnished in a one-part silicone formulation. The sealant must meet the following requirements:

TEST	LIMIT	TEST METHOD
Tack Free Time	20-75 minutes	MIL S 8802
Specific Gravity	1.010-1.515	ASTM D792 (Method A)
Durometer Hardness Type A: [Cured 7 days at $77^{\circ}\text{F} \pm 3^{\circ}$ ( $25^{\circ}\text{C} \pm 2^{\circ}$ ) and 45% to 55% R.H.]	10-25 $0^{\circ}\text{F}$ ( $-18^{\circ}\text{C}$ )	ASTM D2240
Tensile Stress: [at 150% elongation, 7 day (Die C) cure at $77^{\circ}\text{F} \pm 3^{\circ}$ ( $25^{\circ}\text{C} \pm 2^{\circ}$ ) and 45-55% R.H.]	45-psi (310 kPa) max.	ASTM D412
Elongation: [7 day cure at $77^{\circ}\text{F} \pm 3^{\circ}$ ( $25^{\circ}\text{C}$ (Die C) $\pm 2^{\circ}$ ) & 45-55 R.H.]	1000% min.	ASTM D412
Shelf Life	6 month minimum from date of manufacture	
Ozone & Ultra Violet Resistance	No chalking, cracking or bond loss after 5000 hrs.	
Movement capability and adhesion [7 day cure in air $77^{\circ}$	No adhesive or cohesive failure, * all 3 specimens must	

TEST	LIMIT	TEST METHOD
F $\pm 3^\circ$ (25° C $\pm 2^\circ$ )	exceed 500% extension at 0° F (-18° C)	
Bond to Concrete Mortar Concrete briquettes [air cured 7 days at 77°F $\pm 3^\circ$ □ (25° C $\pm 2^\circ$ )]	50 psi (345 kPa) min. 0° F (-18°C)	AASHTO T132**

\* Prepare the specimens using 1" x 2" x 3" (25 mm x 50 mm x 75 mm) concrete blocks made in accordance with ASTM D3407. A sawed face shall be used for bond surface. Seal two inches (50 mm) of block leaving ½ inch (13 mm) on each end of specimen unsealed. The depth of sealant shall be 3/8-inch (10 mm) and the width ½-inch (13 mm). Subject the sealant to movement at a rate of two inches (50 mm) per minute until failure.

\*\* Briquettes molded in accordance with AASHTO T132 sawed in half and bonded with approximately 10 mils (0.25 mm) of sealant and tested using clips meeting AASHTO T132. Briquettes shall be dried to constant weight in oven 100°C  $\pm 5^\circ$ . They shall be tested in tension at a loading rate of 0.3 inches (7.6 mm) per minute.

### **PART 3 EXECUTION**

#### **3.01 CONSTRUCTION JOINTS**

- A. Place construction joints only where shown. In case of a breakdown in concrete placement, form the resulting unscheduled joint in the same orientation as the joints shown on the drawings for similar portions of the structure and include the key, waterstop, and additional reinforcing as may be required for the design function of the structure.
- B. After the concrete has hardened on one side of a construction joint and before placing the next concrete pour, remove the surface laitance and clean exposed surface by dry sandblasting. The sand blasted, roughened joint shall leave sound, exposed aggregate with a surface roughness of 0.2-inch  $\pm$  0.1-inch. Just prior to placing the new concrete, coat the horizontal construction joint with a 2-inch layer of cement mortar and spread uniformly and work into all irregularities of the surface. Use cement mortar of the same mixture as the structural concrete but with the coarse aggregate omitted. The mortar shall not exceed the water-cement ratio of the concrete to be placed on it and the consistency shall be suitable for placing and working. Wet the vertical surface to be joined at a construction joint and use additional spading and vibrating to prevent voids.
- C. Key construction joints unless otherwise shown. Form keyways with beveled strips or boards placed at right angles to the direction of shear. Make keyways at least 1.5 inch in depth over at least 25% of the area of the section. When necessary to make a joint because of a breakdown or emergency, place reinforcing dowels across the joint. Embed dowels 40 bar diameters on each side of the joint. Match reinforcing in size and number.
- D. Provide isolation joints in slabs on ground at all points of contact between slabs on ground and vertical surfaces such as column pedestals, foundation walls, grade beams, and elsewhere as indicated.

#### **3.02 JOINTS WITH JOINT SEALANT**

- A. On structures or surfaces, which require joint sealant, do not remove the material for forming the groove in the concrete until the concrete is cured. Upon removing the groove form,

sandblast the groove, allow it to dry, then place the primer, backup rod, and sealant into the clean groove in accordance with the manufacturer's recommendations. Prior to sealant application, the manufacturer's representative shall demonstrate joint preparation, priming, and sealant materials for the personnel performing joint work. Groove form material shall be installed prior to concrete placement.

- B. Place construction joints perpendicular to the main reinforcement. Continue all reinforcement across construction joints. Construction joints in water holding structures shall be provided with a half inch beveled notch on the inside surface provided for caulking the joints.

### 3.03 CONCRETE PAVEMENT JOINTS

- A. Immediately after sawing the joints to their final configuration, the resulting slurry shall be completely removed from the joint and the immediate area by flushing with a jet of water and other tools as necessary. Curing membrane damaged or protective cover removed during the sawing operation shall be repaired or replaced by the Contractor as directed by the Engineer at no cost to the Owner.
- B. Longitudinal Sawed Joints: Deformed steel tie bars shall be placed perpendicular to the longitudinal joints by approved methods. Tie bars shall not be painted or coated with asphalt or other material, or enclosed in tubes or sleeves. Longitudinal sawed joints shall be cut to the dimensions specified. Suitable guidelines or devices shall be used to assure cutting the joint to a true line. The joint shall be cured a minimum of 24 hours before sawing. The sawed joint will not require reapplication of curing compound. The joint shall be sealed as required in Section 03 15 00.
- C. Longitudinal Construction Joints: When adjacent lanes of pavement are constructed separately, a keyway shall be formed along the construction joint. When deformed steel tie bars are required, they may be bent at right angles for the first lane constructed and straightened into final position before the concrete of the adjacent lane is placed. Tie bars shall conform to Section 03 15 00, except that rail steel shall not be used for tie bars that are to be bent and restraightened. The longitudinal construction joint shall be sawed shortly after the end of the curing period and shall be sealed as required in Section 03 15 00.
- D. Transverse Contraction Joints: Transverse contraction joints shall be created by sawing. Sawing shall commence when the concrete has hardened sufficiently to permit sawing without raveling. Joints shall be sawed before uncontrolled shrinkage cracking takes place. If necessary, the sawing operations shall be carried on both day and night, regardless of weather conditions. The sawed joint will not require reapplication of curing compound.
- E. The sawing of a joint shall be omitted if a crack occurs at or near the joint location prior to the time of sawing. Sawing shall be discontinued when a crack develops ahead of the saw. Any procedure which results in premature and uncontrolled cracking shall be revised immediately by adjusting the sequence of cutting the joints or the time interval involved between the placing of the concrete or removal of curing media and the cutting of joints.
- F. Repair or correction of uncontrolled cracks shall be as directed by the Engineer and at the expense of the Contractor.
- G. Longitudinal random cracks penetrating the full depth of the pavement shall be grooved and sealed. The top of the crack shall be grooved to a minimum depth of  $\frac{3}{4}$  inch (20 mm) and to

a width of not less than 3/8 inch (10 mm) nor more than 5/8 inch (16 mm) by means of a router. The router shall be capable of following the path of the crack and widening the top of the crack to the required dimensions without spalling or damaging the concrete. Loose and fractured concrete shall be removed and the groove shall be thoroughly cleaned and sealed.

- H. For PCC Pavement with no load transfer across the contraction joint (dowel bar assemblies are not required), the following shall apply:
1. When a transverse random crack terminates in or crosses a transverse contraction joint, the uncracked portion of the joint shall be filled with epoxy-resin mortar and the crack shall be routed and sealed in accordance with Section 03 15 00.
  2. Where a transverse random crack parallels the planned contraction joint and is within a distance of five feet (1.5 meters) from the contraction joint in the pavement, the crack shall be routed and sealed in accordance with Section 03 15 00, and the joint shall be filled with epoxy resin mortar.
  3. When a transverse random crack is more than five feet (1.5 meters) from the nearest contraction joint in the pavement, the joint and the crack shall be sealed in accordance with Section 03 15 00. Joints to be filled with epoxy resin mortar shall be thoroughly cleaned.
- I. For PCC Pavement with load transfer across the contraction joint (dowel bar assemblies are required), the following shall apply:
1. When a transverse random crack parallels the planned contraction joint and is more than five feet (1.5 meters) from the contraction joint, the crack shall be routed, the backer rod installed, and sealed with silicone according to Section 03 15 00.
  2. When a transverse random crack parallels the planned contraction joint and is less than five feet (1.5 meters) from the contraction joint, the pavement shall be sawed full depth, removed, and replaced. Load transfer across the contraction joint shall be re-established.
  3. When a transverse random crack intersects or parallels a planned transverse contraction joint and is less than four inches (100 mm) from the planned contraction joint for more than 50 percent of the lane width, the crack shall be routed, the backer rod installed, and sealed with silicone in accordance with Section 03 15 00.
  4. When a transverse random crack intersects or parallels a planned transverse contraction joint and is more than four inches (100 mm) from the planned contraction joint for more than 50 percent of the lane width, the pavement shall be sawed full depth, removed, and replaced. Load transfer across the contraction joint shall be re-established.

#### 3.04 SEALING CONCRETE PAVEMENT

- A. Joints shall be sealed with hot-poured elastic joint sealer or low modulus silicone sealant as specified. Joints shall be sealed immediately after completion of the curing period, before the pavement is opened to traffic.
- B. Joint grooves with spalls greater than ½ inch (13 mm) in depth shall be patched with an approved epoxy mortar. All loose concrete shall be removed from the spalled area and the spalled surface shall be thoroughly cleaned. After cleaning, the spalled surface shall be primed and an epoxy mortar of troweling consistency shall be placed in the spalled area and

finished as the original pavement surface. The epoxy binder components shall be proportioned and mixed as recommended by the manufacturer. After the epoxy binder is thoroughly mixed, dry silica sand shall be blended into the mixture to give an epoxy mortar of trowelable consistency.

- C. After the epoxy mortar has cured, the forming material shall be carefully removed. The finished joint shall have vertical faces and the joint width shall be maintained. Patching of spalls shall be done only when the temperature of the air and pavement are above 50EF (10EC).
- D. Joints to be sealed shall be thoroughly clean and dry. All materials such as old sealant, oil, asphalt, curing compound, paint, rust, and other foreign materials shall be completely removed. Cleaning shall be accomplished by sand blasting and other tools as necessary.
- E. Just prior to sealing, each joint shall be blown out using a jet of compressed air, at a working pressure of not less than 90 psi (620 kPa), to remove all traces of dust. Air compressors used for cleaning joints shall be equipped with traps capable of removing all free water and oil from the compressed air.
- F. Joint sealer application will not be permitted when the air or pavement temperature near the joint is less than 40EF (5EC) or is 40EF (5EC) and falling.
- G. The sealant shall be applied without spilling on the exposed surface. Sealant on the surface of the concrete pavement shall be removed immediately and the pavement surface cleaned. Failure of the joint material in either adhesion or cohesion will be cause for rejection. Repair shall be at the expense of the Contractor.
- H. Hot-Poured Elastic Joint Sealer: Hot-poured elastic joint sealer shall be stirred during heating so that localized overheating does not occur. All joints shall be sealed with an approved pressure-sealing device, equipped with a nozzle inserted into the joint, so sealing material will be forced from the bottom of the joint to the top.
- I. Silicone Sealant: Silicone sealant shall be applied with a mechanical device equipped with a nozzle or spout shaped to fit into the joint. The joint sealant shall be applied under pressure from the inside of the joint to remove entrapped air and ensure good joint contact.
  - 1. Backer rod shall be installed to the proper depth to produce the width and depth of sealant specified.
  - 2. The sealant surface shall be tooled to produce a slightly concave surface ¼-inch (6 mm) below the pavement surface. Tooling shall be accomplished before a skin forms on the sealant surface. The use of soap or oil as a tooling aid will not be permitted.
- J. Seasonal Restrictions:
  - 1. Silicone sealing operations shall be suspended after October 15, unless the Contractor has received written permission from the Engineer to continue sealing. After the October 15 seasonal restriction, only the initial cut shall be performed at all joints. Then the following spring the joints shall be widened, backer rod installed, and sealed with silicone according to Section 03 15 00.

2. All costs related to the seasonal sealing restrictions including additional labor and materials, equipment, traffic control, mobilization, and incidentals shall be at the expense of the Contractor.

### 3.05 WATERSTOP

- A. Install waterstops at construction and expansion joints in structures, which will contain liquid or resist the entry of ground water. Construct forms to prevent injury to waterstops. Position and secure with wire ties, continuous bars, and rings. Heat weld splices and junctions of waterstop to form a continuous water seal. Use the heat welding equipment and temperature recommended by the waterstop manufacturer.

\* \* \* END OF SECTION \* \* \*



# **SECTION 03 20 00 CONCRETE REINFORCEMENT**

## **PART 1 GENERAL**

### **1.01 RELATED DOCUMENTS**

- A. The general provisions of the contract, including general and Supplementary Conditions, apply to the work specified in this section.

### **1.02 DESCRIPTION OF WORK**

- A. The extent of concrete reinforcement is shown on the drawings and in schedules.
- B. The work includes fabrication and placement of reinforcement for cast-in-place concrete, including bars, welded wire fabric, ties, and supports.

### **1.03 QUALITY ASSURANCE**

- A. Examine the substrate and the conditions under which concrete reinforcement is to be performed. Do not proceed with the work until unsatisfactory conditions have been corrected.
- B. Codes and Standards: Comply with requirements of the following codes and standards, except as herein modified.
  - 1. American Concrete Institute, ACI 315 "Manual of Standard Practice for Detailing Reinforced Concrete Structures."
  - 2. American Concrete Institute, ACI 318, "Building Code Requirements for Reinforced Concrete."
  - 3. American Welding Society, AWS D12.1 "Recommended Practices for Welding Reinforcing Steel, Metal Inserts and Connections in Reinforced Concrete Construction."
  - 4. Concrete Reinforcing Steel Institute, "Manual of Standard Practice."

### **1.04 SUBMITTALS**

- A. For information only, submit 2 copies of steel producer's mill test certificates identifying chemical and physical analysis of each type of reinforcing steel delivered.
- B. Submit shop drawings for fabrication, bending, and placement of concrete reinforcement. Comply with the ACI 315 "Manual of Standard Practice for Detailing Concrete Structures," show bar schedules, stirrup spacing, diagrams of bent bars, arrangements and assemblies, as required for the fabrication and placement of concrete reinforcement. Include special reinforcement required at openings through concrete structures.

### **1.05 PRODUCT DELIVERY, HANDLING, AND STORAGE**

- A. Deliver reinforcement to the project site bundled, tagged, and marked. Use metal tags indicating bar size, lengths, and other information corresponding to markings shown on placement diagrams.
- B. Store concrete reinforcement materials at the site to prevent damage and accumulation of dirt or excessive rust.



## **PART 2 PRODUCTS**

### 2.01 MATERIALS

- A. Reinforcing Bars shall conform to ASTM A615, Grade 60, except as otherwise indicated.
- B. Steel Wire shall be plain wire conforming to ASTM A82.
- C. Welded Wire Fabric shall be of the gauge and mesh size as shown conforming to ASTM A185.
- D. Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcement in place shall be as follows:
  - 1. For bar supports, use CRSI Class C, plastic protected or Class E, stainless steel protected.
  - 2. For slabs on grade, use supports with sand plates or horizontal runners where wetted base materials will not support chair legs.
  - 3. Over waterproof membranes, use precast concrete chairs to prevent penetration of the membrane.

### 2.02 FABRICATION

- A. Shop-fabricate reinforcing bars to conform to required shapes and dimensions, with fabrication tolerances complying with ACI 315. In case of fabricating errors, do not re-bend or straighten reinforcement in a manner that will injure or weaken the material.
- B. Unacceptable Materials shall be defined as reinforcement with any of the following defects and will not be permitted in the work:
  - 1. Bar lengths, depths, and bends exceeding specified tolerances.
  - 2. Bends or kinks not indicated on drawings or on the final shop drawings.
  - 3. Bars with reduced cross section due to excessive rusting or other cause.

## **PART 3 EXECUTION**

### 3.01 INSTALLATION

- A. Unless shown otherwise on drawings, comply with the specified codes and standards, and Concrete Reinforcing Steel Institute recommended practice for "Placing Reinforcing Bars," for details and methods of reinforcement placement and supports, and as herein specified.
- B. If the cover depth is not specifically indicated on the plan sheets, the reinforcing steel shall be protected by a minimum thickness of concrete as follows:
  - 1. Concrete against ground or exposed to water - 3" cover
  - 2. Concrete exposed to weather - 2" cover
  - 3. Beams and columns - 1 ½ " cover
  - 4. Slabs on grade or exposed to weather - 1" cover

- C. Clean reinforcement to remove loose rust and mill scale, earth, ice and other materials, which reduce or destroy bond with concrete.
- D. Position, support, and secure reinforcement against displacement by formwork, construction, or concrete placement operations. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as required.
- E. Unless shown otherwise on drawings, place reinforcement to obtain the minimum coverage for concrete protection. Arrange, space, and securely tie bars and bar supports together with 16-gage wire to hold reinforcement accurately in position during concrete placement operations. Set wire ties so that ends are directed away from exposed concrete surfaces.
- F. Install welded wire fabric in as long lengths as practicable. Lap adjoining pieces at least one full mesh and lace splices with 16-gage wire. Do not make end laps midway between supporting beams, or directly over beams of continuous structures. Offset end laps in adjacent widths to prevent continuous laps.
- G. Provide sufficient numbers of supports and of strength to carry reinforcement. Do not place reinforcing bars more than 2 inches beyond the last leg of any continuous bar support. Do not use supports as bases for runways for concrete conveying equipment and similar construction loads.
- H. Splices: Provide standard reinforcement splices by lapping ends, placing bars in contact, and tightly wire tying. Comply with requirements of ACI 318 for minimum lap of spliced bars except as shown on drawings.

\* \* \* END OF SECTION \* \* \*



# SECTION 03 30 00 CAST-IN-PLACE CONCRETE

## PART 1 GENERAL

### 1.01 RELATED DOCUMENTS

- A. The general provisions of the Contract, including General and Supplementary Conditions and General Requirements, apply to the work of this section.
- B. Related Work Specified Elsewhere:
  - 1. Concrete Formwork, Section 03 11 00
  - 2. Concrete Reinforcement, Section 03 20 00

### 1.02 DESCRIPTION OF WORK

- A. The extent of cast-in-place concrete work is shown on the drawings.
- B. The work includes providing cast-in-place concrete consisting of Portland cement, fine and coarse aggregate, water and selected admixtures; combined, mixed, transported, placed, finished and cured as herein specified.

### 1.03 QUALITY CONTROL AND TESTING

- A. Prior to any concrete work, the Contractor shall obtain from his concrete supplier a certificate stating the design mix used by the supplier will meet or exceed the requirements of the specifications for Class A concrete as herein specified.
- B. The Contractor is responsible for controlling the quality of his product and shall make as many tests as necessary to satisfy himself and the Owner that his product meets or exceeds all specifications contained herein. The Contractor shall employ an independent professional testing laboratory experienced in the testing of concrete materials and mixes to perform material evaluation tests and to test concrete test cylinders. The testing agency shall meet the requirements of ASTM 329. The selection of the testing laboratory shall be subject to the Owner's and Engineer's acceptance. All such tests shall be at the expense of the Contractor.
- C. In addition to the Contractor quality control, the Engineer will perform temperature, slump, air, and compressive strength testing for the determination of product acceptance. The Engineer will cast a set of 4 standard 6-inch diameter cylinders for each 10 to 50 cubic yards of concrete placed or portion thereof and care for them as set forth in ASTM C31. These specimens shall be used to determine compressive strength requirements of the product. The results of these tests shall not relieve the Contractor of his responsibility to meet specifications contained herein.
- D. The right is reserved by the Owner to order additional checking of concrete strength by use of a Swiss hammer or by boring. Testing of this nature shall be done in the presence of the Engineer at the expense of the Contractor and may be submitted to an independent testing laboratory mutually agreed upon by the Contractor, Engineer, and Owner.

#### 1.04 SUBMITTALS

- A. The certificate from the concrete supplier as specified above shall be submitted to the Engineer.
- B. The results of all concrete cylinder tests made shall be submitted to the Engineer.
- C. Copies of the delivery tickets for each load of concrete delivered to the site shall be furnished to the Engineer at the time of delivery.

### **PART 2 PRODUCTS**

#### 2.01 CONCRETE MATERIALS

- A. Water shall be clean and free of deleterious amounts of oils, acids, alkali, organics, silt, mud, grass, or other foreign material.
- B. Portland cement used shall meet the requirements of ASTM C150, Type II, for all usages. Only one brand of cement shall be used throughout the project unless otherwise accepted by the Engineer.
- C. Fly ash shall conform to AASHTO M 295 Class F including the optional requirements in the referenced AASHTO specification except as modified by the following:
  - Loss on ignition 2.0% Max.
  - Moisture content 2.0% Max.
  - Available alkalis as Na<sub>2</sub>O 1.5% Max. \*

\* Available alkalis up to 2.0 percent may be used, provided mortar expansion test results at 14 days is less than or equal to that of the control sample. The expansion test shall be run in accordance with modified ASTM C 441. The control sample shall be made using cement that will be used on the project. The test sample shall be made using cement and fly ash that will be used on the project.
- D. Fly ash shall be from approved base loaded electric generating plants using a single coal source. Plants using a limestone injection process for controlling air pollutants are not acceptable. Fly ash from the start up and shut down of the plant shall not be used.
- E. Fine aggregate shall be clean, sharp, natural, uncoated sand free from silt, loam, and clay, dune sand, bank run sand and manufactured sand are not acceptable. Fine aggregate shall conform to ASTM C33, fine aggregate sections.
- F. Coarse aggregate shall be clean, uncoated crushed stone or gravel conforming to ASTM C33. Clay and shale particles shall not exceed 1%. Maximum size aggregate allowed is 1/5 of narrowest dimensions between forms of the concrete member or 3/4 of minimum clear spacing between reinforcing bars. For cement finish use 1/8 inch minimum and 3/8-inch maximum size aggregate.
- G. Aggregates containing soluble salts or other substances such as iron sulphides, pyrite, marcasite, or ochre, which can cause strains on exposed surfaces, will not be allowed.
- H. If noted on the plans, fiber mesh reinforcing shall be used with all concrete sidewalk and pavement. The fiber mesh shall be added at the rate of 1 bag per cubic yard or as otherwise recommended by the manufacturer. The fiber shall be added directly to the truck at the time of mixing.

2.02 CONCRETE ADMIXTURES

- A. Provide admixtures produced by established reputable manufacturers and use in compliance with the manufacturer's printed directions. Do not use admixtures, which have not been incorporated and tested in the accepted mixes unless otherwise authorized in writing by the Engineer. All admixtures shall meet standards as specified herein.
- B. Air-entraining Admixtures shall conform to ASTM C260 and shall be equal to Grace "Darex AEA," Master Builders "MB-VR"; or Sika Chemicals "AER."
- C. Calcium Chloride: Do not use calcium chloride in concrete unless otherwise authorized in writing by the Engineer.

2.03 CONCRETE CLASS

- A. Classes of concrete:

CLASS OF CONCRETE	REQ. MIN. STRENGTH @ 28 DAYS (PSI)	MAX. WATER CONTENT GAL./94 LB. BAG
A	4,000	6.0

- 1. Class A concrete shall be used for all cast-in-place concrete. Minimum cement content for Class A concrete shall be 564 lbs. It may be used for all concrete requirements.

- B. Grout and Topping:

- 1. Plain grout for channel bottoms; tank bottoms where required shall be proportioned as follows:

CONSTITUENT	BY VOLUME
Type II Portland Cement	1 Part
Sand	2 Parts
¼ " Aggregate	1 ½ Parts

- 2. Non-shrinking grout shall be Embeco, Pour-Rok, or approved equal.

2.04 CONSISTENCY

- A. Consistency required for each pour shall be established in advance by the Contractor in cooperation with the Engineer in accordance with ASTM C143 and according to the following slump ranges:

TYPE OF CONSTRUCTION	SLUMP	AIR
Sidewalk	1" - 4 ½"	5% - 7.5%
Curb & Gutter	1" - 4 ½"	5% - 7.5%

TYPE OF CONSTRUCTION	SLUMP	AIR
Pavement (Formed)	1" - 4 ½"	5% - 7.5%
Pavement (Slipformed)	≤ 2"	5% - 7.5%
Miscellaneous	1" - 4 ½"	5% - 7.5%

- B. Concrete shall be of consistency as to insure the required workability and result in compacted masses having dense, uniform surfaces. In general, the consistency of concrete mixture shall be such that:
1. The mortar will cling to the coarse aggregate.
  2. The aggregates will not segregate in the concrete.
  3. The concrete when dropped directly from the discharge chute of the mixer will flatten out at the center of the pile, but the edges of the pile will stand and not flow.
  4. The concrete and mortar will show no free water when removed from the mixer.
  5. The concrete will slide and not flow into place when transported in metal chutes at an angle of 30 degrees with the horizontal.
  6. The surface of the finished concrete will be free from a surface film of "laitance."
- C. Any concrete mix failing to meet the above outlined consistency requirements, although meeting the slump requirements, will be considered unsatisfactory; and the mix shall be changed to correct such unsatisfactory conditions.

#### 2.05 PROPORTIONING OF MATERIALS

- A. The proper proportioning of aggregates and cement will be determined by the Contractor and the professional testing laboratory. The proportioning of aggregates will be the most suitable combination of aggregates, which will give the necessary workability and desired consistency when mixed with water and cement as specified.
- B. The ratio of cement to dry, fine aggregate shall be that necessary to provide the maximum density of the mixture when used with the minimum amount of water required to produce the specified slump in the resulting concrete. This determination of the proper ratio shall be made by a testing laboratory at the expense of the Contractor, using representative samples of the aggregates, which will be used. Laboratory recommendations shall be submitted to the Engineer.
- C. The batch proportions used shall be such that full bags of cement are used in each batch.
- D. Fly ash may be substituted for cement in concrete. The addition or deletion of fly ash from the mix will be at no cost to the Owner. If fly ash is used, the minimum amount of cement to be replaced is 15 percent and the maximum amount is 20 percent by weight.

## 2.06 EXPANSION JOINT MATERIAL

- A. Expansion joint material shall be pre-molded, non-extruding asphalt impregnated joint filler conforming to ASTM D1751 unless shown otherwise on the plans. Joint material shall be full depth of slab or joint and unless otherwise indicated ½-inch thick.

## 2.07 FIBER REINFORCEMENT

### A. Synthetic Fiber Reinforcement.

1. Material: 100 percent virgin homopolymer polypropylene multifilament fibers, containing no reprocessed olefin materials.
2. Conformance: ASTM C 1116, Type III.
3. Fire Classifications:
  - a. UL Report File No. R8534-11.
  - b. Southwest Certification Services (SWCS), Omega Point Laboratories No. 8662-1.
4. Fiber Length: Single-cut lengths.
5. Alkali Resistance: Alkali proof.
6. Absorption: Nil.
7. Specific Gravity: 0.91.
8. Melt Point: 324 degrees F (162 degrees C).

## **PART 3 EXECUTION**

### 3.01 STORAGE OF MATERIALS

- A. Cement shall be stored in well ventilated, weatherproof buildings, which will protect the cement from dampness. The floor supporting the cement shall clear the ground a sufficient distance to prevent the absorption of moisture by the cement. The Engineer may permit small quantities of cement to be stored in the open for short periods of time (maximum of 48 hours) if a raised storage platform and adequate waterproof covering are provided. Lumpy or partially set cement shall not be used, and such cement shall be removed from the premises.
- B. The handling and storage of concrete aggregate shall be such as to prevent the admixture of foreign materials. If the aggregates are stored on the ground, sites for stockpiles shall be grubbed, cleared of all weeds and grass and leveled off. The bottom layer of aggregate shall not be disturbed or used without cleaning. Unless otherwise authorized by the Engineer, all fine aggregate shall be stockpiled at least 24 hours to reduce the free moisture content.

### 3.02 MIXING CONDITIONS

- A. The concrete shall be mixed in quantities required for immediate use, and any concrete, which is not in place within 30 minutes after being discharged from the mixer, shall not be used. Retempering of concrete will not be permitted.
- B. Where work has been started and changes in weather conditions require protective measures to be used, the Contractor shall furnish adequate shelter to protect the concrete against damage from rainfall or damage due to freezing temperatures. In case it is necessary to



continue mixing operations during rainfall, the Contractor shall provide protective coverings for the material stockpiles as well as for the concrete being placed. The covering for aggregate stockpiles will be required only to the extent as may be necessary to control the moisture conditions in the aggregates so that adequate control of the consistency of the concrete mix may be maintained.

- C. No concrete shall be mixed without the approval of the Engineer when the air temperature is at or below 40° F (taken in the shade away from artificial heat) and falling. If authorized by the Engineer, concrete may be mixed when the air temperature is at 35° F and rising. When permission is given for mixing when the temperature is below 40° F, the following requirements shall govern:
1. Water used for mixing shall be heated either by steam or by dry heat to a temperature of at least 70° F but not over 150° F.
  2. Aggregates shall be heated either by steam or by dry heat to a temperature of at least 70° F but not over 150° F.
  3. The heating apparatus shall be such as to heat the mass of aggregates uniformly and preclude the occurrence of hot spots, which will burn the material. Temperature of mixed concrete shall be not less than 60° F at the time of placing in forms. After the concrete has been placed, the Contractor shall provide sufficient protection such as cover, canvas, framework, heating apparatus, etc., to enclose and protect the structure and maintain the temperature of the mix at not less than 50° F until at least 60% of the designed strength has been attained.
  4. The use of an accelerating agent in lieu of proper cold weather protection will not be authorized. In hot weather suitable precautions shall be taken to avoid drying of the concrete prior to finishing operations. Use of windbreaks, sunshades, fog sprays, or other devices shall be provided.
  5. Concrete deposited in hot weather shall not have a placing temperature that will cause difficulty from loss of slump, flash set, or cold joints. Concrete temperatures shall be less than 90° F.

### 3.03 CONCRETE PLACEMENT

- A. Before placing concrete, the Contractor shall see that bottoms of excavations are undisturbed earth, properly leveled off and tamped free of foreign materials. Forms shall be oiled or wetted prior to placing concrete. Water shall be removed from the excavation before any concrete is deposited.
- B. The concrete shall be placed in the structure immediately after mixing. Concrete shall be placed in continuous horizontal layers approximately 12-inch in thickness. Not more than 1 hour shall elapse between the placing of successive layers of concrete in any portion of the structure included in a monolithic placement. Special care must be used to thoroughly surround all reinforcement with concrete and to leave no air space or other void in this work. All concrete shall be well vibrated into all areas of forms.
- C. No concrete shall be used after its initial set has taken place, and no retempered concrete will be allowed under any circumstances or conditions.

- D. Concrete handling from the point of delivery and transfer to the concrete conveying equipment and to the locations of final deposit shall be completed as rapidly as practicable by methods which will prevent segregation and loss of concrete mix materials.
- E. Mechanical equipment for conveying concrete shall be provided to ensure a continuous flow of concrete at the delivery end. Provide runways for wheeled concrete conveying equipment from the concrete delivery point to the locations of final deposit. Keep interior surfaces of conveying equipment, including chutes, free of hardened concrete, debris, water, snow, ice, and other deleterious materials.

### 3.04 CONSTRUCTION JOINTS

- A. Construction joints shall be made at the locations indicated on the plans or at such other locations as designated by the Engineer. In no case shall vertical joints be made in walls at or near corners. Proper bonding shall be obtained in accordance with the above specifications and the CRSI.
- B. Keys shall be provided in all joints where required to provide for either shear or water tightness. The width of the keys shall be approximately  $\frac{1}{2}$  the thickness of the section at that point, and they shall be  $\frac{1}{2}$  as deep as they are wide unless otherwise specified.
- C. All concrete shall be deposited in forms at such rate that the forms will be filled at any point with a vertical rise of concrete surface of not less than 2 feet per hour. Where necessary, the forms shall be bulk headed off and construction joint made to provide a form, which will be filled at the above specified rate. The location of these construction joints shall be approved by the Engineer.
- D. If any concrete is allowed to stand at any elevation below the finished grade or top surface for more than 2 hours without fresh concrete being applied thereon, the top surface shall be considered a construction joint and shall be constructed in accordance with these specifications and provided with keys and water sealing strips.
- E. Where practicable, vertical construction joints shall make a slight angle with the vertical, not to exceed  $\frac{1}{2}$ -inch per foot, in such manner that the freshly deposited concrete will overhang the hardened concrete, allowing the new concrete to settle upon the old during the process of hardening.

### 3.05 PROTECTING AND CURING

- A. All concrete, regardless of temperature, weather, or season, shall be protected from premature drying. Surface cracking shall be a cause for rejection, removal, and replacement. Any concrete poured during freezing or hot weather conditions shall be protected. No salts or other non-freezing materials shall be used. All fresh concrete shall be protected from open rain. All concrete shall be kept damp for at least 6 days after pouring. Membrane curing may be used. Membrane curing compound if used shall be a resin base type approved by the Engineer. Curing will not be required longer than 72 hours if high early strength concrete is used.

### 3.06 FINISH OF FORMED SURFACES

- A. Rough Form Finish:

1. Provide as-cast rough form finish to formed concrete surfaces that are to be concealed in the finish work or by other construction unless otherwise indicated.
2. Standard rough form finish shall be the concrete surface having the texture imparted by the form facing material used with tie holes and defective areas repaired and patched and all fins and other projections exceed ¼-inch in height rubbed down or chipped off.

B. Smooth Form Finish:

1. Provide as-cast smooth form finish for formed concrete surfaces that are to be exposed to view or that are to be covered with a coating material applied directly to the concrete, or a covering material bonded to the concrete such as waterproofing, damp-proofing, painting or other similar system.
2. Produced smooth form finish by selecting form material to impart a smooth, hard, uniform texture and arranging them orderly and symmetrical with a minimum of seams. Repair and patch defective areas with all fins or other projections completely removed and smoothed.

C. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces occurring adjacent to formed surfaces, strike off, smooth, and finish with a texture matching the adjacent formed surfaces. Continue the final surface treatment of formed surfaces uniformly across the adjacent unformed surfaces unless otherwise shown.

### 3.07 MONOLITHIC SLAB FINISHES

A. Float Finish:

1. Apply float finish to monolithic slab surfaces that are to receive trowel finish and other finishes as hereinafter specified.
2. After placing concrete slabs do not work the surface further until ready for floating. Begin floating when the surface water has disappeared or when the concrete has stiffened sufficiently to permit the operation of a power-driven float or both. Consolidate the surface with power-driven floats or by hand floating if area is small or inaccessible to power units. Check and level the surface plane to a tolerance not exceeding ¼-inch in 10 feet when tested with a 10-foot straightedge placed on the surface at not less than 2 different angles. Cut down high spots and fill all low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat the surface to a uniform, smooth granular texture.

B. Trowel Finish:

1. Apply trowel finish to monolithic slab surfaces that are to be exposed to view unless otherwise shown and slab surfaces that are to be covered with epoxy terrazzo, resilient flooring, paint, or other thin-film finish coating system.
2. After floating, begin the first trowel finish operation using a power-driven trowel if desired.
3. Consolidate the concrete surface by the final hand troweling operation, free of trowel marks, uniform in texture and appearance and with a surface plane tolerance not exceeding 1/8-inch in 10 feet when tested with a 10-foot straightedge. Grind smooth surface defects, which would telegraph through applied floor covering system.

C. Non-slip Broom Finish:

1. Apply non-slip broom finish to exterior and interior concrete platforms and bridges, steps, walks and ramps and elsewhere as shown on the drawings or in schedules.
2. Immediately after trowel finishing slightly roughen the concrete surface by brooming in the direction perpendicular to the main traffic route. Coordinate the required final finish with the Engineer before application.

D. Exposed Aggregate Finish:

1. The Contractor shall construct an exposed aggregate sample thirty-six (36) inches long by thirty-six (36) inches wide, and receive the Owner's approval, prior to any work involving this type of surfacing.
2. Following the Owner's acceptance of the exposed aggregate sample, and immediately after removal of form work, wash concrete surfaces with water and scrub with stiff bristle brush exposing aggregate to match accepted sample panel.
3. When desired finish is achieved, wash and rinse exposed aggregate surfaces with cleaning agent.

E. Carpet Drag Finish:

1. Before the concrete has attained its initial set, the surface shall be given a final finish with a carpet drag drawn over the surface in a longitudinal direction. The drag shall be mounted on a bridge and shall be sized so that a strip of the carpet at approximately two feet (600 mm) wide is in contact with the pavement surface while the drag is operated.
2. The condition of the drag shall be maintained so the resultant surface is of uniform appearance with corrugations approximately 1/16 inch (2 mm) in depth. Drags shall be maintained clean and free of encrusted mortar. Drags that cannot be cleaned shall be discarded and replaced.
3. The carpet shall meet the following requirements:
  - a. Facing Material - Molded polyethylene pile face
  - b. Blade Length - 7/8",  $\pm 1/8$ " (22 mm,  $\pm 3$  mm)
  - c. Total Fabric Weight - 70 oz. Per square yard min.
  - d. (2.37 kg per square meter min.)
4. The backing shall be of a strong, durable material, not subject to rot, which is adequately bonded to the facing.
5. Brooming may be used on irregular areas in lieu of the carpet drag and tine finish. The broom shall be drawn transversely across the pavement with adjacent strokes slightly overlapping.
6. Brooming shall be uniform in appearance and shall produce grooves 1/16 inch (2 mm) deep. Texturing shall be completed while the concrete surface can be broomed without being torn or unduly roughened by the operation.
7. The finished surface shall be free from rough and porous areas, irregularities, and depressions resulting from improper handling of the broom.

### 3.08 CONCRETE SURFACE REPAIRS

#### A. Patching Defective Areas:

1. Repair and patch defective areas with cement mortar immediately after the removal of the forms but only after the Engineer has inspected the defective area.
2. Cut out honeycomb, rock pockets, voids over ½-inch diameter and holes left by tie rods and bolts, down to solid concrete, but, in no case, to a depth of less than 1-inch. Make edges of cuts perpendicular to the concrete surface. Before placing the cement mortar, thoroughly clean, dampen with water, and brush coat the area to be patched with neat cement grout. Proprietary patching compounds may be used when acceptable to the Engineer.
3. For exposed-to-view surfaces blend white Portland cement and standard Portland cement so that when dry the patching mortar will match the color of the surrounding concrete. Provide test areas at inconspicuous location to verify mixture and color match before proceeding with the patching. Compact mortar in place and strike off slightly higher than the surrounding surface.
4. Fill holes extending through concrete by means of a plunger type gun or other suitable device from the least exposed face, using a flush stop held at the exposed face to ensure complete filling.

#### B. Repair of Formed Surfaces:

1. Repair exposed-to-view formed concrete surfaces where possible that contain defects which adversely affect the appearance of the finish. Remove and replace the concrete having defective surfaces if the defects cannot be repaired to the satisfaction of the Engineer. Surface defects as such include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets, and holes left by the rods and bolts; fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
2. Repair concealed formed concrete surfaces where possible that contain defects that adversely affect the durability of the concrete. If defects cannot be repaired, remove and replace the concrete having defective surfaces. Surface defects as such include cracks in excess of 0.01 in. wide, cracks of any width and other surface deficiencies which penetrate to the reinforcement or completely through non-reinforced sections, honeycomb, rock pockets, holes left by tie rods and bolts and spalls except minor breakage at corner.

#### C. Repair of Unformed Surfaces:

1. Test unformed surfaces such as monolithic slabs for smoothness and to verify surface plane to the tolerances specified for each surface and finish. Correct low and high areas as herein specified.
2. Test unformed surfaces sloped to drain for trueness of slope in addition to smoothness, using a template having the required slope. Correct high and low areas as herein specified.

3. Repair finished unformed surfaces that contain defects, which adversely affect the durability of the concrete. Surface defects as such include crazing, cracks in excess of 0.01-inch wide or that penetrate to the reinforcement or completely through non-reinforced sections regardless of width, spalling, popouts, honeycomb, rock pockets, and other objectionable conditions.
4. Correct high areas in unformed surfaces by grinding after the concrete has cured sufficiently so that repairs can be made without damage to adjacent areas.
5. Correct low areas in unformed surfaces during or immediately after completion of surface finishing operations by cutting out the low areas and replacing with fresh concrete. Finish repaired areas to blend into adjacent concrete. Proprietary patching compounds may be used when acceptable to the Engineer.
6. Repair defective areas except random cracks and single holes not exceeding 1-inch diameter by cutting out and replacing with fresh concrete. Remove defective areas to sound concrete with clean, square cuts and expose reinforcing steel with at least  $\frac{3}{4}$ -inch clearance all around. Dampen all concrete surface in contact with patching concrete and brush with a neat cement grout coating or use concrete bonding agent. Place concrete before grout takes its initial set. Mix patching concrete of the same materials to provide concrete of the same type of class as the original adjacent concrete. Place, compact, and finish as required to blend with adjacent finished concrete. Cure in the same manner as adjacent concrete.
7. Repair isolated random cracks and single holes not over 1-inch in diameter by the dry-pack method. Groove the top of cracks and cut out holes to sound concrete and clean of dust, dirt, and loose particles. Dampen all cleaned concrete surfaces and brush with neat cement grout coating. Place dry-pack before the cement grout takes its initial set. Mix dry-pack consisting of 1-part Portland cement to 2- $\frac{1}{2}$  parts fine aggregate passing a No. 16 mesh sieve, using only enough water as required for handling and placing. Compact dry-pack mixture in place and finish to match adjacent concrete. Keep patch areas continuously moist for not less than 72 hours.
8. Repair methods not specified above may be used subject to the acceptance of the Engineer.

### 3.09 SURFACE TEST AND TOLERANCES

- A. Ten Foot Straightedge: The concrete surface shall be tested with a 10-foot straightedge. The permissible longitudinal and transverse surface deviation shall be 1/8-inch in 10 feet.
- B. Areas where the maximum deviation exceeds the permissible deviation by not more than 3/8 inch will be subject to the following at the discretion of the Engineer.
  1. Grind down to an elevation where the area or spot will be within the permissible deviation.
  2. Accept affected area without corrective action with price reduction at a rate noted below.
- C. Areas where maximum deviation exceeds the permissible by more than 3/8 inch will be subject to the following at the discretion of the Engineer.

1. Grind down to an elevation where the area or spot will be within the permissible deviation.
  2. Accept affected area without corrective action with price reduction at a rate noted below.
  3. Satisfactorily remove and replace deficient area.
- D. Grinding shall be accomplished with specially prepared circular diamond blades mounted on a horizontal shaft. Areas that have been ground shall not be left smooth or polished, but shall have a uniform texture equal in roughness to the surrounding unground concrete.
- E. Measurements for determining the limits of deficient areas will be made in the following manner:
1. The length of the deviation will be that length out of specification tolerance at the location of the surface test as checked with a 10-foot straightedge and a 1/8-inch shim.
  2. Where the transverse surface test is out of specification, the maximum length and maximum width at a particular site shall be used in computation of the area.

### 3.10 DEFECTIVE WORK

- A. Concrete work, which does not conform to the specified requirements, including strength, tolerances, and finishes, shall be corrected at the Contractor's expense without extension of time therefore. The Contractor shall also be responsible for the cost of corrections to any other work affected by or resulting from corrections to the concrete work.

\* \* \* END OF SECTION \* \* \*

# SECTION 31 23 00 EXCAVATION AND FILL

## PART 1 GENERAL

### 1.01 RELATED DOCUMENTS

- A. The general provisions of the Contract, including General and Supplementary Conditions and General Requirements, if attached, apply to the work specified in this section.
- B. Related Work Specified Elsewhere:
  - 1. Watering for Embankments - Section 31 23 11

### 1.02 DESCRIPTION OF WORK

- A. The Work covered by this section of the specifications shall consist of furnishing all plant, labor, and equipment, appurtenances and material, and of performing all operations in connection with the excavation, embankment, compaction, topsoiling, and grading required for the reconstruction of the City streets in accordance with these specifications and in conformity with the dimensions and typical sections shown on the plans and with the lines and grades established by the Engineer.
- B. The Owner's representative will provide the initial and final grade stakes as discussed in Section 01 32 23. The Contractor shall be responsible for providing all interim slope and grade staking and other staking as may be necessary to complete construction.

### 1.03 CLASSIFICATION OF EXCAVATION

- A. "Unclassified Excavation" shall include all excavation performed under this section regardless of the material encountered.

### 1.04 QUALITY ASSURANCE

- A. During the construction of the subgrade, a representative of the Owner shall be on site to allow for the examination of the exposed subgrade.
- B. In-place density tests will be taken, by the Owner's representative, on each layer of the subgrade as directed by the Geotechnical report.
- C. The Contractor will conduct additional soil tests and quality control testing as desired for his own information and use. The Contractor shall have submitted directly to the Engineer with copies to the Owner, three (3) copies of all field and laboratory tests and reports of inspections performed by him or his agents.
- D. All grades shall be finished to within 0.10 feet of the final elevations as staked by the Owner's authorized representative.



## **PART 2 PRODUCTS**

### 2.01 CONTRACTOR FURNISHED BORROW (if required)

*A. Borrow Material furnished by the Contractor shall be clean earthen fill material free from sticks, roots, stones larger than 3 inches and other deleterious material. **Prior to any hauling the Contractor shall furnish laboratory test results showing the classification of the borrow material by the Unified Soil Classification System (USCS), Liquid Limit, Plasticity Index and Standard Proctor w/ Max Density at Optimum Moisture.** The Borrow material shall meet the USCS requirements for the following soil classifications: (SC) Clayey Sands and (CL) Sandy Clays.*

## **PART 3 EXECUTION**

### 3.01 GENERAL

- A. The excavation shall be carried to the elevations or depths required to obtain the specified depths as shown on the plans. Should the Contractor, through negligence or other fault, excavate below the designated lines or elevations, he shall replace the excavation with suitable materials and properly compact and control the moisture content in a manner as specified herein under "Formation of Embankments". All replacement work shall be at the Contractor's expense.
- B. The Contractor shall inform and satisfy himself as to the character, quantity, and distribution of all material to be excavated. No payment will be made for any excavated material which is used for purposes other than those designated. All spoil areas shall be leveled to a uniform line and section and shall present a neat appearance before project acceptance.
- C. Those areas outside of the embankment areas in which the top layer of soil material becomes compacted due to hauling or to any other activity of the Contractor shall be scarified and disced to a depth of 4 inches as directed to loosen and pulverize the soil.
- D. If it is necessary to interrupt existing surface drainage, sewers, or under drainage, conduits, utilities, or similar underground structures, or parts thereof, the Contractor shall be responsible for and shall take all necessary precautions to protect and preserve or provide temporary service. When such facilities are encountered, the Contractor shall notify the Engineer. The Contractor, at his own expense, shall satisfactorily repair all damage to such facilities or structures which may result from any of his operations during the period of the contract.
- E. The Contractor shall supervise the excavation, moving, placing, and deposition of all material and shall, with the assistance of the Engineer and/or his representative, determine the suitability of materials to be placed in embankments. All material determined to be unsuitable and all excess shall be disposed of in the appropriate areas as shown on plans, or in the outer portions of the embankments.
- F. Topsoil shall not be used directly below any areas to receive surfacing.

### 3.02 STRIPPING

- A. All vegetation such as brush, heavy sods, heavy growth of grass, decayed vegetation, rubbish, roots, and any other unsuitable material within the area to which excavation is to occur, or upon which embankment is to be placed, shall be cleared, stripped, grubbed, and disposed of, before the excavation of suitable materials or a formation of embankment is started.
- B. In no case shall such objectionable material be allowed in or under the subgrades for any areas to receive surfacing.
- C. All depressions or holes below the ground surface, whether caused by grubbing or otherwise, shall be backfilled with suitable material and compacted to the ground surface elevation or up to twelve (12) inches below the proposed final subgrade elevation before the construction of the embankment will be permitted to start.

### 3.03 EXCAVATION OF SUITABLE MATERIAL

- A. Excavation shall be performed to the lines, grades, and elevations as indicated in the plans or as directed by the Engineer and shall be made so that the requirements for formation of embankments and floor can be followed. No excavation or stripping shall be started until the Engineer has taken cross sectional elevations and measurements of the existing ground surface and has provided control stakes for the proposed work. During the process of excavation, the grade shall be maintained so that it will be properly drained at all times. Temporary drains and drainage ditches shall be installed to intercept or divert all surface water which may affect the work.
- B. The suitable excavation material shall be handled in such a manner as to allow the material to be properly placed and compacted in the fill areas.
- C. The Contractor shall make the distribution of the excavated material as indicated in the plans. Widening or narrowing of the section and raising or lowering of the grade to avoid haul will not be permitted. The right is reserved by the Engineer to make minor adjustments or revisions in lines or grades if found necessary as the work progresses to obtain satisfactory construction.
- D. Stones or rock fragments larger than 4 inches in their greatest dimension will not be permitted in the top eight (8) inches of the subgrade or embankment.
- E. All cut-and-fill slopes shall be uniformly dressed to the slope, cross section, and alignment as shown in the plans.
- F. No payment or measurement for payment will be made for suitable materials removed, manipulated, and replaced in order to obtain required density. Any removal, manipulation, aeration, replacement, and recompaction of suitable materials necessary to obtain the required density shall be considered as incidental to the excavation and embankment operations and shall be performed by the Contractor at no additional compensation.

### 3.04 STOCKPILING

- A. If at the time of excavation it is not possible to place any material in its proper section of the permanent construction, it shall be stockpiled in approved areas for later use at no extra cost to the Owner.
- B. The stockpiled material shall be handled and placed as specified in the section of these

specifications covering excavation, embankment, and topsoil.

- C. Stockpiles of topsoil or any other material shall be located within the project limits as near the final placement site as practicable. When stockpiling within the project limits is not possible, it shall be the Contractor's obligation to arrange for and maintain stockpile sites at his own expense. Stockpiles of topsoil shall not be placed within 50 feet of embankment areas and shall not be placed on areas which subsequently will require any excavation or embankment.
- D. Prior to Completion of the Work, the Contractor shall obtain and furnish to the Owner a lien waiver or a letter of satisfaction written by the owner of the stockpile area property and addressed to the Contractor.

### 3.05 EXCESS EXCAVATION

- A. When the volume of excavation exceeds that required to construct the embankments to the grades indicated, the excess shall be used to grade the areas of ultimate development or wasted in areas secured by the Contractor, subject to the approval of the Engineer and the Owner. In general, suitable excess excavation will be used in the widening of embankments, flattening of slopes, etc.
- B. If it is necessary to dispose of any material, it shall be disposed of in such a manner as to present a neat appearance and to not obstruct proper drainage or cause damage to abutting property.

### 3.06 PREPARATION OF EMBANKMENT AREA

- A. Prior to the placement of any fill material beneath the proposed trail, the entire layer of topsoil upon which the embankment is to be placed, except where limited by solid rock, shall be removed for its entire depth to the bottom of the natural existing topsoil.
- B. A minimum of six (6) inches of material below the bottom of the natural existing topsoil or to the depth as previously described shall be scarified for the entire width of the subgrade embankment. The area shall be scarified in furrows uniformly spaced so that at least 50% of the surface will be broken to the required depth. All roots, debris, large stones, or objectionable material that would cause interference with the compaction of the foundation for fill shall be removed from the area and disposed of as specified.
- C. After removal and scarifying of the topsoil and other material under the embankment areas, the area should be examined by the Contractor for the existence of unsuitable materials. The Contractor shall notify the Engineer if he feels that unsuitable materials exist. The volume of unsuitable material shall be determined by cross sectioning the area before and after removal. The area of unsuitable material shall be removed to a depth as shown in the plans or as directed by the Owner's representative. The area shall be filled and compacted in accordance with "Formation of Embankments".
- D. A thin layer (approximately 3 inches) of the fill material shall then be uniformly spread over the scarified foundation and the whole area compacted to ##% (see Geotechnical report) of maximum density as determined by standard proctor ASTM Test Designation D698 at a moisture content between 3% under and 3% over optimum.
- E. Except for the undercut of unsuitable materials which lie at a depth greater than six (6) inches below finished grade elevation in areas previously described, no direct payment shall be

made for work performed under this section.

### 3.07 FORMATION OF EMBANKMENTS

- A. Embankments shall be formed of satisfactory materials placed in successive horizontal layers of not more than 8 inches loose depth for the full width of the cross section.
- B. The grading operations shall be conducted and the various soil strata shall be placed to produce a soil structure as shown in the typical cross section or as directed. All materials entering the embankment shall be reasonably free of organic matter such as leaves, grass, roots, and other objectionable material. Soil, granular material, shale, and any other material permitted for use in embankment shall be spread in successive layers as specified.
- C. The subgrade embankments shall be constructed from the in-place non-organic soils.
- D. Operations on earthwork shall be suspended at any time when satisfactory results cannot be obtained because of rain, freezing weather, or other unsatisfactory conditions of the field. The Contractor shall drag, blade, or slope the embankment to provide proper surface drainage. Frozen material shall not be placed in the embankment nor shall embankments be placed over frozen material.
- E. The material in the layers shall be of the proper moisture content before rolling to obtain the prescribed compaction. Wetting or drying of the material and manipulation when necessary to secure a uniform moisture content throughout the layer shall be required. Should the material be too wet to permit proper compaction or rolling, all work on all portions of the embankment thus affected shall be delayed until the material has dried to the required moisture content. Sprinkling shall be done in accordance with the requirements of Section 31 23 11. Samples of embankment materials for testing, both before and after placement and compaction, will be taken. From these tests, corrections, adjustments, and modifications of methods, materials, and moisture content will be made to construct the embankment.
- F. Where a large portion of the materials excavated consist of rock, the rock may be used in the construction of the embankment as hereinafter specified:
  - 1. The maximum dimension of any rock used shall not exceed 12" maximum.
  - 2. Rocks shall be carefully distributed throughout the embankment and imbedded with earth or other fine material so that the interstices between the large particles are filled and a dense, compact, uniform embankment is secured.
  - 3. No rock larger than 4" in any direction will be allowed in the upper eight (8) inches of any embankment as this portion of the embankment shall be composed solely of earth or other suitable material.
- G. The Contractor shall be responsible for the stability of all embankments made under the contract and shall replace any portion which in the opinion of the Engineer has become displaced due to carelessness or negligence on the part of the Contractor. The Contractor shall plan his work so that the necessary compaction tests on each lift can be completed prior to placing additional lifts of material.

### 3.08 DIVERSION DITCHES AND DRAINAGE PROVISIONS

- A. If it is necessary, in the prosecution of the work, to interrupt the natural drainage of the surface, or the flow of artificial drain, the Contractor shall provide temporary drainage

facilities that will prevent damage to public or private interests and shall restore the original drains as soon as the work will permit. The Contractor shall, at his own expense, take all measures necessary to properly drain the work site. The Contractor shall be held liable for all damages which may result from neglect to provide for either natural or artificial drainage which his work may have interrupted. All temporary diversion ditches shall be of adequate size to handle any anticipated flow.

B. Diversion ditches which are to be permanent shall conform to the shape required in the plans.

### 3.09 TOPSOIL

A. The topsoil shall be stripped and stockpiled from the regular grading areas and placed on all disturbed areas, at the conclusion of the project, as shown on plans.

B. All topsoil removed from the excavation areas shall be salvaged (on areas to be grass, topsoil shall be replaced at conclusion of the project).

C. The stockpiling of topsoil shall be in accordance with the requirements of paragraph 3.04.

### 3.10 TOLERANCES

A. The subgrade and all other graded surfaces shall be of such smoothness that it will not vary more than 0.10 of a foot from true grade as established by grade hubs. Any deviation in excess of this amount shall be corrected by loosening, adding, or removing materials, reshaping, and compacting.

### 3.11 WATERING FOR EMBANKMENTS

A. Refer to Section 31 23 11 - Watering for Embankments.

### 3.12 EQUIPMENT

A. The Contractor may use any type of earthmoving, compaction, and watering equipment he may desire or has at his disposal, provided the equipment is in a satisfactory condition and is of such capacity that the construction schedule can be maintained as planned by the Contractor and as approved by the Owner in accordance with the completion schedule specified for the construction. The Contractor shall furnish, operate, and maintain such equipment as is necessary to control uniform density, layers, section, and smoothness of grade.

### 3.13 HAUL

A. No payment will be made separately or directly for haul on any part of the Work. All hauling will be considered a necessary and incidental part of the Work, and its cost shall be considered by the Contractor and included in the contract price for the work involved.

## **PART 4 MEASUREMENT AND PAYMENT**

### **4.01 METHOD OF MEASUREMENT**

- A. In the event unsuitable material is encountered during subgrade construction, and the Contractor has requested in writing and received the Engineer's approval, measurement of the additional amount of excavation required, payment for excavation, removal and disposal of said unsuitable material shall be on a cubic yard basis at the contract unit price bid for unclassified excavation.

### **4.02 BASIS OF PAYMENT**

- A. Payment for unsuitable material shall be on a cubic yard basis at the contract unit price bid for unclassified excavation.

\* \* \* END OF SECTION \* \* \*

# **SECTION 31 23 11 WATERING FOR EMBANKMENTS**

## **PART 1 GENERAL**

### 1.01 RELATED DOCUMENTS

- A. The general provisions of the Contract, including General and Supplementary Conditions and General Requirements, apply to the work of this section.
- B. Related Work Specified Elsewhere:
  - 1. Excavation and Fill - Section 31 23 00

### 1.02 DESCRIPTION OF WORK

- A. This item shall consist of furnishing and applying water required in the compaction of embankments and/or the clay cover, and for other purposes in accordance with the requirements of these specifications or as directed.

## **PART 2 PRODUCTS**

### 2.01 WATER SOURCE

- A. The Contractor shall obtain a Temporary Water Rights Permit to use water for construction, testing, or drilling purposes from the SD Department of Agriculture and Natural Resources for all water sources. Contact DANR by phone at 605 773-3352 for more information.
- B. The Contractor shall be responsible to provide own source of water for construction. Contractor shall obtain all federal, state, and local permits necessary for sources provided by Contractor. Upon receipt of the permits the Contractor shall submit two copies to the Engineer for his review and approval prior to removal of any water.
- C. The Contractor shall be responsible for all measures necessary to protect the health and safety of all personnel with access to the site.

## **PART 3 EXECUTION**

### 3.01 CONSTRUCTION METHODS

- A. Water, when required, shall be applied at the locations, in the amounts, and during the hours, including nights, as required. An adequate water supply shall be provided by the Contractor.
- B. The equipment used for watering shall be of ample capacity and of such design as to assure uniform application of water in the amounts required.
- C. Contractor shall provide information to Engineer on size or capacity of water vehicle used and shall provide daily load counts to the Resident Project Representative.



\*\*\* END OF SECTION \*\*\*

# **SECTION 31 23 14 SHEETING, SHORING, AND BRACING**

## **PART 1 GENERAL**

### 1.01 RELATED DOCUMENTS

- A. The general provisions of the contract, including General and Supplementary Conditions shall apply to work covered in this section.
- B. Related requirements specified elsewhere:
  - 1. Trenching, Backfilling and Compacting - Section 31 23 33
  - 2. Water Utility Piping and Fittings – Section 33 11 00
  - 3. Sanitary Sewer Piping and Fittings – Section 33 31 00

### 1.02 DESCRIPTION OF WORK

- A. Furnish and install all necessary sheeting, shoring, and bracing to adequately protect all new and existing structures, all existing piping as may be required during construction period, and all new piping.

## **PART 2 PRODUCTS**

### 2.01 MATERIALS AND CONDITION

- A. All sheeting, shoring, and bracing shall be in good or new condition and shall conform to the requirements of current safety codes and guidelines.

## **PART 3 EXECUTION**

### 3.01 METHODS

- A. All excavation shall be properly shored, sheeted, and braced to furnish safe working conditions conforming to the current codes, regulations, and guidelines; to prevent any shifting and movement of material which may endanger personnel; to prevent damage to structures, or other work; and to avoid delay to the work.
- B. Bracing shall be so arranged as not to place any strain on portions of completed work until the general construction has proceeded far enough to provide ample strength. If the Engineer is of the opinion that at any point the sheeting or supports furnished are inadequate or unsuited for the purpose, he may order additional sheeting or support to be installed. Whether so ordered by the Engineer or not, sufficient sheeting or support shall be installed to protect the work from any damage to new structures.
- C. Trench sheeting shall remain in place until pipe, etc., has been laid, tested for defects, and repaired if necessary, and the earth around it compacted to a depth of one foot over the top of the pipe. Timber sheeting if used shall not be removed below an elevation of two feet above the top of the pipe.
- D. No sheeting, shoring, and bracing which is within three feet of the surface of the finished grade may be left in place without the written permission of the Engineer.

- E. In general, the sheeting and bracing shall be removed as the excavation is refilled in such a manner as to avoid the caving in of the bank or disturbance to adjacent areas or structures. The voids left by the withdrawal of the sheeting shall be carefully filled by ramming or otherwise as directed. Permission of the Engineer shall be obtained before the removal of any shoring, sheeting, or bracing.
- F. It shall be the duty and responsibility of the Contractor to be familiar with all local, state, and federal regulations relating to this type of work and to comply with those regulations.

\* \* \* END OF SECTION \* \* \*

# **SECTION 31 23 33 TRENCHING, BACKFILLING, AND COMPACTING**

## **PART 1 GENERAL**

### 1.01 RELATED DOCUMENTS

- A. The general provisions of the Contract, including General and Supplementary Conditions shall apply to the work covered in this Section.
- B. Related Requirements specified elsewhere:
  - 1. Sheeting, Shoring and Bracing - Section 31 23 14
  - 2. Curbs, Gutters, Sidewalks and Driveways - Section 32 16 00
  - 3. Existing Underground Utilities - Section 33 01 00
  - 4. Water Utility Piping and Fittings – Section 33 11 00
  - 5. Sanitary Sewer Piping and Fittings – Section 33 31 00

### 1.02 SCOPE

- A. This section covers the excavation of all necessary trenching for underground utilities and backfilling same after the pipe and related material has been properly laid, inspected and tested all in accordance with applicable federal, state and local laws and regulations.

### 1.03 QUALITY ASSURANCE

- A. The Contractor shall obtain qualified testing and inspection services and such other independent services as may be required to assure compliance with the requirements as specified hereinafter. Certified tests of all granular materials will be provided to the Engineer prior to delivery or installation on the job site.
- B. Moisture-density (Proctor) tests on the engineered fill materials and all in-place engineered fill field density tests shall be made as herein specified and in accordance with the General Conditions. Sufficient tests in number and location will be performed so as to assure that the engineered fill is in general compliance with the compaction requirements as specified herein.
- C. The Contractor may conduct additional soil testing and quality control testing as desired for his own information and use.
- D. When requested by the Engineer or Resident Project Representative, the Contractor shall excavate and expose the pipe previously laid at any point.

## **PART 2 PRODUCTS - NOT USED**

## **PART 3 EXECUTION**

### **3.01 GENERAL EXCAVATION**

- A. All material encountered shall be excavated to the lines and grades as shown on the plans, set by the Engineer or as specified herein.
- B. Unless otherwise shown on the plans, trenches for forcemain shall be of a depth that will provide the following minimum covers over the top of the pipe as measured from the original ground surface.
  - 1. Minimum cover for all watermain and forcemain shall be seventy-two (72) inches.
- C. Where pipe elevation is determined by minimum depth only, the excavation shall be sufficient at all points to grade the pipes on the tangents and vertical curves as dictated by the minimum bending radius of the pipe and fittings as recommended by the manufacturers.
- D. The trenches shall be sufficiently straight between designated angle points to permit the pipe to be laid true to line in the approximate center of the trench.
- E. Intersections with and crossings of other underground utilities shall be as shown on the plans and/or in accordance with applicable state and local laws and regulations. Refer to Section 33 01 00 for additional requirements.
- F. All excavated material suitable for backfilling shall be placed in an area away from the trench edges so as to avoid overloading, sliding, and cave-ins.
- G. The areas immediately adjacent to the trench shall be graded as required to prevent surface water from entering the trenches.

### **3.02 EXCAVATION FOR APPURTENANCES**

- A. A minimum of twelve (12) inches shall be left between the trench wall and the outside surface of the appurtenance.

### **3.03 SHEETING, SHORING AND BRACING**

- A. Refer to Section 31 23 14 of these specifications

### **3.04 ROAD, STREET, AND DRIVEWAY CROSSINGS**

- A. At such road and all other crossings as may be designated by the Engineer, the trenches are to be mechanically tamped and filled in such a manner as to prevent any serious interruption of traffic upon the roadway or crossing.
- B. Not more than one street crossing may be obstructed by the same trench at any one time except by permission of the Engineer and Owner.

### **3.05 ROCK EXCAVATION**

- A. Rock excavation shall be completed to a minimum of eight (8) inches below and on each side of all pipes, valves, fittings, and other appurtenances.
- B. Excess excavation shall be backfilled with compacted material conforming to the bedding material required for the material being used.

### 3.06 DEWATERING

- A. Where water is encountered in a trench, water shall be removed by pumping to lower the water level to such elevation that the pipe may be laid dry at the grade shown on the plans.
- B. All water pumped from the trench shall be disposed of in a manner so as not to cause any damage to adjacent property.
- C. When dewatering is paid for, it shall be considered as dewatering only when a manifold or pump and system of well points is installed to lower ground water such that excavation and construction can take place.
- D. The process of pumping water out of the trench with a suction hose and pump will not be considered as dewatering.
- E. Where seepage of water into the trench occurs that can be removed using standard pumping procedures, it shall not be deemed sufficient cause for installing a system of manifolds and well points and classified as dewatering in order to obtain remuneration under the Bid Item - Dewatering.
- F. A dewatering permit is required when the discharge from dewatering may reach the waters of the state. To obtain information on the General Dewatering Permit, the Contractor should contact the Department of Agriculture and Natural Resources at (605) 773-3351.

### 3.07 TRENCH BOTTOM PREPARATION

- A. The sides of all trenches shall be vertical from the bottom of the trench to a point one (1) foot above the top of the pipe.
- B. The width of the trench shall be a minimum of twelve (12) inches on each side of the pipe bell.
- C. The bottom of all trenches for underground piping shall be carefully and accurately formed to the lines and grades as shown on the plans, set by the Engineer or as specified herein.
- D. Rock, boulders, and large stones, or other manmade material shall be removed to provide a clearance of at least eight (8) inches below the outside barrel of the pipes, valves, fittings appurtenances. Adequate clearance for properly jointing pipe laid in rock trenches shall be provided at bell holes. The space between the rock at the bottom of the trench and the bottom of the pipe barrel shall be filled with compacted bedding material.
- E. If the trench bottom is inadvertently excavated deeper than necessary, it shall be backfilled to the proper grade with compacted bedding material.

### 3.08 UNSTABLE TRENCH BOTTOM

- A. Whenever wet, soft or unstable soils incapable of properly supporting the pipe, or other appurtenances are encountered in the trench, the Contractor shall be required to remove the unsuitable materials and backfill to the proper grade with concrete, granular material or other suitable approved material.
- B. Backfill material shall be compacted to provide a firm and level support for the piping system. Firm support is defined as no visual deformation in the surface when workers walk on the compacted material.

3.09 BACKFILLING AND COMPACTING

- A. Any trenches improperly backfilled or showing excessive settlement shall be reopened to a depth required for proper compaction.
- B. Backfill material shall be free of boulders, frozen clods, large roots, excessive sod or other vegetation, construction debris.
- C. No backfilling shall take place in freezing weather without written permission from the Engineer.
- D. Borrowed granular bedding material shall conform to the gradation indicated below.

<u>Sieve Opening</u>	<u>Bedding Material (Percent Passing)</u>
1"	95-100
No. 200	< 15

- E. Bedding material excavated from the job site shall be finely divided material free from organic material and clods, lumps of frozen material or stones larger than 1 1/2" in maximum diameter. Bedding material shall be of proper moisture content to form a firm bed for the pipe.
- F. The bedding material backfilling around the pipe shall be deposited in layers not to exceed eight inches (8") and carefully compacted to a degree of compaction at least equal to 90% maximum dry density as determined by Standard Proctor Test, ASTM Test Designation D698 throughout the entire depth of each layer. Where the pipe has a protective coating, care shall be taken not to damage the coating.
- G. The embedment material shall be finely divided material free from debris, organic material, and clods, lumps or stones larger than 1-1/2 inches maximum diameter. The material shall be borrowed material or job site excavated material. Embedment material shall be placed in uniform layers not more than twelve (12) inches thick and compacted to 90% maximum density as determined by ASTM D698 until the pipe has a cover of not less than one (1) foot.
- H. The remainder of the backfill shall consist of selected material from excavation or borrow, and shall be free from cinders, ashes, refuse, organic and frozen material, boulders or other materials that are unsuitable. Stones larger than 3 inches in diameter shall not be placed within two feet of the top of the pipe. This material shall be placed from 12 inches above the top of the pipe to 6 inches below the ground surface, unless otherwise specified, or to the subgrade elevation for streets or paved surfaces.
- I. After completing the bedding and embedment of the pipe as specified above, the remainder of the backfill material beneath unpaved areas shall be placed in uniform layers not exceeding one (1) foot and tamped. It shall be the Contractor's responsibility to compact each layer throughout its entire depth to a degree of compaction at least equal to that of the surrounding earth. The Contractor shall moisten or aerate the backfill material to obtain the required compaction. The Contractor shall provide a final cover of topsoil as specified herein. Any additional settlement of the trench shall be brought back to grade with additional topsoil. The trench shall be left in a condition so as to present a neat appearance.
- J. Open trenches under road surfacing, sidewalks, curb and gutter, and other adjacent improvements to a point eight (8) feet from the edge of the road surface and as otherwise

noted on the plans shall be backfilled with uniform layers not exceeding one (1) foot. Each layer, except the upper 6 inches of subgrade underlying the pavement, shall be spread uniformly and tamped with a hand tamper or other approved device until thoroughly compacted to at least 90% of the maximum density obtainable at optimum moisture content. The upper 6-inch layer, forming the subgrade for surfacing shall be compacted to at least 97% of the maximum density obtainable at optimum moisture content. Density of backfill shall be determined based on Standard Proctor Test, ASTM Test Designation D698.

### 3.10 TESTING REQUIREMENTS

- A. Frequency of Testing: Minimum of one (1) test every 250 feet to 350 feet of trench per lift or as directed by Engineer. Frequency of testing may be altered by Engineer after adequate testing is completed to determine level of effort by Contractor is sufficient. When frequency is altered by the Engineer, random testing will be performed to verify compaction efforts. The Contractor may be required to excavate to depths required by Engineer for testing and backfill test holes to density specified.
- B. Retesting: In the event of failure to meet compaction criteria, the Contractor shall re-excavate and re-backfill at direction of Engineer. All retesting to be paid for by Contractor and to be performed by soils testing firm secured by the Contractor and approved by the Engineer.

### 3.11 EXCESS EXCAVATION

- A. The Contractor shall be responsible for securing and maintaining an adequate area where excess excavation can be stockpiled for future use or wasted.
- B. The Engineer's approval on the site selection shall be required.
- C. The Contractor shall be responsible for the final cleanup of the site chosen. The site shall be cleaned to the satisfaction of the property owner, and a lien waiver or a letter of satisfaction written by the property owner and addressed to the Contractor shall be obtained by the Contractor and furnished to the Owner.

### 3.12 TOPSOIL

- A. All lawns areas shall be left smooth with a minimum of 6" of compacted black dirt throughout the entire area disturbed by the trench.
- B. Prior to topsoiling and finish grading, all rough grades shall be corrected, adjusted, and brought to the required elevations.
- C. The subgrade surface shall be prepared for topsoiling by cross disking to a depth of two (2) inches or more to permit bonding of the topsoil to the subgrade.
- D. All stones and other debris greater than two (2) inches in any dimension shall be removed from the surface of the subgrade prior to the placement of the topsoil.
- E. Topsoil material shall not be placed when the topsoil or subgrade is frozen or wet enough to cause clodding.
- F. Topsoiling operations adjacent to lagoons and along piping routes shall be considered complete when the finished surface is:
  - 1. Free of sticks, stones and other material one (1) inch or more in any dimension.



2. Smooth and true to required grades with a maximum allowable deviation of 0.1 foot.
- G. All lawns shall be raked with a landscape rake, garden rake, or other approved equipment to remove all clods, stones, sticks, or other material greater than one (1) inch in any dimension. Trenches shall be slightly crowned and all disturbed areas smoothed to a maximum deviation of 0.1 foot and ready for seeding operations by Contractor prior to acceptance by the Engineer.

\* \* \* END OF SECTION \* \* \*

# SECTION 32 11 23 AGGREGATE MATERIAL

## PART 1 GENERAL

### 1.01 RELATED DOCUMENTS

- A. The general provisions of the contract, including General and Special Conditions shall apply to work covered in this section.
- B. Related requirements specified elsewhere:
  - 1. Asphalt Concrete Surfacing - Section 32 12 16

### 1.02 DESCRIPTION OF WORK

- A. Aggregates shall be hauled, spread, compacted, and laid to grade as staked by the Owner's representative and shown on plans.

### 1.03 QUALITY ASSURANCE

- A. The finished grade of the base course/gravel cushion shall be within 0.05 feet at any point, as staked and checked by the Owner's Representative.

## PART 2 PRODUCTS

### 2.01 BASE COURSE/GRAVEL CUSHION

- A. The aggregates shall consist of sound durable particles of gravel and sand with which may be included limited amounts of fine soil particles. The physical characteristics and quality of the materials shall conform to the specifications for the particular material required by the contract as follows:

REQUIREMENT	Aggregate Base Course	Gravel Cushion
SIEVE	PERCENT PASSING	
2" (50 mm)		
1" (25.0 mm)	100	
3/4" (19.0 mm)	80-100	100
1/2" (12.5 mm)	68-91	
No. 4 (4.75 mm)	46-70	50-75
No. 8 (2.36 mm)	34-58	38-64
No. 40 (425 μm)	13-35	15-35
No. 200 (75 μm)	3.0-12.0	3.0-12.0
Liquid Limit Max	25	25

REQUIREMENT	Aggregate Base Course	Gravel Cushion
SIEVE	PERCENT PASSING	
Plasticity Index	0-6	0-6
L.A. Abra. Loss, max.	40	40
Foot Notes	1,2	
Processing Required	crushed	crushed

- <sup>1</sup> The fraction passing the No. 200 (75 µm) sieve shall not be greater than 2/3 of the fraction passing the No. 40 (425 µm) sieve. In no case shall the upper limit specified for the No. 200 (75 µm) sieve be exceeded.
- <sup>2</sup> Requirements include quarried ledge rock.

B. Granular material of which 30% of the particles retained on the No. 4 sieve shall contain one or more fractured faces. A crushed particle shall be defined to be a fragment of stone showing at least one freshly fractured face.

### **PART 3 EXECUTION**

#### 3.01 BASE COURSE

A. Base course material, meeting the requirements as set forth in Part 2 above, shall be furnished and installed to obtain the desired grades, as shown on the plans. The base course material shall then be compacted-see Geotechnical report for % and moisture levels.

#### 3.02 GRAVEL CUSHION

A. Gravel cushion material, meeting the requirements as set forth in Part 2 above, shall be furnished and installed to obtain the desired grades, as shown on the plans. No density requirements are needed under the sidewalk but the material shall be approved by the Engineer prior to placement of the fiber/rebar reinforced concrete sidewalks.

#### 3.03 UNSUITABLE MATERIAL

A. Unsuitable material shall be excavated and replaced with approved base course material as designated by the Owner or his Representative. No additional compensation shall be considered for this operation.

\* \* \* END OF SECTION \* \* \*

# **SECTION 32 12 13.13 BITUMINOUS TACK COAT**

## **PART 1 GENERAL**

### **1.01 RELATED DOCUMENTS**

- A. The general provisions of the contract, including General and Supplementary Conditions shall apply to work covered in this section.
- B. Related requirements specified elsewhere:
  - 1. Asphalt Concrete Surfacing - Section 32 12 16

### **1.02 DESCRIPTION OF WORK**

- A. This item shall consist of preparing and treating a bituminous surface with bituminous material in accordance with these specifications and in reasonably close conformity to the lines shown on the plans.

### **1.03 QUALITY ASSURANCE AND SUBMITTALS**

- A. Samples of the bituminous material that the Contractor proposes to use, together with a statement as to its source and character, must be submitted and approved before use of such material begins. The Contractor shall require the manufacturer or producer of the bituminous material to furnish material subject to this and all other pertinent requirements of the contract. Only satisfactory materials so demonstrated by service tests, shall be acceptable.
- B. The Contractor shall furnish the vendor's certified test reports for each carload, or equivalent, of bituminous material shipped to the project. The report shall be delivered to the Engineer before permission is granted for use of the material. The furnishing of the vendor's certified test report for the bituminous material shall not be interpreted as a basis for final acceptance. All such test reports shall be subject to verification by testing samples of material received for use on the project.
- C. Before the final estimate is allowed, the Contractor shall file with the Engineer receipted bills when railroad shipments are made, and certified weigh bills when materials are received in any other manner, of the bituminous materials actually used in the construction covered by the contract. The Contractor shall not remove bituminous material from the tank car or storage tank until the initial outage and temperature measurements have been taken by the Engineer, nor shall the cart or tank be released until the final outage has been taken by the Engineer. Copies of freight bills and weigh bills shall be furnished to the Engineer during the progress of the work.

**PART 2 PRODUCTS**

2.01 MATERIALS

- A. The bituminous material shall be either cutback asphalt, emulsified asphalt, or tar and shall conform to the requirements of Table 1. The type, grade, controlling specification, and application temperature of bituminous material to be used shall be specified by the Engineer.

TYPE AND GRADE	SPECIFICATION	APPLICATION TEMPERATURE	
		DEG. F.	DEG. C
Emulsified Asphalt	ASTM D977	75-130	25-55
SS-1h, CSS-1h	ASTM D2397	75-130	25-55

**PART 3 EXECUTION**

3.01 WEATHER LIMITATIONS

- A. The tack coat shall be applied only when the existing surface is dry and the atmospheric temperature is above 60 degrees F (15 degrees C). The temperature requirements may be waived, but only when so directed by the Engineer.

3.02 EQUIPMENT

- A. The Contractor shall provide equipment for heating and applying the bituminous materials.
- B. The distributor shall be designed, equipped, maintained, and operated so that bituminous material at even heat may be applied uniformly on variable widths of surface at the specified rate. The allowable variation from the specified rate shall not exceed 10 percent. Distributor equipment shall include a tachometer, pressure gages, volume-measuring devices, or a calibrated tank, and a thermometer for measuring temperatures of tank contents. The distributor shall be self-powered and shall be equipped with a power unit for the pump and full circulation spray bars adjustable laterally and vertically.
- C. A power broom and/or blower shall be provided for any required cleaning of the surface to be treated.

3.03 APPLICATION OF BITUMINOUS MATERIAL

- A. Immediately before applying the tack coat, the full width of surface to be treated shall be swept with a power broom and/or air blast to remove all loose dirt and other objectionable material.
- B. Emulsified asphalt shall be diluted by the addition of water where directed by the Engineer and shall be applied a sufficient time in advance of the paver to ensure that all water has evaporated before any of the overlying mixture is placed on the tacked surface.

- C. The bituminous material including vehicle or solvent shall be uniformly applied with a bituminous distributor at the rate of 0.10 to 0.15 gallons per square yard (0.24 to 0.72 liters per square meter) depending on the condition of the existing surface. The type of bituminous material and application rate shall be approved by the Engineer prior to application.
- D. Following the application, the surface shall be allowed to cure without being disturbed for such period of time as may be necessary to permit drying out and setting of the tack coat. This period shall be determined by the Engineer. The surface shall then be maintained by the Contractor until the next course has been placed. Suitable precautions shall be taken by the Contractor to protect the surface against damage during this interval.

\* \* \* END OF SECTION \* \* \*



# **SECTION 32 12 16 ASPHALT CONCRETE SURFACING**

## **PART 1 GENERAL**

### 1.01 RELATED DOCUMENTS

- A. The general provisions of the contract, including General and Supplementary Conditions shall apply to work covered in this section.
- B. Related requirements specified elsewhere:
  - 1. Bituminous Tack Coat – Section 32 12 13.13

### 1.02 DESCRIPTION OF WORK

- A. The work covered under these specifications shall include the furnishing of all labor, materials, and equipment necessary to lay a compacted asphalt concrete mat (at a depth as indicated in the plans), complete in place, as specified herein.

### 1.03 SUBMITTALS

- A. The Contractor shall submit for review copies of all certificates from the manufacturer that the materials meet or exceed specified requirements.

### 1.04 QUALITY ASSURANCE

- A. The contractor shall provide the required control tests of the mineral aggregate for the asphalt surfacing. The cost is considered incidental to the project.
- B. The contractor shall provide the required job mix, prepared by an independent testing laboratory approved by the Engineer for the Class E, Type 1 Asphalt concrete to the Engineer/Owner 14 days prior to start of production. The cost of the job mix designs shall be paid for by the Contractor and are considered incidental to the project.
- C. Following the Engineer's approval of the above-mentioned tests, all remaining tests shall be performed by the Owner's representative with results being given to both the Contractor and the Owner.

## **PART 2 PRODUCTS**

### 2.01 GENERAL

- A. Specifications to be used for this section shall be the South Dakota Department of Transportation Standard Specifications for Roads and Bridges, 2015 Edition, Division III Materials Details with the following modifications, and/or special provisions.
  - 1. Where the term Engineer, Area Engineer, Department, etc., is used it shall be replaced with Helms and Associates, Owner etc. as applicable.



2. The shale content or other particles of low specific gravity (less than 1.95) passing the No. 4 sieve shall not exceed four (4) percent.

## 2.02 ASPHALT CONCRETE

- A. The construction requirements and material handling shall conform to the requirements of Section 320, Section 880, and Section 890 of the South Dakota Department of Transportation Standard Specifications for Roads and Bridges, 2015 edition.
- B. Mineral aggregate for asphalt concrete shall conform to the requirements of the standard specifications for Class E, Type I. The asphalt cement shall be PG 64-22 or PG 64-28. The Contractor shall provide a job mix formula with the supporting mix design data prior to production.
- C. A bituminous tack coat (SS-1H or CSS-1H) shall be applied between each lift at a rate of 0.10 to 0.15 gallon per square yard.

## **PART 3 EXECUTION**

### 3.01 GENERAL

- A. The construction requirements and material handling shall conform to the requirements of Section 320, Section 880, and Section 890 of the South Dakota Department of Transportation Standard Specifications for Roads and Bridges, 2015 Edition, except as modified hereinafter.
  1. Where the term Engineer, Area Engineer, Department, etc. is used it shall be replaced Helms and Associates, Owner etc. as applicable.

### 3.02 ASPHALT CONCRETE SURFACE

- A. Asphalt concrete surfaces will be replaced in the areas as designated by the Owner and Engineer.
- B. Placement of asphalt concrete surfaces shall be on compacted granular base course as indicated on the plans. The compacted thickness of asphalt concrete shall be as shown on the plans or as directed by the Owner and Engineer.
- C. The contractor shall adjust and cover all manholes and valve boxes, prior to tack coat application, with material approved by the Engineer.

### 3.03 GENERAL

- A. The Asphalt Concrete Paving equipment, weather limitations, job mix formula, mixing, construction methods, compaction, finishing, tolerance, and protection shall conform to the requirements of the appropriate sections of the State Highway Specifications for the type of material specified.

### 3.04 MIXING ASPHALTIC CONCRETE MATERIALS

- A. Provide hot plant-mixed asphaltic concrete paving materials.
  1. Temperature leaving the plant: 143 degrees C (290 degrees F) minimum, 160 degrees C (320 degrees F) maximum.

2. Temperature at time of placing: 138 degrees C (280 degrees F) minimum.

### 3.05 SUBGRADE

- A. Shape to line and grade and compact with self-propelled rollers.
- B. All depressions that develop under rolling shall be filled with acceptable material and the area re-rolled.
- C. Soft areas shall be removed and filled with acceptable materials and the area re-rolled.
- D. Should the subgrade become rutted or displaced prior to the placing of the subbase, it shall be reworked to bring to line and grade.
- E. Proof-roll the subgrade with weighted dump truck as directed by Engineer. If pumping, pushing, or other movement is observed, rework the area to provide a stable and compacted subgrade.

### 3.06 BASE COURSES

- A. Base
  1. Spread and compact to the thickness shown on the drawings.
  2. Rolling shall begin at the sides and continue toward the center and shall continue until there is no movement ahead of the roller.
  3. After completion of the base rolling there shall be no hauling over the base other than the delivery of material for the top course.
- B. Thickness tolerance: Provide the compacted thicknesses shown on the Drawings within a tolerance of minus 0.0mm (0.0") to plus 12.7mm (0.5").
- C. Smoothness tolerance: Provide the lines and grades shown on the Drawings within a tolerance of 5mm in 3m (3/16 inch in ten feet).
- D. Moisture content: Use only the amount of moisture needed to achieve the specified compaction.

### 3.07 PLACEMENT OF ASPHALTIC CONCRETE PAVING

- A. Remove all loose materials from the compacted base.
- B. Apply the specified prime coat, and tack coat where required, and allow to dry in accordance with the manufacturer's recommendations as approved by the Architect or Engineer.
- C. Receipt of asphaltic concrete materials:
  1. Do not accept material unless it is covered with a tarpaulin until unloaded, and unless the material has a temperature of not less than 130 degrees C (280 degrees F).
  2. Do not commence placement of asphaltic concrete materials when the atmospheric temperature is below 10 degrees C (50 degrees F), not during fog, rain, or other unsuitable conditions.
- D. Spreading:
  1. Spread material in a manner that requires the least handling.
  2. Where thickness of finished paving will be 76mm (3") or less, spread in one layer.

E. Rolling:

1. After the material has been spread to the proper depth, roll until the surface is hard, smooth, unyielding, and true to the thickness and elevations shown on the drawings.
2. Roll in at least two directions until no roller marks are visible.
3. Finished paving smoothness tolerance:
  - a. No depressions which will retain standing water.
  - b. No deviation greater than 3mm in 1.8m (1/8" in six feet).

3.08 PROTECTION

- A. Protect the asphaltic concrete paved areas from traffic until the sealer is set and cured and does not pick up under foot or wheeled traffic.

3.09 FINAL CLEAN-UP

- A. Remove all debris, rubbish, and excess material from the work area.

\* \* \* END OF SECTION \* \* \*

# **SECTION 32 16 00 CURBS, GUTTERS, SIDEWALKS AND DRIVEWAYS**

## **PART 1 GENERAL**

### 1.01 RELATED DOCUMENTS

- A. The general provisions of the Contract, including General and Supplementary Conditions shall apply to the Work covered in this Section.
- B. Related requirements specified elsewhere:
  - 1. Trenching, Backfilling and Compaction - Section 31 23 33
  - 2. Asphalt Concrete Surfacing – Section 32 12 16

### 1.02 SCOPE

- A. This section covers the labor, materials, equipment and related services necessary to install or repair pavement and related structures damaged during construction.

### 1.03 QUALITY ASSURANCE

- A. The Contractor shall be responsible for obtaining the services of a qualified testing firm as may be required to assure compliance with the requirements of these specifications.

### 1.04 SUBMITTALS

- A. A complete description of the materials to be used in the Work covered by this Section of the specifications shall be submitted to the Engineer for review.
- B. Three (3) copies of all reports and test results completed by the independent testing service shall be submitted directly to the Engineer.

## **PART 2 PRODUCTS**

### 2.01 CONCRETE

- A. See Division 030000.

## **PART 3 EXECUTION**

### 3.01 GENERAL

- A. After completing proper compaction of the backfill, the Contractor shall replace the disturbed surfaces to the original grade. Surfacing material, as specified herein shall be replaced to the same depths and limits with the same type of material as the surfacing material removed, unless otherwise shown on plans.
- B. A flush, smooth, adjoining surface transition shall be provided.
- C. Existing asphalt paved surface, sidewalks, curb and gutter, concrete or asphalt driveways and alley approaches shall be scored along a straight line by a concrete saw to a depth of two (2)

inches (or by a method previously approved by the Engineer) at a distance of two (2) feet beyond each edge of proposed ditch. The remaining thickness of surfaces shall be fractured to a true vertical face. All exposed faces shall be adequately cleaned to ensure bonding between new and existing surfaces and cut and fractured to a vertical face immediately prior to placement of the new surfacing.

- D. Placement of concrete or asphalt on frozen surfaces will not be permitted.
- E. Concrete surfaces shall be cured and protected for a sufficient period of time (not less than 3 days) to prevent damage to concrete and insure required compressive strength requirements.

### 3.02 CONCRETE SIDEWALK

- A. Concrete Sidewalk shall be replaced at locations as designated by the Engineer with nominal five (5) inch thick fiber reinforced concrete or six (6) inch rebar reinforced concrete sidewalk. Concrete sidewalk shall be poured on compacted gravel cushion, at a depth as indicated on the plans.
- B. Sidewalk to be replaced shall be removed to nearest expansion or scored joint from each edge of the trench.
- C. Expansion joints shall be provided where walks abut a structure, at changes in directions, and at intervals of not more than 50 feet. Expansion joints shall be filled to within one inch of the surface with bituminous expansion joint material, and then filled flush to the surface with joint sealing compound. The joint sealing compound shall be finished slightly concave, and shall not be allowed to overflow the joint.
- D. Concrete walks shall be edged and grooved, with the grooves dividing each walk into equal length sections approximately equal to the width of the walk. Walks shall be floated smooth and even, and given a light broom finish at right angles to the length of the walk.

### 3.03 CONCRETE PAVEMENT

- A. Concrete Pavement, including driveways and heavy concrete sidewalk sections, shall be replaced at locations designated by the Engineer with six (6) inch thick, rebar reinforced concrete placed on compacted base course, at a depth as indicated on the plans.
- B. If an expansion or scored joint is within six (6) feet of the edge of the trench, the existing concrete shall be removed and replaced to the joint.
- C. The alignment of the new surface shall match that of the existing surface unless otherwise directed.
- D. The alignment and grade of the new surface shall match that of the existing surface unless otherwise directed.
- E. Expansion joints shall be filled to within one (1) inch of the surface with bituminous expansion joint material. Dowels shall be placed across the expansion joint at maximum 24" spacings.
- F. Contraction joints shall be provided at intervals of not more than ten (10) feet. Contraction joints shall consist of a groove of at least one third (1/3) the depth of the pavement sawed in green concrete or a plane of weakness formed by inserting a removable metal template.
- G. All expansion and contraction joints shall be filled flush to the surface with joint sealing

compound. The joint sealing compound shall be finished slightly concave, and shall not be allowed to overflow the joint.

H. Reinforcement shall consist of #4 deformed rebar placed at 24" OC both directions.

### 3.04 CONCRETE CURB AND GUTTER OR STRAIGHT GUTTER

- A. Curb and gutter shall be replaced to the thickness, geometric design, and alignment of the existing section with non-reinforced concrete on a 6-inch compacted gravel base course.
- B. In the event a joint is encountered within 5 feet of a proposed edge of the trench, the concrete shall be removed to such joint.
- C. Expansion joints shall be placed at changes in direction and at intervals not greater than 50 feet. Expansion joints shall be 1/2 inch wide, filled to within one inch of the surface with bituminous expansion joint material cut to the shape of the curb section. Dowels shall be placed across expansion joints as shown on the drawings or as directed.
- D. Contraction joints shall be provided at intervals of not more than 10 feet. Contraction joints shall consist of a groove at least 1-1/4 inches deep sawed in the green concrete or a plane of weakness formed by inserting a removable metal template.
- E. All expansion and contraction joints shall be filled flush to the surface with joint sealing compound. The joint sealing compound shall be finished slightly concave, and shall not be allowed to overflow the joint.
- F. All exposed edges of curbs and gutters shall be rounded with a suitable edging tool. Exposed surfaces shall be finished smooth and even with a steel trowel, and then given a light broom finish.

### 3.05 CONTRACTOR'S RESPONSIBILITY

- A. Any repaired areas which will include surface material and/or seeding requiring further repair due to trench settlement shall be repaired by the Contractor at his expense for a period of one year after written final acceptance of the project by the Owner.

\* \* \* END OF SECTION \* \* \*



**SECTION 328423  
UNDERGROUND SPRINKLERS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Pipe and fittings, valves, and accessories.
- B. Control system.

**1.02 DEFINITIONS**

- A. Lateral Piping: Downstream from control valves to sprinklers, specialties, and drain valves. Piping is under pressure during flow.
- B. Main Piping: Downstream from point of connection to water distribution piping to, and including, control valves. Piping is under water-distribution-system pressure.
- C. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.

**1.03 REFERENCE STANDARDS**

- A. ASTM D2564 - Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems; 2020.
- B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2020.

**1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination: Coordinate the work with site backfilling, landscape grading and delivery of plant life.

**1.05 SUBMITTALS**

- A. Product Data: For each type of product indicated. Include rated capabilities, operating characteristics, specialties and accessories.
- B. Qualification Data for Installer: Include list of similar projects completed by Installer demonstrating Installer's capabilities and experience. Include project names, addresses, and year completed, and include names and addresses of owners' contact persons.
  - 1. Maintenance Proximity: Not more than two hours' normal travel time from Installer's place of business to Project site.
  - 2. An installer that has successfully installed projects of similar scope and size with a minimum of three years experience.
- C. Operation and Maintenance Data:
  - 1. Provide instructions for operation and maintenance of system and controls, seasonal activation and shutdown, and manufacturer's parts catalog.
  - 2. Provide schedule indicating length of time each valve is required to be open to provide a determined amount of water.
  - 3. Statement of Warranty: Describing an understanding of the required warranty. Provide name and phone number for individual responsible for overseeing warranty services. Include product warranties for each component warranted by manufacturer.
- D. Record Documents: The Contractor is responsible for documenting changes to the design.
  - 1. Record work that is installed differently than shown on the construction shop drawings. Record pipe and wiring network alterations and location changes to equipment. Keep documents current. Do not permanently cover work until as-built information is recorded.
  - 2. Turn over the "Record Drawings" to the Landscape Architect. Completion of the Record Drawings will be a prerequisite for irrigation system substantial completion and final payment.

**1.06 QUALITY ASSURANCE**

- A. Installer Qualifications: An installer that has successfully installed projects of similar scope and size. with minimum three years of experience.

**1.07 WARRANTY**



- A. The purpose of this guarantee/warranty is to ensure that the Owner receives irrigation materials of prime quality, installed and maintained in a thorough and careful manner.
- B. For a period of one year from project substantial completion, the contractor will guarantee/warranty irrigation materials, equipment, and workmanship against defects. Fill and repair depressions. Restore landscape or structural features damaged by the settlement of irrigation trenches or excavations. Repair damage to the premises caused by a defective item. Make repair within seven days of notification from the Owner's Representative.
  - 1. Contract documents govern replacements identically as with new work. Make replacements at no additional cost to the contract price.
  - 2. Guarantee/warranty applies to originally installed materials and equipment and replacements made during the guarantee/warranty period.

## **PART 2 PRODUCTS**

### **2.01 REGULATORY REQUIREMENTS**

- A. Comply with applicable code for piping and component requirements.

### **2.02 IRRIGATION SYSTEM**

- A. Electric solenoid controlled underground irrigation system, with pressure blow-out drain.

### **2.03 PIPE MATERIALS**

- A. PE Pipe with Controlled ID: ASTM F 771, PE 4710 compound; SDR 15.
  - 1. Insert Fittings for PE Pipe: ASTM D 2609, nylon or propylene plastic with barbed ends. Include bands or other fasteners.
- B. PVC Pipe, Pressure Rated: ASTM D 2241, PVC 1120 compound, SDR 21, 200 psi.
- C. Fittings:
  - 1. PVC Socket Fittings: ASTM D 2466, Schedule 40.
  - 2. PVC Threaded Fittings: ASTM D 2464, Schedule 80.
- D. Pipe Risers at Valves: Schedule 80 PVC nipples.
- E. Solvent Cement: ASTM D2564 for PVC pipe and fittings.
- F. Sleeve Material: PVC.

### **2.04 SPRINKLERS**

- A. Turf Rotors and Spray Heads
  - 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or approved equal.

### **2.05 VALVES**

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or approved equal.
- B. Isolation Valves: Bronze construction non-rising stem.
- C. Valve Box and Cover: with open bottom and openings for piping; designed for installing flush with grade.
  - 1. Size: As required for valves and service.
  - 2. Shape: Rectangular for control valves, circular for specialties as indicated on details.
  - 3. Material: PE or ABS.
  - 4. Drainage Backfill: Cleaned gravel or crushed stone, graded from 3/8 inch minimum to 3/4 inches maximum, to 6" depth below base of box. Install prior to box installation.

### **2.06 CONTROLS**

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or approved equal.
- B. Wire Conductors: 14-2 cable with solid copper conductors; insulated for direct burial and compatible with control system specified.

- C. Wire Splices: Shall be located at valve boxes. All connections shall be made with 3M DBY/Y-6 watertight wire connectors.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Verify location of existing utilities.
- B. Verify that water stub out is available, in proper location, and ready for use.

#### **3.02 PREPARATION**

- A. Piping layout indicated is diagrammatic only. Route piping to avoid plants, ground cover, and structures.
- B. Layout and stake locations of system components.
- C. Review layout requirements with other affected work. Coordinate locations of sleeves under paving to accommodate system.

#### **3.03 TRENCHING**

- A. Trench Size:
  - 1. Minimum Cover Over Installed Mainline Piping: 18 inches. Maximum Cover Over Installed Mainline Piping: 36 inches (915 mm).
  - 2. Minimum Cover Over Installed Lateral Piping: 12 inches. Maximum Cover Over Installed Mainline Piping: 24 inches (610 mm).
- B. Trench to accommodate grade changes and slope to drains.
- C. Maintain trenches free of debris, material, or obstructions that may damage pipe.

#### **3.04 INSTALLATION**

- A. Install pipe, valves, controls, and outlets in accordance with manufacturer's written instructions and details found on plan sheets.
- B. Connect to water source.
- C. Set outlets and box covers at finish grade elevations.
- D. Provide for thermal movement of components in system.
- E. Use pre-manufactured swing joints for risers to each outlet.
- F. Mark valves with valve markers.
- G. After piping is installed, but before outlets are installed and backfilling commences, open valves and flush system with full head of water.

#### **3.05 FIELD QUALITY CONTROL**

- A. Prior to backfilling, test system for leakage at main piping to maintain 100 psi pressure for one hour.

#### **3.06 BACKFILLING**

- A. Backfill trench and compact to specified subgrade elevation. Protect piping from displacement.

#### **3.07 SYSTEM STARTUP**

- A. Contractor will ensure backflow devices have been inspected if required by local code, and communicate nonconformance to management.
- B. Contractor will review controller programming and update or change programs as necessary. Programming must conform to local watering restrictions. Contractor is liable for fines associated with watering during restricted times.
- C. Contractor will confirm proper function of sensors and proper communication between sensors and controllers.
- D. Contractor will gradually introduce water into the system in accordance with industry best practices to avoid system damage.

- E. Contractor will run every zone and adjust heads when necessary to achieve proper performance.
- F. Contractor will identify damaged system components and make repairs as necessary.
- G. Contractor will communicate results of system inspection to Engineer within 36 hours of completion.
- H. Adjust control system to achieve time cycles required.
- I. Adjust head types for full water coverage as directed.

**3.08 CLOSEOUT ACTIVITIES**

- A. Instruct Owner 's personnel in operation and maintenance of system, including adjusting of controller timing. Use operation and maintenance data as basis for demonstration.

**3.09 MAINTENANCE**

- A. Provide one complete spring start-up and a fall shutdown by installer, at no extra cost to Owner.

**END OF SECTION**

**SECTION 329219  
SEEDING**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Soil preparation.
- B. Seeding, mulching and fertilizer.
- C. Erosion control.
- D. Turf and native grass establishment.

**1.02 DEFINITIONS**

- A. Finish Grade: Elevation of finished surface of planting soil.
- B. Growing Season: A growing season is considered May 1 to October 1.
- C. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. This includes insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. It also includes substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.
- D. Pests: Living organisms that occur where they are not desired or that cause damage to plants, animals, or people. These include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.
- E. Planting Soil: Standardized topsoil; existing, native surface topsoil; existing, in-place surface soil or imported topsoil that is modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.

**1.03 SUBMITTALS**

- A. Product Data: For each type of product indicated.
  - 1. Pesticides and Herbicides: Include product label and manufacturer's application instructions specific to this Project.
- B. Certification of grass seed: From seed vendor for each grass-seed monostand or mixture stating the botanical and common name, percentage by weight of each species and variety, and percentage of purity, germination, and weed seed. Include the year of production and date of packaging.
- C. Product tags to confirm quantity installed of the following products. Payment will not be approved until product tags have been received and approved by the Landscape Architect.
  - 1. Seed.
  - 2. Fertilizer.
  - 3. Fiber Mulch.
- D. Qualification Data: For qualified Installer. Include list of similar projects completed by Installer demonstrating Installer's capabilities and experience. Include project names, addresses, and year completed, and include names and addresses of owners' contact person.
  - 1. Maintenance Proximity: Not more than two hours' normal travel time from Installer's place of business to Project site
  - 2. Pesticide Applicator: State licensed, commercial.
- E. Maintenance Instructions: Recommended procedures to be established by Owner for maintenance of turf and grasses during a calendar year. Submit before expiration of required initial maintenance periods.
- F. Establishment Plan. Describing an understanding of the required establishment period including anticipated dates for mowing, pest control, observation and overseeding.

**1.04 QUALITY ASSURANCE**

- A. Installer's Field Supervision: Require installer to maintain an experienced full-time supervisor on Project site when work is in progress.

- B. Pre-installation Conference: Schedule a pre-installation meeting to review soil preparation and grading with the Contractor and Landscape Architect prior to seeding.
- C. Seasonal limitations have been designated below. If seasonal limitations cannot be met, then an alternate soil stabilization practice must be used. Payment will be made to the Contractor for these alternate stabilization practices if caused by the conditions out of the Contractor's control and not the result of the Contractor's negligence or inability to keep the Project on schedule.
  - 1. Spring: April 1 – June 15
  - 2. Fall: August 15 –September 15
  - 3. Dormant: November 1 – Freeze Up

**1.05 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver grass seed mixture in sealed containers. Seed in damaged packaging is not acceptable. Deliver seed mixture in containers showing percentage of seed mix, year of production, net weight, date of packaging, and location of packaging.
- B. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of manufacturer.

**PART 2 PRODUCTS**

**2.01 SEED MIXTURE**

- A. Seed Mixture - Turf:
  - 1. Millborn Seed "GK Elite Turf Mix", or approved equal, proportioned by weight as follows:
    - a. 80 percent Elite Kentucky Bluegrass (minimum 5 varieties)
    - b. 20 percent Fine-Leaf Perennial Ryegrass (minimum 2 varieties)

**2.02 ACCESSORIES**

- A. Microbial Inoculant
  - 1. Inoculate seed prior to planting at rate recommended by manufacturer for seed type specified.
- B. Fiber Mulch: Biodegradable, dyed-wood, cellulose-fiber mulch; nontoxic and free of plant-growth or germination inhibitors; with a maximum moisture content of 15 percent and a pH range of 4.5 to 6.5.
- C. Nonasphaltic Tackifier: Colloidal tackifier recommended by fiber-mulch manufacturer for slurry application; nontoxic and free of plant-growth or germination inhibitors.
- D. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition
  - 1. Composition: 18-24-12.
  - 2. Application rate: 7.0 lb/1000 SF
    - a. For use on turf seed areas only.
- E. Water: Clean, fresh and free of substances or matter that could inhibit vigorous growth of grass.
- F. Pesticide, registered and approved by EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.

**PART 3 EXECUTION**

**3.01 EXAMINATION**

- A. Examine areas to be planted for compliance with requirements and other conditions affecting performance.
  - 1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.

2. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Architect and replace with new planting soil.
- B. Finish Grading: Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Grade to within plus or minus 1/2 inch of finish elevation. Roll and rake, remove ridges, and fill depressions to meet finish grades. Limit finish grading to areas that can be planted in the immediate future.

### **3.02 PREPARATION**

- A. Protect structures, utilities, sidewalks, pavements, and other facilities, trees, shrubs, and plantings from damage caused by planting operations.
- B. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.
- C. Seedbed Preparation
1. Kill existing weed growth with non-selective herbicide a minimum of two weeks prior to planting date. Apply a second application as necessary a minimum of 24 hours prior to seeding or sodding.
    - a. Apply at rate recommended by manufacturer.
  2. Loosen soil to a depth of 4-inches.
  3. Remove stones larger than 1-1/2 inches. in any dimension and sticks, roots, trash, and other extraneous matter.
    - a. Legally dispose of waste material, including grass, vegetation, and turf, off Owner's property.
- D. Finish Grading: Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Grade to within plus or minus 1/2 inch of finish elevation. Roll and rake, remove ridges, and fill depressions to meet finish grades. Limit finish grading to areas that can be planted in the immediate future.
1. Uniformly moisten excessively dry soil that is not workable and which is too dusty.
- E. Pre-emergent herbicide: Prior to seeding, apply pre-emergent herbicide to native grass seed areas.
1. Apply per manufacturer recommendations.
- F. Before planting, obtain Landscape Architect's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

### **3.03 FERTILIZING**

- A. Apply fertilizer in accordance with manufacturer's instructions.
- B. Apply after smooth raking of topsoil and prior to roller compaction.
- C. Apply fertilizer no more than 48 hours prior to seeding.
- D. Mix thoroughly into upper 2 inches of topsoil.

### **3.04 SEEDING**

- A. The specified seed mixture shall be uniformly drilled using a press drill equipped with individually mounted, adjustable, spring loaded, double disk furrow openers fitted with depth control bands or drums.
- B. Seed Rates:
1. Turf: 4lb per 1,000 sq ft.
- C. Hydroseeding is not permitted.
- D. Do not seed areas in excess of that which can be mulched on same day.
- E. Do not sow immediately following rain, when ground is too dry, or during windy periods.
- F. Roll seeded area with roller not exceeding 112 lbs.

### **3.05 MULCHING**

- A. Fiber Mulch: Rate of application shall be 2,000 pounds per acre. Areas of excessive thickness of mulch, which will smother grass seedlings, shall be avoided. Mulch shall be placed on a given area as soon as possible or within 48 hours after seeding as a separate operation. The Contractor shall allow the fiber mulch to cure a minimum of 18 hours prior to watering.

### **3.06 ESTABLISHMENT**

- A. Provide maintenance at no extra cost to Owner; Owner will pay for water.
- B. Provide maintenance of seeded areas for three months from Date of Substantial Completion.
  - 1. When maintenance period has not elapsed before the end of the growing season, or if turf is not fully established, continue maintenance during next growing season.
  - 2. Notify the Landscape Architect in writing upon the termination of required maintenance services. The Contractor shall continue maintenance services until written notification is provided.
- C. Maintain as required to establish a satisfactory turf or native grass stand. Roll, regrade, and replant bare or eroded areas and remulch to produce a uniformly smooth turf. Materials and installation methods shall be the same as those used in the original installation.
  - 1. Fill and establish turf or grasses in areas where settling occurs.
  - 2. In areas where mulch has been disturbed by wind or maintenance operations, add new mulch and anchor as required to prevent displacement.
- D. Mow turf as soon as top growth is tall enough to cut. Repeat mowing to maintain height appropriate for species without cutting more than 1/3 of grass height. Remove no more than 1/3 of grass-leaf growth in initial or subsequent mowings. The contractor is required to mow all seeded turf areas one time. Document and notify the Landscape Architect and Owner in writing upon completion.
  - 1. Neatly trim edges and hand clip where necessary.
  - 2. Immediately remove clippings after mowing and trimming.
- E. Watering: Where an irrigation system will be installed, maintain the irrigation program to keep turf uniformly moist to a depth of 4 inches. The Contractor may obtain water from Owner's existing water system for use without metering and without payment of use charges. If seeding is performed within the specified seeding windows watering is not required in areas where an irrigation system is not present.
  - 1. Schedule irrigation to prevent wilting, puddling, erosion, and displacement of seed or mulch.
  - 2. Apply water with irrigation system at a minimum rate of 1 inch per week unless rainfall precipitation is adequate.
- F. Roll surface to remove minor depressions or irregularities.
- G. Control growth of weeds. Apply herbicides in accordance with manufacturer's instructions. Remedy damage resulting from improper use of herbicides.
  - 1. Apply pesticides and other chemical products and biological control agents in accordance with requirements of authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with Owner's operations and others in proximity to the Work. Notify Owner before each application is performed.
  - 2. Broadleaf herbicide application:
    - a. Turfgrass: apply a broadleaf herbicide application once turf is established, or as directed by Landscape Architect, when grass is dry.
- H. Immediately reseed areas that show bare spots.
- I. Protect seeded areas with warning signs during maintenance period.
- J. Turf Post-fertilization: Apply second fertilizer application at the end of the maintenance period, or as directed by Landscape Architect, when grass is dry. Use fertilizer that will provide actual nitrogen of at least 1 lb/1000 sq. ft. to turf area.

### **3.07 SATISFACTORY TURF**

- A. Turf installations shall meet the following criteria as determined by Architect:

1. At end of maintenance period, a healthy, uniform, close stand of grass has been established, free of weeds and surface irregularities, with coverage exceeding 90 percent over any 10 sq. ft. and bare spots not exceeding 6 by 6 inches.
- B. Use specified materials to reestablish turf that does not comply with requirements and continue maintenance until turf is satisfactory.
- C. If satisfactory lawn has not been established at final inspection, another inspection shall be made upon written Contractor request that the lawn is ready for re-inspection, but no earlier than sixty (60) calendar days thereafter.

### **3.08 CLEANUP AND PROTECTION**

- A. Promptly remove soil and debris created by turf work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.
- B. Erect temporary fencing or barricades and warning signs as required to protect newly planted areas from traffic. Maintain fencing and barricades throughout initial maintenance period and remove after plantings are established.
- C. Remove nondegradable erosion-control measures after grass establishment period.

**END OF SECTION**



**SECTION 329300  
PLANTS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Planting soil preparation.
- B. New trees, plants, and ground cover.
- C. Mulch and Fertilizer.
- D. Edging.
- E. Weed barrier fabric.
- F. Plant establishment.

**1.02 DEFINITIONS**

- A. Backfill: The earth used to replace or the act of replacing earth in an excavation.
- B. Finish Grade: Elevation of finished surface of planting soil.
- C. Growing Season: A growing season is considered to be May 1 to October 1.
- D. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. This includes insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. It also includes substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.
- E. Pests: Living organisms that occur where they are not desired, or that cause damage to plants, animals, or people. These include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.
- F. Planting Soil: Standardized topsoil; existing, native surface topsoil; existing, in-place surface soil or imported topsoil that is modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.
- G. Root Flare: Also called "trunk flare." The area at the base of the plant's stem or trunk where the stem or trunk broadens to form roots; the area of transition between the root system and the stem or trunk.

**1.03 REFERENCE STANDARDS**

- A. ANSI A300 Part 1 - American National Standard for Tree Care Operations - Tree, Shrub, and Other Woody Plant Management - Standard Practices (Pruning); 2017.

**1.04 SUBMITTALS**

- A. Product Data: For each type of product indicated.
  - 1. Mulch
  - 2. Edging
  - 3. Weed Barrier Fabric
- B. Qualification Data: For qualified landscape Installer. Include list of similar projects completed by Installer demonstrating Installer's capabilities and experience. Include project names, addresses, and year completed, and include names and addresses of owners' contact persons.
  - 1. Maintenance Proximity: Not more than two hours' normal travel time from Installer's place of business to project site.
  - 2. Pesticide Applicator: State licensed, commercial.
- C. Maintenance Agreement: Statement of required maintenance period, duties to be performed, name and contact information of individual responsible for overseeing maintenance services.
- D. Maintenance Instructions: Recommended procedures to be established by Owner for maintenance of plants during a calendar year. Submit before start of required maintenance periods.
- E. Statement of Warranty. Describing an understanding of the required warranty. Provide name and phone number for responsible contact.

F. See Section 013000 - Administrative Requirements, for submittal procedures.

### 1.05 QUALITY ASSURANCE

- A. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
- B. Provide quality, size, genus, species, and variety of plants indicated, complying with applicable requirements in ANSI Z60.1.
- C. Pre-installation Conference: Schedule a pre-planting meeting to review preparation and planting requirements with the Landscape Architect and Contractor prior to planting. All plants, trees and shrubs shall be planted in accordance with all the drawings and specifications included in the plans.
  - 1. Plant one (1) sample tree for review to demonstrate an understanding of Project requirements. Provide 48 hours' notice to Landscape Architect for planting approval prior to proceeding with remaining tree planting.
- D. Planting Restrictions: Plant during one of the following periods.
  - 1. Spring Planting: April 1 to June 15.
  - 2. Fall Planting: August 15 to November 15.
- E. Installer Qualifications: Company specializing in installing and planting the plants with 5 years experience.

### 1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of manufacturer.
- B. Protect and maintain plant life until planted.
  - 1. Do not prune trees and shrubs before delivery. Protect bark, branches, and root systems from sun scald, drying, wind burn, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees or shrubs in such a manner as to destroy their natural shape. Provide protective covering of plants during shipping and delivery. Do not drop plants during delivery and handling.
  - 2. Handle planting stock by root ball.
  - 3. Deliver plants after preparations for planting have been completed and install immediately. If planting is delayed more than six hours after delivery, set plants and trees in their appropriate aspect (sun, filtered sun, or shade), protect from weather and mechanical damage, and keep roots moist.
  - 4. Trees may not be stored on site for more than 24 hours prior to planting without prior approval and installation of moisture retaining cover or bedding around all root balls.

### 1.07 FIELD CONDITIONS

- A. Do not install plant life when ambient temperatures may drop below 35 degrees F or rise above 90 degrees F.

### 1.08 WARRANTY

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. Installer agrees to repair or replace plantings and accessories that fail in materials, workmanship or growth within the specified warranty period.
- C. Failures include, but are not limited to: death and unsatisfactory growth, lack of adequate maintenance and damage from falling or blowing over. The Contractor will be responsible to remove all dead plantings and trees immediately upon notification from the Landscape Architect, even if the replacement is not immediate. This requirement applies during the warranty period as well.
- D. All plants, trees and shrubs shall be **warrantied for ONE YEAR from date of Project Substantial Completion**. At the end of the warranty period the Landscape Architect shall make an inspection of the project and dead, unhealthy, or otherwise not acceptable plants, trees, and shrubs shall be replaced by the Contractor at no additional cost to the Owner.

1. Notify the Owner and Landscape Architect in writing immediately upon completion of any warranty replacement plantings. For replacements after the initial establishment period has expired the Contractor shall water replacement plants for one week, after which the Owner assumes responsibility for watering replacement plants. If written notice is not provided the Contractor shall continue to water replacement plants until notice requirements are fulfilled.
  2. An intermediate warranty inspection may occur prior to the one year warranty expiration. Replacement is required within 60 days of the intermediate warranty inspection.
    - a. If a plant replaced during the intermediate warranty period dies prior to the final warranty the contractor is not required to install a second replacement without additional compensation. Requests for additional compensation must be approved prior to proceeding with the work.
  3. Notify the Landscape Architect in writing with any concerns regarding Owner Maintenance of plant material during the warranty period.
- E. Warranty: Include coverage for one continuous growing season; replace dead or unhealthy plants.
- F. Replacements: Plants of same size and species as specified, planted in the next growing season, with a new warranty commencing on date of replacement.

## **PART 2 PRODUCTS**

### **2.01 PLANTS**

- A. Plants: Species and size identified in plant schedule, grown in climatic conditions similar to those in locality of the work.
- B. General: All plants, trees and shrubs shall conform to or exceed minimum quality standards as defined by the American Nursery and Landscaping Association, current edition of ANSI Z60.1, and shall be purchased from a licensed Landscape Nursery. Plants, trees and shrubs furnished shall be of the same genus, species, cultivar and size as specified in the plans. Species and variety may be substituted only by the approval of the Landscape Architect. Each plant, tree and shrub shall have an identification label, removed after the Substantial Completion inspection.
- C. Root-Ball Depth: Furnish trees and shrubs with root balls measured from top of root ball, which shall begin at root flare according to ANSI Z60.1. Root flare shall be visible before planting.

### **2.02 SOIL AMENDMENT MATERIALS**

- A. Commercial Fertilizer: All natural slow release nitrogen fertilizer:
  1. Composition: 8-2-4.
  2. Suggested supplier: Sustane Natural Fertilizer, Inc., or approved equal.
    - a. Product: Sustane 8-2-4, or approved equal.
    - b. Phone: 800-352-9245
    - c. Web: [www.sustane.com](http://www.sustane.com)
  3. Application rate: 10 lb/1000 SF
- B. Compost: Compost shall be a well decomposed, stable, weed free organic matter source. It shall be derived from: agricultural, food, or industrial residuals; biosolids (treated sewage sludge); yard trimmings; source-separated or mixed solid waste. The product shall contain no substances toxic to plants and shall be reasonably free (< 1% by dry weight) of man-made foreign. The compost will possess no objectionable odors and shall not resemble the raw material from which it was derived. The product shall be certified through the U.S. Composting Council's (USCC) Seal of Testing Assurance (STA) Program.

### **2.03 MULCHES**

- A. Rock Mulch: Crushed granite - Milbank 'Dakota Mahogany'.
  1. Plant Beds: Uniformly graded; 1-1/2 x 3/4 inches.
- B. Organic Mulch: Shredded bark mulch.
  1. Particle size and consistency: a general mixture of fibers 3 inches in length or less.
  2. Remove any large mulch chunks that do not meet the requirements above.

## **2.04 LANDSCAPE EDGINGS**

- A. Plastic Edging: Standard black polyethylene or vinyl edging, V-lipped bottom grooved, extruded in standard lengths, with 9-inch steel angle stakes.
  - 1. Basis-of-Design Valley View Industries Black Diamond, or approved equal.
    - a. Edging Size: 0.1 inch wide by 5 inches deep.
    - b. Top Profile: Round top, 1 inch in diameter.
    - c. Accessories: Manufacturer's standard alignment clips or plugs.

## **2.05 WEED-CONTROL BARRIERS**

- A. Composite Fabric: Woven, needle-punched polypropylene substrate bonded to a nonwoven polypropylene fabric.
  - 1. Basis-of-Design: DeWitt Pro 5, or equal as approved by addendum prior to bid.

## **2.06 TREE WATERING BAG**

- A. Treegator slow release watering bag, or approved equal; [www.treegator.com](http://www.treegator.com)
  - 1. Size: 20 Gallon
  - 2. Supply and install one per tree - at trees NOT located in irrigated turfgrass or irrigated plant beds.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Examine areas to be planted for compliance with requirements and other conditions affecting performance.
  - 1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
  - 2. Do not mix or place soils and soil amendments in frozen, wet, or muddy conditions.
  - 3. Suspend soil spreading, grading, and tilling operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
  - 4. Uniformly moisten excessively dry soil that is not workable and which is too dusty.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Landscape Architect and replace with new planting soil.

### **3.02 PLANT BED PREPARATION**

- A. Protect structures, utilities, sidewalks, pavements, and other facilities, trees, shrubs, and plantings from damage caused by mulching operations.
- B. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.
- C. Prepare surface soil:
  - 1. Kill existing weed growth with non-selective herbicide a minimum of two weeks prior to planting date. Apply a second application as necessary a minimum of 24 hours prior to planting.
    - a. Apply at rate recommended by manufacturer.
  - 2. Loosen surface soil to a depth of at least 6 inches.
  - 3. Remove stones larger than 1-1/2 inches. in any dimension and sticks, roots, trash, and other extraneous matter.
    - a. Legally dispose of waste material, including grass, vegetation, and turf, off Owner's property.
  - 4. Incorporate compost into the top 6 inches of plant bed soil.
    - a. Apply at a rate of 4 cubic yards per 1,000 sq ft.

- D. Finish Grading: Grade areas to a smooth, uniform surface plane with loose, uniformly fine texture. Grade to within plus or minus 1/2 inch of finish elevation. Roll and rake, remove ridges, and fill depressions to meet finish grades. Limit finish grading to areas that can be planted in the immediate future.

### 3.03 FERTILIZING

- A. Apply fertilizer in accordance with manufacturer's instructions.
- B. Apply after initial raking of topsoil.
- C. Mix thoroughly into upper 2 inches of topsoil.

### 3.04 TREE PLANTING

- A. Place plants as indicated.
- B. Before planting, verify that root flare is visible at top of root ball according to ANSI Z60.1.
  - 1. Expose root flare; root flare may have been buried in the root ball during growing or tree harvesting operations.
- C. Remove stem girdling roots and kinked roots. Remove injured roots by cutting cleanly; do not break.
- D. Excavate planting pits with sides sloping inward at a 30-degree angle. Excavations with vertical sides are not acceptable. Trim perimeter of bottom leaving center area of bottom raised slightly to support root ball and assist in drainage away from center. Do not further disturb base. Ensure that root ball will sit on undisturbed base soil to prevent settling. Scarify sides of planting pit smeared or smoothed during excavation.
  - 1. Excavate approximately five times as wide as ball diameter.
  - 2. Do not excavate deeper than depth of the root ball, measured from the root flare to the bottom of the root ball.
  - 3. Hand dig tree planting pits when in close proximity to existing utilities.
- E. Set stock plumb and in center of planting pit or trench with **root flare 1 inch above adjacent finish grades**.
  - 1. Use planting soil for backfill.
  - 2. Balled and Burlapped: After placing some backfill around root ball to stabilize plant, carefully cut and remove burlap, rope, and wire baskets from tops of root balls and from sides, but do not remove from under root balls. Remove pallets, if any, before setting. Do not use planting stock if root ball is cracked or broken before or during planting operation.
  - 3. Container-Grown: Carefully remove root ball from container without damaging root ball or plant.
  - 4. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.
  - 5. Continue backfilling process. Water again after placing and tamping final layer of soil.
- F. When planting on slopes, set the plant so the root flare on the uphill side is flush with the surrounding soil on the slope; the edge of the root ball on the downhill side will be above the surrounding soil. Apply enough soil to cover the downhill side of the root ball.
- G. Place plants for best appearance for review and final orientation by Landscape Architect.
- H. Set plants vertical.
- I. Remove non-biodegradable root containers.

### 3.05 TREE PRUNING

- A. Prune trees as recommended in ANSI A300 Part 1.
- B. Prune newly planted trees as required to remove dead, broken, and split branches.

### 3.06 SHRUB, PERENNIAL AND ORNAMENTAL GRASS PLANTING

- A. Set out and space plants according to plan and in even rows with triangular spacing.
- B. Use planting soil for backfill.

- C. Dig holes large enough to allow spreading of roots.
- D. Work soil around roots to eliminate air pockets and leave a slight saucer indentation around plants to hold water.
- E. Water thoroughly within two hours after planting, taking care not to cover plant crowns with wet soil.

### **3.07 EDGING INSTALLATION**

- A. Plastic Edging:
  - 1. Dig 4 inch deep trench along lawn edge. Sink edging into trench with the 'V' lip facing the plant bed.
  - 2. Secure edging with a stake every 5 feet at a 45 degree angle. The stake shall not be installed higher than 2" above the 'V' lip.
  - 3. For connecting two sections of edging together, cut five inches from one of the sections of bead. Overlap and use the provided connector when joining two lengths of edging together. Secure with stake through overlap.

### **3.08 MULCHING (ROCK MULCH)**

- A. Install weed-control barriers before mulching according to manufacturer's written instructions. Completely cover area to be mulched, overlapping edges a minimum of 6 inches and secure seams with galvanized pins.
- B. Apply 3-inch average thickness of rock mulch as indicated on plan over whole surface of planting area, and finish level with adjacent finish grades.
  - 1. Place organic mulch ring around each individual plant or shrub.
  - 2. Do not place rock mulch within 3 inches of trunks or stems.

### **3.09 ESTABLISHMENT**

- A. Provide maintenance during establishment period at no extra cost to Owner.
- B. Maintain plant life for 60 days from date of Project Substantial Completion.
  - 1. During the establishment period the Contractor shall be on site a minimum of one hour per week throughout the maintenance period to monitor plants, water, adjust irrigation, and weed as necessary.
  - 2. When maintenance period has not elapsed before the end of the growing season continue maintenance during the next growing season.
  - 3. Notify the Landscape Architect in writing upon termination of the required maintenance services. The Contractor shall continue maintenance services until written notification is provided.
- C. Irrigate sufficiently to saturate root system and prevent soil from drying out.
- D. Remove dead or broken branches and treat pruned areas or other wounds.
- E. Neatly trim plants where necessary.
- F. Immediately remove clippings after trimming.
- G. Control growth of weeds. Apply herbicides in accordance with manufacturer's instructions.
- H. Control insect damage and disease. Apply pesticides in accordance with manufacturers instructions. Coordinate applications with Owner's operations and others in proximity to the Work. Notify Owner before each application is performed.
- I. Remedy damage from use of herbicides and pesticides.
- J. Replace mulch when deteriorated or displaced.
- K. Protect plants from damage due to landscape operations and operations of other contractors and trades. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged plantings.

**END OF SECTION**

# **SECTION 33 01 00 EXISTING UNDERGROUND UTILITIES**

## **PART 1 GENERAL**

### 1.01 RELATED DOCUMENTS

- A. The general provisions of the contract, including General and Supplementary Conditions shall apply to the Work covered in this Section.

### 1.02 SCOPE

- A. This Section describes, but is not limited to, the relationship of the Project to existing underground utilities and the Work associated with the location, adjustment, and repair of underground utilities.
- B. The information and data relative to existing underground utilities are provided to assist the Contractor with the preparation of his bid. This information should not be used by the Contractor for reference during construction of the Work.

## **PART 2 PRODUCTS - NOT USED**

## **PART 3 EXECUTION**

### 3.01 GENERAL

- A. Existing underground utilities, as shown on the drawings, are located in accordance with available data, but locations may vary and cannot be guaranteed. The exact locations shall be determined by each Contractor as the Work proceeds. Excavation work shall be done carefully so as to avoid damaging the existing utilities and Work.
- B. Each Contractor shall provide for protection, temporary removal and replacement or relocation of obstructions as required for the performance of this Work required in these contract documents.
- C. Other obstructions not shown on the plans and requiring relocation shall be exposed by the Contractor without injury; or if injured, shall be repaired by Contractor at his expense. Removal of such obstruction or its relocation shall be made by the Contractor according to the provisions of the General Conditions.

### 3.02 UTILITY CONTACT

- A. Prior to Work in a specific area affecting underground utilities, the following individuals shall be notified as appropriate:
- B. All above utilities, excepting water, may be located utilizing the South Dakota One Call Notification Center:

(Locate Phone Number) 1-800-781-7474

(Admin. Phone Number) 1-800-422-1242

- C. The failure of any utility to be present for any reason, at the Pre-Construction Conference, if held, shall not relieve the Contractor of any responsibility described herein.

### 3.03 UTILITY REPAIR:

- A. When an underground utility is exposed or damaged, the Contractor shall comply with the repair requirements of the affected utility.
- B. When an underground utility is exposed, the Contractor shall compact the backfill beneath the exposed utility before completion of the backfill operation.

### 3.04 SANITARY/STORM SEWER AND WATER MAIN SEPARATION:

- A. Horizontal Separation - Sewers shall be laid at least 10 feet (3.0 m) horizontally from any existing or proposed watermain. The distance shall be measured edge to edge. In cases where it is not practical to maintain a 10 foot (3.0 m) separation, the Department may allow deviation on a case-by-case basis, if supported by data from the design engineer. Such deviation may allow installation of the sewer closer to a watermain, provided that the watermain is in a separate trench or on an undisturbed earth shelf located on one side of the sewer and at an elevation so the bottom of the watermain is at least 18 inches above the top of the sewer.

- B. If it is impossible to obtain proper horizontal separation as described above, both the watermain and sewer shall be constructed of slip-on or mechanical joint pipe complying with public water supply design standards of the Department and be pressure tested in accordance with AWWA standards to assure water tightness before backfilling.

#### C. Vertical Separation

1. Sewers Crossing Under Watermains - The sewer shall be laid to provide a minimum of 18 inches from the top of the sewer to the bottom of the watermain. The crossing shall be arranged so the sewer joints will be equidistant and as far as possible from the watermain.
2. Sewers Crossing Over Watermains - Either the watermain or the sewermain must be encased in a watertight carrier pipe that extends 10 feet (3.0 m) on both sides of the crossing, measured perpendicular to the watermain. The carrier pipe shall be PVC, ABS, or HDPE, and the ends sealed with a rubber gasket or boot.
3. Special Conditions - When it is impossible to obtain the proper horizontal and vertical separation as stipulated above, one of the following methods shall be specified:
4. Water Pipe - The sewer shall be designed and constructed equal to water pipe and shall be pressure tested in accordance with AWWA standards prior to backfilling to assure water tightness; or;
5. Carrier Pipe - Either the watermain or the sewermain may be encased in a watertight carrier pipe that extends 10 feet (3.0 m) on both sides of the crossing, measured perpendicular to the watermain. The carrier pipe shall be PVC, ABS, or HDPE, and the ends sealed with a rubber gasket or boot.

#### D. Storm Sewer Requirements:

1. A reinforced concrete pipe (RCP) storm sewer may cross below a watermain with a separation of less than 18 inches or at any height above a watermain provided the joints



on the RCP within 10 feet of either side of the watermain are assembled with:

2. Prefomed butyl rubber sealant meeting federal specification #SS-S-210A and AASHTO M 198, and each of these joints are encased with a minimum 2-foot wide by 6-inch thick concrete collar centered over the joint and reinforced with the equivalent steel area as that in the RCP. Encasement of the watermain will not be required when the RCP joints are collared within the 20-foot section.
  3. An O-ring that conforms to ASTM C 443 specifications. O-rings are manufactured for concrete pipe with diameters up to 18 inches.
  4. A strip of impermeable material held in place with stainless steel bands and tested to 5 psi prior to the storm sewer being put into use.
- E. There shall be at least a 10-foot horizontal separation between watermains and sanitary sewer forcemains. There shall be an 18-inch vertical separation at crossings as required in paragraphs B and C.

#### **PART 4 MEASUREMENT AND PAYMENT**

##### 4.01 METHOD OF MEASUREMENT

- A. The cost to repair any underground utilities or other obstructions damaged by the Contractor's activities shall be considered incidental Work with no separate measurement made.

##### 4.02 BASIS OF PAYMENT

- A. The cost to repair any underground utilities or other obstructions damaged by the Contractor's activities shall be considered incidental Work with no separate and payment to be made.

\* \* \* END OF SECTION \* \* \*

# **SECTION 33 11 00 WATER UTILITY PIPING AND FITTINGS**

## **PART 1 GENERAL**

### **1.01 RELATED DOCUMENTS**

- A. The general provisions of the Contract, including General and Supplementary Conditions shall apply to the Work covered in this section.
- B. Related Work Specified Elsewhere:
  - 1. Trenching, Backfilling and Compacting - Section 31 23 33
  - 2. Standard Drawing 33 11 00-1

### **1.02 DESCRIPTION OF WORK**

- A. The work covered under these specifications shall include the furnishing of all labor, material, tools, and equipment necessary to furnish and install, complete in place, all piping and fittings as shown on the drawings and as specified herein.

### **1.03 SUBMITTALS**

- A. The Contractor shall submit for review copies of shop drawings for materials specified herein.
- B. Certificates from the manufacturer that the materials meet or exceed specified requirements.
- C. The manufacturer's installation recommendations, including types and amounts of gasket lubricant, where applicable, to be used.
- D. Certification shall be provided that all pipes, plumbing fittings, and fixtures are "Lead Free" in accordance with the January 4, 2011 modification to Section 1417 of the Safe Drinking Water Act.

### **1.04 PRODUCT DELIVERY, STORAGE AND HANDLING**

- A. All materials shall be packed, loaded, transported, unloaded, and handled in such a manner so as to prevent damage to the materials.
- B. All material shall be loaded and unloaded by lifting with slings or hoists or skidding so as to avoid shock or damage. Dropping or rolling will not be permitted. The use of end hooks to install or move piping will not be allowed.
- C. All materials shall be stored on the site in accordance with the manufacturer's recommendations. Do not store materials directly on the ground.
- D. All materials shall be kept clean and dry. The insides of all piping and fittings shall be kept free of dirt and debris.

## **PART 2 PRODUCTS**

### **2.01 DUCTILE IRON FITTINGS**

- A. Ductile iron fittings shall conform to the requirements of AWWA/ANSI Specifications C110/A21.10 & C153/A21.53.
- B. Ductile Iron Fittings to be installed underground shall be mechanical joint type conforming to the requirements of AWWA/ANSI Specifications C111/A21.11.
- C. Ductile Iron Fittings to be installed in "non-buried" locations shall be provided with flanged joints with rubber full-face gaskets. Flanged faces shall be drilled to standard 125-pound template unless otherwise noted.
- D. All Ductile Iron Fittings shall be lined with cement mortar in accordance with AWWA/ANSI Specifications C104/A21.4. The exterior finishes shall be an asphaltic varnish coating not less than 1-mil thick.
- E. When utilized for contaminated soils areas, the fittings will be furnished with Nitrile Butadiene gaskets.

### **2.02 PRESSURIZED POLYVINYL CHLORIDE (PVC) PIPE**

- A. All Polyvinyl Chloride pipe shall be pressure class 150 AWWA C-900 rated pipe with rubber gasket sealed joints.
- B. The pipe shall be made from Type 1, Grade 1, Class 12454-B compounds conforming to ASTM D1784 with a hydrostatic design basis (HDB) of 4,000 psi as per ASTM 2837.
- C. All pipes shall be marked with the following: Nominal pipe size, material code designation, SDR, pressure rating, manufacturer's name or trademark, NSF seal and ASTM numbers.
- D. The PVC pipe shall be furnished in 20 foot laying lengths. Longer lengths will be allowed only if the Contractor certifies that he will provide equipment on the project to fully support the pipe while being transported and distributed over the project.
- E. All PVC pipe shall be furnished with gasket joints conforming to ASTM D3139. Rubber gaskets shall conform to the requirement of ASTM F477.
- F. Manufacturer's proof of design tests and joint dimensions shall be submitted to the Engineer for gasket joints, which do not maintain SDR throughout the joint.
- G. Gasket joint couplings used for plain end pipe shall have a pressure rating equal to the pipe on which used. Centering of pipe within the coupling will be assured by means of an integral positive stop in the coupling. All couplings must be of the double gasket type. Couplings requiring welds will not be allowed.
- H. All gasket joints shall have a seating depth equal to at least 50% of the nominal pipe diameter.
- I. The ends of the pipe to be inserted into couplings or joints shall be factory marked to allow field checking of the depth of setting of the pipe in the joint socket.

### **2.03 FITTINGS FOR PRESSURIZED PVC PIPE**

- A. Repair couplers and gaskets will be pressure Class 150 PVC pressure fittings meeting the requirements of:

1. AWWA-C907 (also referred to as C900 fittings)
  2. ASTM D-1784, Materials
  3. ASTM D-3139, Joints
  4. ASTM F-477, Gaskets
  5. NSF Standard 61, Suitability for Potable Water
- B. All other fittings for use on PVC C-900 Class 150 pipe shall be ductile iron fittings conforming to the requirements of paragraph 2.02 above, with the exception of transition couplers as specified in paragraph 2.05 below.

#### 2.04 TRANSITION COUPLERS

- A. The couplings used for transitions between piping of different materials, piping of different diameters, and existing piping to new piping (excluding repair couplers), shall be a wide-range flexible coupler with a sleeve type design meeting the requirements of AWWA C219.
1. The coupling body shall be a center sleeve fabricated of high strength carbon steel tubing equivalent to ANSI/AWWA C200. The transition couplers will be readily available in nominal diameter ranges from 1.5 to 24 inches on all pipe classes.
  2. Compression End Rings: One gasket compression end ring per coupling end. End rings to be of either one, two, or four bolt design, fabricated of carbon steel equivalent to ASTM A576.
  3. Hydraulic Wide Range Gasket: Chloramine Resistant NSF-61 approved EPDM gasket designed with a multi-layered wide range removable outer layer. Gasket hydraulically actuated with a pressure-equalizing dam, pressure cavity and sealing lip for working pressure of 260 psi (1.5 to 16 inches) and 232 psi (18 to 24 inch nominal diameter coupling).
  4. Fasteners shall be grade 304 (A2) or 316 (A4) stainless steel with yield strengths that conform to all nationally recognized standards. Bolts to be coated with an anti-seize type coating to prevent galling.
  5. The interior and exterior coatings shall NSF-61 approved fusion bonded epoxy coating conforming to AWWA C213.
  6. When properly installed the coupling will provide a minimum deflection of 8 degrees, up to 260 psi working pressure and 3/8 inch longitudinal pipe movement without leakage. (Flanged adapters will provide half the longitudinal movement and deflection.)
  7. All products will be proof tested to a minimum of 1.5 times working pressure.
- B. Flanged couplers shall consist of one compression end and gasket, coupling center sleeve, and AWWA Class "D" Flange (per AWWA C207).
- C. Pre-Approved transition couplers are: "Macro" extended range coupling by Romac Industries, Inc.; Omega Series Style CRCER by Cascade Waterworks Mfg. Co.; Maxi-Range Pipe Coupling by Mueller Co.; or Engineer approved equal.

#### 2.05 FASTENERS

- A. All fasteners in buried locations shall be Grade 304 (A2) or Grade 316 (A4) stainless steel.

Anti-Seize shall be applied to all threads prior to installation.

## 2.06 LUBRICANT FOR PIPE GASKETS

- A. Lubricant shall be an emulsified polymer based product, specifically formulated to be water-soluble without causing turbidity. Lubricant shall not transfer taste and/or odor to new water main installations. Lubricant must not promote bacterial growth and be safe for use on all metal and plastic pipes. Lubricant shall be easily flushed from the line and be non-reactive to chlorinated water. Lubricant should work easily on both wet and dry surfaces.

## 2.07 POLYETHYLENE WRAP

- A. All ductile fittings shall be wrapped with polyethylene plastic film having a minimum thickness of 0.006 inches or with a cross woven polyethylene plastic film having a minimum thickness of 0.004 inches.

## 2.08 TRACER WIRE

- A. Tracer wire shall be 12-gauge solid copper or high strength stainless steel wire with a 45-mil polyethylene coating. Provide sufficient length to be continuous over each separate run of nonmetallic pipe.
- B. Corp Stop compression joints will be provided with an optional tracer wire hole that has a set screw for a positive connection. Curb Box lids will also be provided with a tracer wire screw that is tapped into the bottom of the lid for securing a quick connect eyelet terminal. Once tightened, the threaded end of the screw becomes accessible for attaching an alligator clip at the top of the lid.
- C. All tracer wires are to be connected to a combination cast iron & ABS/PVC tamper proof tracer wire access box. The cover is to be manufactured of cast iron and ABS/PVC components produced in the USA. Cast iron collar & cover is to be manufactured in accordance with ASTM A48 Class 25. The ABS is to be manufactured in accordance with ASTM D 1788. The cover shall be lettered "Water" and shall have a standard AWWA size cast-in pentagonal bolt. Box will be a minimum of 3 inches in diameter and adjustable from 18 to 24 inches.

## 2.09 BEDDING MATERIAL

- A. Borrowed granular bedding material shall conform to the gradation indicated below.

<u>Sieve Opening</u>	<u>Bedding Material (Percent Passing)</u>
1"	95-100
No. 200	< 15

- B. Bedding material excavated from the job site shall be finely divided material free from organic material and clods, lumps of frozen material or stones larger than 1 1/2" in maximum diameter. Bedding material shall be of proper moisture content to form a firm bed for the pipe.

## **PART 3 EXECUTION**

### 3.01 GENERAL

- A. The areas to receive piping shall be examined for defects that may adversely affect the execution and quality of Work. Prior to the start of piping installation, all measurements shall be checked for deviations from allowable tolerances for piping.

### 3.02 BURIED PIPING INSTALLATION

- A. All piping and fittings shall be laid true to line and grade as shown on the plans. Each section of pipe shall be so laid and fitted together that when complete the piping will have a smooth uniform flow line. The inside of all pipes shall be cleaned before installation and kept thoroughly clean during and after the laying. Pipe ends shall be cleaned inside and outside.
- B. Apply lubricant liberally to the inside of the pipe bell and spigot. Make sure lubricated surfaces remain free of dirt, gravel or other debris. Assemble the pipe joint immediately after application of the lubricant.
- C. All pipe and fitting shall be examined for defects before being lowered into the trench. The interior and exterior protective coating shall be inspected and field repaired, if required, and possible accordance with applicable standards.
- D. The pipe shall be handled and installed in accordance with manufacturer's recommendations and the requirements of AWWA C600 for Ductile Iron pipe, ANSI/AWWA C605 and ASTM D2774 for PVC pipe.
- E. When pipe laying is not in progress, including the noon hours, the open ends of pipe shall be closed. No trench water, animals, or foreign material shall be permitted to enter the pipe.
- F. Granular Bedding shall be used as bedding material. After each pipe has been graded, aligned, and placed in final position on the bedding material and shoved home, sufficient pipe embedment material shall be deposited and compacted under and around each side of the pipe and back of the bell or end thereof to hold the pipe in proper position and alignment during subsequent pipe joining and embedment operations. Granular Bedding shall be placed as in Class C Bedding on Standard drawing 331100-1. Bedding material shall be as specified in Part 2.
- G. The pipe shall be laid upon properly placed bedding material so that the barrel of the pipe will have a bearing for its full length. Bell holes and depressions for joints shall be excavated after the trench bedding has been graded.
- H. The Contractor shall provide and maintain all necessary means and devices at all times to remove and dispose of all water entering the trench during the process of pipe laying. The trench shall be kept dry until the pipe laying and jointing are completed. Removal of water shall comply with Section 31 23 33.
- I. Thrust blocks or restraining fittings to restrain pressurized piping shall be provided at all abrupt changes in direction, tees, bends, dead ends and hydrants, and shall be in accordance with the pipe manufacturer's recommendations.

### 3.03 EXPOSED PIPING INSTALLATION

- A. Each item or system shall be furnished complete and installed as shown on the plans and in accordance with the manufacturer's recommendations, instructions, and directions. All installed equipment and systems shall be properly protected during subsequent construction operation.
- B. The Contractor shall inspect all material or equipment as it is received to determine damage and/or missing parts. It shall be his responsibility to repair or replace damaged items in accordance with the manufacturer's instructions.
- C. The Contractor shall provide all scaffolding required for the proper installation of this work in conformance with the standards of any local and state safety codes applying to scaffolding.
- D. All pipes shall be set such that the vertical and horizontal centerlines are properly aligned. Installation of piping by means of springing, forcing or stressing the pipe or adjacent fittings, valves or equipment will not be allowed.

### 3.04 MECHANICAL JOINTS AND COUPLINGS

- A. Mechanical joints shall be carefully assembled in accordance with the manufacturer's recommendations. If effective sealing is not obtained, the joint shall be disassembled, thoroughly cleaned, and reassembled or replaced. Over tightening bolts to compensate for poor installation practice will not be permitted.
- B. The holes in mechanical joints with tie rods shall be carefully aligned to permit installation of the tie rods. In flange and mechanical joint pieces, holes in the mechanical joint bells and the flanges shall straddle the top (or side for vertical piping) centerline. The top (or side) centerline shall be marked on each flange and mechanical joint piece at the foundry.

### 3.05 TRACER WIRE INSTALLATION

- A. Tracer wire shall be installed in the trench at the same time as the pipe or immediately prior to starting the backfill of the trench.
- B. Install a continuous length of tracer wire for the full length of each run of nonmetallic pipe. Attach wire to top of pipe in such manner that it will not be displaced during construction operations.
- C. Splices will be allowed at pipeline intersections, manholes, bored crossings, and at other locations as agreed upon by the Resident Project Representative. Splices in tracer wire will be made with split bolt or compression-type connectors. Wire nuts may not be used. A waterproof connection is necessary to prevent corrosion. Splices shall be completed in accordance with the manufacturer's recommendations.
- D. Prior to final acceptance, all tracer wire shall be electrically tested for continuity from one exposed end to another.
- E. Tracer wire will be installed from Corporation Pack Joint to the Curb Stop. Attach wire to corporation stop compression nut and underside of curb stop box.
- F. Bring the wire to the ground surface at each fire hydrant and loop the wire in a tracer wire terminal box. These boxes shall be located between the hydrant and the hydrant valve with at least two feet of extra wire inside the box. The tracer wire terminal box must be installed



flush with the finished grade.

### 3.06 TESTING

- A. All piping shall be tested in accordance with Section 33 13 01.
- B. All piping shall be cleaned and flushed in accordance with the requirements of Section 33 13 00.

\* \* \* END OF SECTION \* \* \*



# **SECTION 33 12 16 WATER UTILITY DISTRIBUTION VALVES**

## **PART 1 GENERAL**

### 1.01 RELATED DOCUMENTS

- A. The general provisions of the Contract, including General and Supplementary Conditions shall apply to the Work covered in this Section.
- B. Related requirements specified elsewhere:
  - 1. Watermain Piping and Fittings – Section 33 11 00
  - 2. Sanitary Sewer Piping and Fittings - Section 33 31 00

### 1.02 DESCRIPTION OF WORK

- A. This section covers the furnishing and installation of valves and appurtenances as specified herein and as shown on the plans.

### 1.03 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. All valves and related appurtenances shall be shipped in accordance to the requirements of AWWA C509 or C515. Valve ends shall be sealed to prevent the entry of foreign matter into the valve body. The boxes and crates in which valves are shipped shall completely enclose and protect the valve and accessories from foreign matter.
- B. Valves and accessories shall be stored in a manner so as to be protected from weather, moisture, and other possible damage. Materials shall not be stored directly on the ground.
- C. All material shall be handled in a manner that will prevent damage to the interior and exterior surfaces.

### 1.04 SUBMITTALS

- A. The Contractor shall submit for review copies of shop drawings for materials specified herein.
- B. Certification of performance, leakage, and hydrostatic tests as described in Section 5 of AWWA C-504 (Butterfly Valves) and/or AWWA C-509/515 (Resilient Seated Gate Valves) shall be furnished when requested by the Engineer.
- C. Certifications for all fasteners shall be provided for valves, fittings, and all other appurtenances provided under this specification.

## **PART 2 PRODUCTS**

### 2.01 GATE VALVES

- A. Gate valves shall be resilient wedge type manufactured to meet all applicable requirements of AWWA Standard for Resilient Seated Gate Valve C509 or C515.
- B. All valves shall have non-rising stems, opening by turning left and provided with standard 2”

square nut operator with arrow cast in metal to indicate direction of opening.

- C. Cast iron wedge shall have sealing surfaces of the wedge permanently bonded with resilient material to meet ASTM tests for rubber to metal bond ASTM D429. Each valve shall have a smooth unobstructed waterway free from any sediment pockets. Stuffing boxes shall be O Ring seal type with 2 rings located in stem above thrust collar. Low friction torque reduction thrust bearings shall be located both above and below the stem collar.
- D. Body and cover bolts and nuts shall be Grade 304 (A2) or 316 (A4) stainless steel. Anti-Seize shall be applied to all threads prior to installation.
- E. Exterior and interior coatings in accordance with ANSI/AWWA C550 for potable water.
- F. Non-rising stems shall be in full compliance with AWWA specification with cast integral stem collar and furnished of bronze conforming to ASTM B584 Alloy A. Stem nuts shall be independent of wedge and shall be made of solid bronze conforming to ASTM B 62.
- G. Valves shall have hydrostatic shell test of 400 psi and shut-off test of 200 psi. At the 200-psi shut-off test, valve must be bubble-tight with a zero (0) leakage allowance.
- H. Resilient wedge gate valves shall be the product of a manufacturer having a minimum of five (5) years experience in the manufacture of water works and distribution valves.
- I. Pre-Approved resilient wedge gate valves are as manufactured by: American Darling Valve Co., Birmingham, Alabama; Mueller Company, Decatur, Illinois; Clow Valve Division, Oskaloosa, Iowa; American AVK, Minden, NV; or Engineer approved equal.

## 2.02 VALVE BOXES

- A. Valve boxes shall be cast iron, 5-1/4" inside diameter, adjustable valve boxes of the screw type with sufficient length for the pipe bury as shown. Where the valve box is shown or required on control manholes, the length shall be sufficient to penetrate the valve marker and the Type II reinforced manhole cover. The cast iron cover of the valve box shall have an arrow indicating the direction of opening.
- B. Covers for water piping shall have the word "WATER" cast on the top.
- C. Pre-Approved valve boxes and covers are as manufactured by: Tyler Pipe Utilities Division, Tyler, Texas; Mueller Co., Decatur, Illinois; Clow Corporation, Oak Brook, Illinois; or Engineer approved equal.
- D. Each valve box shall be furnished with valve box centering adaptor compatible with the valve boxes furnished.
- E. The Contractor shall furnish one T-handled valve wrench to the owner that is compatible with the installed valves.

## 2.03 FLANGED AND MECHANICAL JOINT VALVES

- A. Valves located in non-bury locations shall be flanged style with 125 lb. ANSI flanged ends. Valves located in buried locations shall be mechanical joint type conforming to the requirements of ANSI Specification A21.11.

## 2.04 FASTENERS

- A. All fasteners in buried locations shall be Grade 304 (A2) or 316 (A4) stainless steel. Anti-

Seize shall be applied to all threads prior to installation.

#### 2.05 POLYETHYLENE WRAP

- A. All ductile fittings shall be wrapped with polyethylene plastic film having a minimum thickness of 0.008 inches or with a cross woven polyethylene plastic film having a minimum thickness of 0.004 inches.

### **PART 3 EXECUTION**

#### 3.01 VALVE INSTALLATION

- A. All valves shall be installed in locations as shown on the plans or as directed by the Owner's Resident Project representative.
- B. The valve and joints shall be installed in accordance with the manufacturer's recommendations.
- C. All pipe bevels shall be removed prior to installation of any valve or ductile iron fitting.

#### 3.02 VALVE BOX INSTALLATION

- A. All foreign material and debris shall be removed from the top of the valve operator prior to setting the valve box.
- B. Valve box centering device shall be installed to center valve box on valve.
- C. Valve boxes shall be centered and plumb over the operating nut of the valve and shall be set so that no shock or stress will be transmitted to the valve.
- D. Tops of the valve boxes shall be set flush with the valve identification collar or manhole cover unless otherwise directed.

\* \* \* END OF SECTION \* \* \*



# **SECTION 33 13 00 DISINFECTING OF WATER UTILITY DISTRIBUTION**

## **PART 1 GENERAL**

### 1.01 RELATED DOCUMENTS

- A. The general provisions of the contract, including General and Supplementary Conditions shall apply to the work covered in this section.

### 1.02 DESCRIPTION OF WORK

- A. This section covers flushing of new and existing water lines, and disinfection of the installed piping.
- B. The Contractor shall furnish all water required for flushing and disinfection work as specified in the temporary facilities section.
- C. The Contractor shall provide, at his own expense, all means required for draining and disposing of water used in flushing and disinfection. This shall include, but not be limited to, additional drain valves, temporary piping and pumping equipment. Wastewater shall be stored and/or treated, if required, so as to cause the water quality to meet the requirements of the S. D. Department of Agriculture & Natural Resources for discharge. Contact the South Dakota Department of Agriculture & Natural Resources at 1-800-737-8676 for more information.

### 1.03 SUBMITTALS

- A. Copies of all bacteriological test reports shall be furnished to the Engineer and Resident Project Representative.

## **PART 2 PRODUCTS**

### 2.01 CHLORINE

- A. Liquid chlorine shall conform to AWWA Specification B-301.
- B. Hypochlorites shall conform to AWWA Specification B-300.

## **PART 3 EXECUTION**

### 3.01 CLEANING AND FLUSHING

- A. All lines shall be thoroughly flushed before acceptance until all traces of construction materials, soil or other foreign matter have been removed.
- B. The Contractor shall take all necessary measures to protect adjacent facilities and property. Damages caused by flushing water or water carried material shall be the responsibility of the Contractor.
- C. All flushing shall be completed prior to the initiation of the disinfection process described herein.

- D. The chlorinated water used for disinfection/pressure testing shall not be discharged to a stream, river, or other waterway where danger to aquatic life may occur. Dechlorination may be necessary prior to discharge. Contact the SD-DANR Surface Water Quality Program at 1-800-737-8676 for more information.

### 3.02 PIPELINE DISINFECTION

- A. Each unit of completed supply line and distribution system shall be sterilized with chlorine before acceptance.
- B. The amount of chlorine applied shall be such as to provide a dosage of not less than 50 parts per million. The chlorinating material shall be introduced to the water lines and distribution system in an approved manner. If possible to do so, the lines shall be thoroughly flushed before introduction of the chlorinating material.
- C. After a contact period of not less than 24 hours, the system shall be flushed with clean water until the residual chlorine content is not greater than 1.0 parts per million. All valves in the lines being sterilized shall be opened and closed several times during the contact period.
- D. Prior to final flushing, the treated water shall contain at least 25-ppm chlorine as per AWWA Specification C651.
- E. After the disinfection and flushing process, two (2) consecutive samples of water from the end of the disinfected water line must be collected at least 24 hours apart and submitted to the State Health Laboratory in Pierre or another approved laboratory. The sample shall be found free of bacteria before the system is placed into service.
- F. Should the sample be returned positive, the disinfection process shall be repeated until negative samples are obtained.

## **PART 4 MEASUREMENT AND PAYMENT**

- 4.01 Cleaning and disinfection will be considered incidental work pertaining to the contract with no direct measurement or compensation made for this work.

\* \* \* END OF SECTION \* \* \*



# **SECTION 33 13 01 TESTING OF WATER UTILITY DISTRIBUTION**

## **PART 1 GENERAL**

### 1.01 RELATED DOCUMENTS

- A. The general provisions of the Contract, including General and Supplementary Conditions shall apply to the Work covered in this section.

### 1.02 DESCRIPTION OF WORK

- A. All piping and related appurtenances shall be subjected to alignment and pressure and/or leakage tests as specified herein and as directed by the Engineer.
- B. The required pressure and leakage tests shall be made by the Contractor and witnessed by the Engineer. All tests shall be completed after all pipe laying has been completed. All concrete reaction blocks and bracing or restraining facilities shall be in place at least 7 days before the initial pressure testing of the lines, except where tension joints are used at bends.
- C. The Contractor shall perform the necessary work to fill the pipeline with test water as specified. The Contractor shall furnish all water, pumping equipment, water meter, pressure gage, and other equipment, materials, and facilities required for the tests.

### 1.03 SUBMITTALS

- A. Prior to filling, flushing and testing the system, the proposed procedures shall be submitted for review by the Engineer.
- B. Pressure test forms completed in the field shall be submitted to the Engineer and Owner.

## **PART 2 PRODUCTS - None**

## **PART 3 EXECUTION**

### 3.01 TEST SECTIONS

- A. The pressure and leakage tests shall be applied to all sections of the line with a section being the shortest practical length between shut-off valves.
- B. The Contractor shall be solely responsible for any and all damage to the pipeline, and to public and private property, which may result from defective material or workmanship.
- C. The chlorinated water used for disinfection/pressure testing shall not be discharged to a stream, river, or other waterway where danger to aquatic life may occur. Dechlorination may be necessary prior to discharge. Contact the SD-DANR Surface Water Quality Program at (605) 773-3351 for more information.

### 3.02 FILLING AND VENTING OF WATERMAINS

- A. The section of line to be tested shall be slowly filled with water and all air expelled from the pipe. Care shall be taken that all air valves are installed and open in the section being filled

and that the rate of filling does not exceed the venting capacity of the air valves.

### 3.03 TEST EQUIPMENT AND FACILITIES

- A. Test pressures shall be applied by means of a force pump of such design and capacity that the required pressure can be applied and maintained without interruption for the duration of each test.
- B. The water meter and the pressure gage shall be accurately calibrated and shall be subject to the approval of the Engineer.

### 3.04 WATERMAIN PRESSURE TEST

- A. Test pressures shall be applied to each section of pipeline with all connections, valves and fittings along the length of the test section in place.
- B. The pressure test shall be initiated by bringing the hydrostatic pressure in the section being tested to a minimum of 90 psi, as measured at the highest point of the section being tested.
- C. After the section of the line to be tested has been filled with water and brought to the specified level, the test pressure shall be maintained for a period of not less than one hour, or for whatever longer period as may be necessary for the Engineer to complete the inspection of the line under test, or for the Contractor to locate any and all defective joints and pipeline materials.
- D. If repairs are needed, such repairs shall be made, the line refilled and the test pressure applied as before; this operation shall be repeated until the line and all parts thereof withstand the test pressure in a satisfactory manner.

### 3.05 WATERMAIN LEAKAGE TEST

- A. All hydrostatic testing shall be completed in accordance with ANSI/AWWA C600/Sec. 5.2 for ductile iron pipe and ANSI/AWWA C605/Sec. 7.3 for PVC pipe.
- B. After the specified pressure test has been completed, the line being tested shall be subjected to a leakage test under the same hydrostatic pressure specified. The pressure shall be maintained constant (within a maximum variation, plus or minus, of 5%) during the entire time that line leakage measurements are being made so that the allowable leakage rate may be determined accurately from the leakage rate formula.
- C. Leakage testing shall not be started until a constant test pressure has been established. After the test pressure has been established and stabilized, the line leakage shall be measured by means of a water meter installed on the line side of the force pump.
- D. Line leakage is defined as the total amount of water introduced into the line as measured by the meter during the leakage test. The pipeline or tested section thereof will not be accepted if and while it has a leakage rate in excess of the following rate:
  - 1. Leakage rate for ductile iron buried pipelines shall be as determined by the following formula:

$$L=S*D*\sqrt{P} \div 148,000$$

in which: Q = Maximum permissible leakage rate, in gallons per hour, throughout the entire length of line being tested.

S = Length of line under test in feet.

D = Nominal diameter (in inches) of the pipe in the line.

P = The average test pressure, in psig, in the tested portion of the line.

2. Leakage rate for PVC buried pipelines shall be as determined by the following formula:

$$Q=L*D*\sqrt{P} \div 148,000$$

in which: Q = Maximum permissible leakage rate, in gallons per hour, throughout the entire length of line being tested.

L = Length of line under test in feet.

D = Nominal diameter (in inches) of the pipe in the line.

P = The average test pressure, in psig, in the tested portion of the line.

- E. Where the leakage rate is in excess of the permissible maximum, the Contractor shall be responsible for the location and the repair of all leaks to the extent required to reduce the total leakage to an acceptable amount.
- F. All joints in piping in non-buried locations shall be watertight and free from visible leaks during the prescribed tests.
- G. Each and every leak which may be discovered at any time prior to the expiration of one year from and after the date of final acceptance of the work by the Owner shall be located and repaired by and at the expense of the Contractor regardless of any amount that the total line leakage rate during the specified leakage test may be below the specified maximum rate.

\* \* \* END OF SECTION \* \* \*



# **SECTION 33 31 00 SANITARY SEWER PIPING AND FITTINGS**

## **PART 1 GENERAL**

### 1.01 RELATED DOCUMENTS

- A. The general provisions of the Contract, including General and Supplementary Conditions shall apply to the Work covered in this section.
- B. Related Work Specified Elsewhere:
  - 1. Trenching, Backfilling and Compacting - Section 31 23 33
  - 2. Sanitary Sewer Gravity Pipe Cleaning - Section 33 01 30.12
  - 3. Standard Drawing: 33 31 00

### 1.02 DESCRIPTION OF WORK

- A. The work covered under these specifications shall include the furnishing of all labor, material, tools, and equipment necessary to furnish and install, complete in place, all piping and fittings as shown on the drawings and as specified herein.

### 1.03 SUBMITTALS

- A. The Contractor shall submit for review shop drawings for materials specified herein as hereinafter specified.
- B. Certificates from the manufacturer that the materials meet or exceed specified requirements.
- C. The manufacturer's installation recommendations, including types and amounts of gasket lubricant, where applicable, to be used.

### 1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. All materials shall be packed, loaded, transported, unloaded, and handled in such a manner so as to prevent damage to the materials.
- B. All material shall be loaded and unloaded by lifting with slings or hoists or skidding so as to avoid shock or damage. Dropping or rolling will not be permitted. The use of end hooks to install or move piping will not be allowed.
- C. All materials shall be stored on the site in accordance with the manufacturer's recommendations. Do not store materials directly on the ground.
- D. All materials shall be kept clean and dry. The insides of all piping and fittings shall be kept free of dirt and debris.

## **PART 2 PRODUCTS**

### 2.01 DUCTILE IRON FITTINGS

- A. Ductile iron fittings shall conform to the requirements of ANSI/AWWA C110 &

C153/A21.10 & A21.53.

- B. Ductile Iron Fittings to be installed underground shall be mechanical joint or push-on joint type conforming to the requirements of ANSI/AWWA C 111/A 21.11.
- C. Ductile Iron Fittings to be installed in "non-buried" locations shall be provided with flanged joints with rubber full-face gaskets. Flanged faces shall be drilled to standard 125-pound template unless otherwise noted.
- D. All Ductile Iron Fittings shall be lined with cement mortar in accordance with ANSI/AWWA C104/A21.4 the exterior finishes shall be an asphaltic varnish coating not less than 1 mil thick.

#### 2.02 GRAVITY PVC PIPE

- A. Polyvinyl Chloride (PVC) gravity pipe shall be Type I, Grade I, conforming to the requirements of ASTM Specification D 3034 for Rigid Poly (Vinyl Chloride) Sewer pipe.
- B. Solvent Cement for PVC pipe joints shall conform to ASTM Specification ASTM D 2564 and shall be applied in conformance with ASTM D 2855. Solvent weld joints will be allowed on PVC cleanout risers only.
- C. Gasket type joints shall be made with rubber gaskets conforming to the requirements of ASTM F-477.
- D. The pipe shall be capable of withstanding trench loads imposed on it.

#### 2.03 GRAVITY PVC PIPE FITTINGS

- A. Repair couplers, tees, wyes, and bends for Polyvinyl Chloride (PVC) gravity pipe fittings shall be of PVC with material and dimensions conforming to the requirements of ASTM Specification D 3034.
- B. Gaskets for elastomeric joints shall conform to the requirements of ASTM F-477.
- C. Solvent Cement for solvent weld joints shall conform to the requirements of ASTM Specification D 2564 and shall be applied in conformance with ASTM D 2855. Solvent weld joints will be allowed on PVC cleanout risers only.
- D. Sewer "Wyes" for service connections shall be in-line sewer wyes. Saddle wyes will not be permitted for use without permission from Project Engineer.

#### 2.04 TRANSITION COUPLINGS (PRESSURE PIPING)

- A. The couplings used for transitions between piping of different materials shall be a wide-range flexible coupler with a sleeve type design meeting the requirements of AWWA C219.
  - 1. The coupling body shall be a center sleeve fabricated of high strength carbon steel tubing equivalent to ANSI/AWWA C200. The transition couplers will be readily available in nominal diameter ranges from 1.5 to 24 inches on all pipe classes.
  - 2. Compression End Rings: One gasket compression end ring per coupling end. End rings to be of either one or two bolt design, fabricated of carbon steel equivalent to ASTM A576. (One bolt per end in Nominal Size ranges of 2 to 12 inches and two bolts per end on the 16 to 24 inch nominal diameter coupling.)

3. Hydraulic Wide Range Gasket: Chloramine Resistant NSF-61 approved EPDM gasket designed with a multi-layered wide range removable outer layer. Gasket hydraulically actuated with a pressure-equalizing dam, pressure cavity and sealing lip for working pressure of 260 psi (1.5 to 16 inches) and 232 psi (18 to 24 inch nominal diameter coupling).
  4. Fasteners shall be grade 304 (A2) or 316 (A4) stainless steel with yield strengths that conform to all nationally recognized standards. Bolts to be coated with an anti-seize type coating to prevent galling.
  5. The interior and exterior coatings shall NSF-61 approved fusion bonded epoxy coating conforming to AWWA C213.
  6. When properly installed the coupling will provide a minimum deflection of 8 degrees, up to 260 psi working pressure and 3/8 inch longitudinal pipe movement without leakage. (Flanged adapters will provide half the longitudinal movement and deflection.)
  7. All products will be proof tested to a minimum of 1.5 times working pressure.
- B. Flanged couplers shall consist of one compression end and gasket, coupling center sleeve, and AWWA Class "D" Flange (per AWWA C207).
- C. Pre-Approved transition couplers are: Hymax-2000 Series wide range coupling; Hymax-2100 Series wide range flanged coupling adapter; "Macro" extended range coupling by Romac Industries, Inc.; or Engineer approved equal.

## 2.05 TRANSITION COUPLINGS (GRAVITY PIPING)

### A. GASKET

1. Manufactured to meet the material requirements of:
  - a. CSA B602 - mechanical couplings for drain, waste, vent pipe and sewer pipe
  - b. ASTM D 5926 - Standard Specification for Poly Vinyl Chloride (PVC) Gaskets for Drain, Waste, and Vent (DWV), Sewer, Sanitary, and Storm Plumbing Systems
  - c. ASTM C 1173 - Standard Specification for Flexible Transition Couplings for Underground Piping Systems
  - d. Hardness, Shore "A", Inst.  $\pm 5$ .....65
  - e. Tensile Strength, Min. psi .....1000
  - f. Elongation at Rupture, Min. %.....250
  - g. Tear Strength, Min..... 150 lb/in.
  - h. Brittleness Temperature..... -40°F

### B. CLAMPS

1. Manufactured to the requirements of CSA B602
2. Clamp Housing- 301 Stainless Steel
3. Clamp Band - 301 Stainless Steel

4. Clamp Screw - 305 Stainless Steel

5. Installation torque 60" lbs

C. SHEAR RING

1. 0.012" Thick, 300 Series Stainless Steel

2. Width manufactured according to coupling width (1.50", 2.13", or 4")

3. Length manufactured according to coupling diameter

4. Clamps spot welded in place

D. COUPLING

1. Manufactured to conform to the performance requirements of:

a. ASTM C 1173 - standard specification for flexible transition couplings for underground piping systems

b. CSA B602 - mechanical couplings for drain, waste, vent pipe and sewer pipe

c. Maximum test pressure: 4.3 PSI (29.6KPA)

d. Maximum operating temperature: 140° F nonconsistent

E. Pre-Approved transition couplers are Strong Back RC Series Repair Couplings manufactured by Fernco Inc. or Engineer approved equal.

2.06 BEDDING MATERIAL

A. Borrowed granular bedding material shall conform to the gradation indicated below.

<u>Sieve Opening</u>	<u>Bedding Material (Percent Passing)</u>
1"	95-100
No. 200	< 15

B. Borrowed granular bedding material for unstable trench bottom shall conform to the gradation indicated of size 67 Course Aggregate, ASTM C33 which is indicated below.

<u>Sieve Opening</u>	<u>Bedding Material (Percent Passing)</u>
1-1/2"	100
3/4"	90-100
3/8"	20-55
No. 4	0-10
No. 8	0-5

C. Bedding material excavated from the job site shall be finely divided material free from organic material and clods, lumps of frozen material or stones larger than 1 1/2" in maximum diameter. Bedding material shall be of proper moisture content to form a firm bed for the pipe.

2.07 FASTENERS

A. All fasteners in buried locations shall be Grade 304 (A2) or Grade 316 (A4) stainless steel.



Anti-Seize shall be applied to all threads prior to installation.

## 2.08 LUBRICANT FOR GASKETED PIPE

- A. Lubricant shall be an emulsified polymer based product, specifically formulated to be water-soluble without causing turbidity. Lubricant shall not transfer taste and/or odor to new water main installations. Lubricant must not promote bacterial growth and be safe for use on all metal and plastic pipes. Lubricant shall be easily flushed from the line and be non-reactive to chlorinated water. Lubricant should work easily on both wet and dry surfaces.

## 2.09 POLYETHYLENE WRAP

- A. All ductile fittings shall be wrapped with polyethylene plastic film having a minimum thickness of 0.008 inches or with a cross woven polyethylene plastic film having a minimum thickness of 0.004 inches.

# **PART 3 EXECUTION**

## 3.01 GENERAL

- A. The areas to receive piping shall be examined for defects that may adversely affect the execution and quality of Work. Prior to the start of piping installation, all measurements shall be checked for deviations from allowable tolerances for piping.

## 3.02 BURIED PIPING INSTALLATION

- A. All piping and fittings shall be laid true to line and grade as shown on the plans. Each section of pipe shall be so laid and fitted together that when complete the piping will have a smooth uniform flow line. The inside of all pipe shall be cleaned before installation and kept thoroughly clean during and after the laying. Pipe ends shall be cleaned inside and outside.
- B. Apply lubricant liberally to the inside of the pipe bell and spigot. Make sure lubricated surfaces remain free of dirt, gravel, or other debris. Assemble the pipe joint immediately after application of the lubricant.
- C. All pipe and fitting shall be examined for defects before being lowered into the trench. The interior and exterior protective coating shall be inspected and field repaired, if required.
- D. The pipe shall be handled and installed in accordance with manufacturer's recommendations and the requirements of AWWA C 600 for Ductile Iron pipe, ASTM D 2774 for PVC pressure piping and ASTM D 2321 for PVC gravity sewer piping.
- E. When pipe laying is not in progress, including the noon hours, the open ends of pipe shall be closed. No trench water, animals, or foreign material shall be permitted to enter the pipe.
- F. Class "C" Bedding shall be used with all piping. The bedding material shall conform to the requirements of Part 2 above. General requirements for placement are shown on Standard Drawing 333100-1. On all non-rigid piping, care will be taken to provide maximum support in the haunch area of the pipe. This area extends from the bedding material to the center of the pipe. If coarse materials with voids have been used for bedding materials, the same bedding materials will be used for haunching. When a trench box or similar device is used during excavation, the box will be raised sufficiently to recompact the haunch area in the natural trench to 97% maximum dry density as determined by ASTM D 698.

- G. After each pipe has been graded, aligned, and placed in final position on the bedding material and shoved home, sufficient pipe embedment material shall be deposited and compacted under and around each side of the pipe and back of the bell or end thereof to hold the pipe in proper position and alignment during subsequent pipe joining and embedment operations.
- H. The pipe shall be laid upon properly placed bedding material so that the barrel of the pipe will have a bearing for its full length. No blocking will be allowed to bring the piping up to grade. Bell holes and depressions for joints shall be excavated after the trench bedding has been graded to provide uniform support for the entire pipe.
- I. The Contractor shall provide and maintain all necessary means and devices at all times to remove and dispose of all water entering the trench during the process of pipe laying. The trench shall be kept dry until the pipe laying and jointing are completed. Removal of water shall comply with Section 31 23 33.
- J. Thrust blocks or restraining fittings to restrain pressurized piping shall be provided at all abrupt changes in direction, tees, bends, dead ends and hydrants, and shall be in accordance with the pipe manufacturer's recommendations.
- K. The Contractor shall place backfill material in lifts not exceeding 1-foot and compact to 97% Standard Proctor Density. Stones equal to or larger than 3-inches in diameter shall not be placed within 2-feet of the pipe.

### 3.03 EXPOSED PIPING INSTALLATION

- A. Each item or system shall be furnished complete and installed as shown on the plans and in accordance with the manufacturer's recommendations, instructions, and directions. All installed equipment and systems shall be properly protected during subsequent construction operation.
- B. The Contractor shall inspect all material or equipment as it is received to determine damage and/or missing parts. It shall be his responsibility to repair or replace damaged items in accordance with the manufacturer's instructions.
- C. The Contractor shall provide all scaffolding required for the proper installation of this work in conformance with the standards of any local and state safety codes applying to scaffolding.
- D. All pipe shall be set such that the vertical and horizontal centerlines are properly aligned. Installation of piping by means of springing, forcing or stressing the pipe or adjacent fittings, valves or equipment will not be allowed.

### 3.04 MECHANICAL JOINTS AND COUPLINGS

- A. Mechanical joints shall be carefully assembled in accordance with the manufacturer's recommendations. If effective sealing is not obtained, the joint shall be disassembled, thoroughly cleaned, and reassembled or replaced. Over tightening bolts to compensate for poor installation practice will not be permitted.
- B. The holes in mechanical joints with tie rods shall be carefully aligned to permit installation of the tie rods. In flange and mechanical joint pieces, holes in the mechanical joint bells and the flanges shall straddle the top (or side for vertical piping) centerline. The top (or side) centerline shall be marked on each flange and mechanical joint piece at the foundry.

### 3.05 TRACER WIRE INSTALLATION

- A. Tracer wire shall be installed in the trench at the same time as the pipe or immediately prior to starting the backfill of the trench.
- B. Install a continuous length of tracer wire for the full length of each run of nonmetallic pipe. Attach wire to top of pipe in such manner that it will not be displaced during construction operations.
- C. Splices will be allowed at manholes, bored crossings, and at other locations as agreed upon by the Resident Project Representative. Splices in tracer wire will be made with split bolt or compression-type connectors. Wire nuts may not be used. A waterproof connection is necessary to prevent corrosion. Splices shall be completed in accordance with the manufacturer's recommendations.
- D. Prior to final acceptance, all tracer wire shall be electrically tested for continuity from one exposed end to another.
- E. Bring the wire to the ground surface at each manhole and boring ends and loop the wire in a tracer wire terminal box. These boxes shall be located adjacent to the manhole and/or bored crossing in the boulevard with at least two feet of extra wire inside the box. The tracer wire terminal box must be installed flush with the finished grade.

### 3.06 TESTING

- A. All piping shall be cleaned and flushed after completion of installation.

\* \* \* END OF SECTION \* \* \*



# **SECTION 33 39 13 MANHOLES AND CASTINGS**

## **PART 1 GENERAL**

### 1.01 RELATED DOCUMENTS

- A. The general provisions of the Contract, including General and Supplementary Conditions and the provisions of Division 1, Special Requirements apply to Work specified in this Section.
- B. Related Work Specified Elsewhere:
  - 1. Sheeting, Shoring and Bracing - Section 31 23 14
  - 2. Curbs, Gutters, Sidewalks and Driveways - Section 32 16 00
  - 3. Existing Underground Utilities - Section 33 01 00
  - 4. Sanitary Sewer Piping and Fittings – Section 33 31 00

### 1.02 DESCRIPTION OF WORK

- A. The Work covered under these specifications shall include the furnishing of all material, labor, tools, and equipment necessary to furnish, install, and construct complete in place all manholes as shown on the drawings and specified herein.
- B. When the term "manhole" is used in these specifications, it shall mean a structure that is placed on the sewer line to permit entry, inspection, cleaning, and repair of the sewer, and shall apply to all types of manholes whether standard, drop, flow measuring, or pond control.

### 1.03 JOB CONDITIONS

- A. Existing underground utilities, as shown on the drawings, are located in accordance with available data, but locations may vary and cannot be guaranteed. The exact locations shall be determined by the Contractor as work proceeds. Excavation work shall be done carefully so as to avoid damaging existing work.
- B. Contractor shall provide for protection, temporary removal and replacement or relocation of said obstructions as required for the performance of the work required in these contract documents.

### 1.04 SUBMITTALS

- A. The Contractor shall submit for review copies of shop drawings for the materials as specified.

## **PART 2 PRODUCTS**

### 2.01 MANHOLES

- A. Manholes shall be constructed of concrete or precast concrete with bases, rings, and covers according to the dimensions and details as shown on the plans or as called for in the specifications.
- B. The materials used shall conform to the following requirements:

1. Concrete shall conform to the requirements of Division 3 of these specifications.
2. Concrete reinforcing shall be Class 60 and conform to the requirements of Division 3 of these specifications.
3. Precast manhole sections and bases shall be of the class as shown on the drawings and shall conform to ASTM C-478.

## 2.02 CASTINGS

- A. Gratings and covers shall be of the standard design of the manufacturer. All castings shall be of uniform quality, free from blowholes, shrinkage, cracks, distortion, or other defects affecting strength and appearance. They shall be smooth and well cleaned.
- B. Metal used in the manufacture of castings shall conform to ASTM A48, Class 35B for gray iron or ASTM A536, Grade 65-45-12 for ductile iron.
- C. All castings shall be manufactured true to pattern; component parts shall fit together in a satisfactory manner. Round frames and covers shall have continuously machined bearing surfaces to prevent rocking and rattling.
- D. All cast dimensions may vary 1/2 the maximum shrinkage possessed by the metal or plus or minus 1/16 inch per foot.
- E. All weights shall not exceed the manufacturer's published weights by plus or minus 5%.
- F. All castings shall exceed proof load requirements of 16,000 lbs. The proof load test results shall be furnished upon request. The proof load test procedure shall be in accordance with Federal Specification A-A 60005.
- G. Standard manhole castings and covers will provide a minimum 24.0 inches clear opening for access. Manholes will have a minimum height of 7.0 inches and a minimum base width of 35.25 inches. Manhole lids will be provided with a rubber gasket to provide a self-sealing water tight lid when installed. Lids will be furnished with concealed pick holes.
- H. Manhole castings listed on the plans as "Frost Retardant" will provide a minimum 22.0 inches clear opening for access. Manhole frame will have an inner lid to provide an air break to prevent frost. Inner lid will be furnished with a handle to easily remove inner lid. Manholes will have a minimum height of 7.0 inches and a minimum base width of 38.0 inches. Manhole outer lids will be provided with a rubber gasket to provide a self-sealing water tight lid when installed. Outer lids will be furnished with concealed pick holes.

## 2.03 LADDERS AND STEPS

- A. Steps when called for on the detailed drawings and specifications shall conform to the requirements shown thereon and as supplemented herein.
- B. Manhole Steps will have a minimum step width of 11.0" and have a minimum 5.75" projection from the wall.
- C. Steps will have copolymer polypropylene cover with 1/2 inch ASTM A615 Grade 60 Steel reinforcement. All steel will be powder coated as per ASTM A934.

## 2.04 MANHOLE WALL JOINT SEALANT

- A. Manholes will be constructed with flexible rubber joints meeting the requirements of C990, “Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants.”
- B. It is also recommended, but not specifically required, that a flexible gasket material be used on each joint to insure sealing of manhole wall joints. Flexible sealants may be RAM-NEK as manufactured by Henry Company, Houston Texas; ConSeal as manufactured by Concrete Sealants, Inc., New Carlisle, Ohio; Polylok’s Butyl Joint Sealant, Polylok, Incorporated, Wallingford, CT; or Engineer approved equal.
- C. **Under no conditions will spray foam insulation of any form or brand be used to seal manhole joints.**

2.05 MANHOLE WALL - CASTING SEALANT

- A. Unless otherwise shown on the plans, sealant material meeting the requirements of Paragraph 2.04-A above shall be used to make a watertight seal between the manhole wall and casting.
- B. When shown on the plans, the manhole wall - casting joint shall be sealed with an internal flexible rubber seal that conforms to the following requirements:
  - 1. The rubber sleeve shall have a minimum thickness of 3/16 inches. The rubber sleeve shall be corrugated to allow up to 2 inches of vertical and horizontal movement without stretching the material. The rubber sleeve shall have a minimum unexpanded vertical height of 6 inches. The rubber sleeve material shall have the physical properties as shown in Table I.

TABLE I - RUBBER SLEEVE

PHYSICAL PROPERTIES	
Tensile Strength	1200 psi
Elongation at break	350% min.
Hardness (Durometer)	45 \ 5
Accelerated oven aging	max. 15% decrease of tensile, 20% of elongation
Chemical resistance	no weight loss in 1N of sulfuric or hydrochloric acid
Compression set	25% maximum decrease
Water absorption	max. 10% increase by weight
Ozone resistance	rating 0
Low temperature brittle point	No fracture at -40 degrees C.
Tear resistance	200 lb. f/in.
Splice strength	180 degree bend with no visible separation

- 2. The expansion bands shall be one piece; channeled 16-gauge stainless steel with a minimum width of 1-1/4 inches. The bands shall have a minimum 10-inch long adjustment slot which shall provide a minimum of 2-1/2 inches of diameter range. The bands shall be locked in place by the tightening of 2 self-locking stainless steel studs.
- C. Manhole casting seals shall be an Internal Manhole Chimney Seal as manufactured by Cretex Specialty Products, or approved equivalent.

2.06 PIPE OPENING GASKET

A. Unless otherwise shown on the plans, the pipe opening in the manhole wall shall be made watertight with a rubber gasket assembly meeting the requirements of ASTM C923 and the following:

1. GASKET:

Minimum Thickness of Gasket Material

8" Holes thru 16" Hole Sizes ----- 0.290" \ 0.025

18" Holes and Larger Hole Sizes ----- 0.300" \ 0.025

Minimum Compound Tensile

Strength of Rubber ----- 1,800 PSI

Elongation of Rubber ----- 450% - 550%

Shore A Durometer of Rubber ----- 42 \ 5

2. EXPANSION SLEEVE:

Type 304 Stainless Steel

Tensile Strength of Steel ----- 85,000 PSI

Yield Strength of Steel ----- 35,000 PSI

8" thru 26" Hole Sizes ----- 1.5" Wide 11-Gauge

28" Hole Sizes and Larger ----- 1.5" Wide 10-Gauge

3. TAKE UP CLAMPS:

Stainless Steel

Band, Saddle and Housing made of Type 302

Screw made of Type 305 Stainless Steel

**PART 3 EXECUTION**

3.01 LOCATIONS

A. Manholes shall be constructed at the locations and grades indicated on the plans.

3.02 GENERAL CONSTRUCTION

A. Manholes shall be constructed only when the temperature is above 32 degrees F. All Work shall be protected against freezing.

B. The bottom of the foundations shall be not lower than 12 inches below the lines of the invert of the sewer at that point and shall be included in the unit price bid for manholes.

C. Invert channels shall be smooth, accurately shaped, and in accordance with the plan elevations. Invert channels may be formed directly in the concrete of the manhole base, may be formed using a section of PVC of required size and length as form material, and pouring concrete around same on top of the manhole foundation, may be built up of brick work and mortar, may consist of half tile laid in the concrete base, or may be constructed by laying full section sewer pipe straight through the manhole and cutting out the top half after the manhole floor is constructed and sufficiently set. The floor of the manhole shall be constructed in such a manner as to drain into the invert properly.

D. Manholes shall be built up so that the cover, when placed, will be at the grade required in the



plans or as set by the Engineer.

### 3.03 PRECAST CONCRETE MANHOLES

- A. Monolithic precast concrete manholes shall be constructed in accordance with the details shown on the plans, as required by ASTM specification C478 and as specified hereinafter.
- B. Monolithic concrete and precast concrete manholes shall have offset cones; that is, one side shall be vertical.
- C. Precast base sections may be a base riser section and separate base slab or base section with integral floor. Cast in place bases shall be furnished as shown on the plans.
- D. Precast concrete manholes shall be placed using present acceptable construction methods.
- E. The openings in monolithic precast manhole sections shall be sealed using a rubber sleeve gasket to make a flexible watertight connection.
- F. All manhole sections shall be sealed with a double ring of sealant to form a watertight seal.
- G. All lifting holes in the manhole walls shall be carefully grouted with non-shrink grout prior to backfilling.

### 3.04 BACKFILLING

- A. After completion of footings, walls, and other construction below the elevation of the final grades and prior to backfilling, all forms shall be removed and the excavation cleaned of all trash and debris.
- B. The Contractor shall protect the manhole from all elements and from displacement during backfill operations. If any displacement of a manhole occurs, the Contractor shall repair all resulting damage and return the manhole to the original position required at his own expense.

### 3.05 CASTING PLACEMENT

- A. The manhole casting and cover shall be carefully centered and sealed in the opening manhole wall-casting. Sealant methods and material as shown on the plans.
- B. When an internal or external manhole casting sleeve is required. The Contractor shall install seal according to Manufacturer's requirement. Care shall be taken to insure seal is not damaged during installation. Contractor shall replace any damaged seals at no cost to Owner if damaged during installation procedures.

### 3.06 SURFACE FINISH

- A. The surface of the area shall be finished and smoothed to the lines and grades as shown on the plans.
- B. The requirements for the surface finish of the surrounding area shall conform to the requirements of the specifications relating to the surface to be replaced.

\*\*\* END OF SECTION \*\*\*

# **SECTION 33 41 00 STORM UTILITY DRAINAGE PIPING**

## **PART 1 GENERAL**

### 1.01 RELATED DOCUMENTS

- A. The general provisions of the Contract, including General and Supplementary Conditions shall apply to the Work covered in this section.
- B. Related Work Specified Elsewhere:
  - 1. Trenching, Backfilling and Compacting - Section 31 23 33
  - 2. Standard Detail – 33 41 00-01

### 1.02 DESCRIPTION OF WORK

- A. The work covered under these specifications shall include the furnishing of all labor, material, tools, and equipment necessary to furnish and install, complete in place, all storm water drainage piping and related appurtenances as shown on the drawings and as specified herein.

### 1.03 SUBMITTALS

- A. The Contractor shall submit for review copies of shop drawings for materials specified herein.
- B. Certificates from the manufacturer that the materials meet or exceed specified requirements.
- C. The manufacturer's installation recommendations, including types and amounts of gasket lubricant, where applicable, to be used.

### 1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. All materials shall be packed, loaded, transported, unloaded and handled in such a manner so as to prevent damage to the materials.
- B. All material shall be loaded, unloaded and placed in position by lifting with slings or hoists or skidding so as to avoid shock or damage. Dropping or rolling will not be permitted. The use of end hooks to install or move piping will not be allowed.
- C. All materials shall be stored on the site in accordance with the manufacturer's recommendations.

## **PART 2 PRODUCTS**

### 2.01 PE STORM SEWER PIPE

- A. Storm sewer pipe will conform to the requirements of ASTM F2648 Standard Specification for 2 in. to 60 in. Annular Corrugated Profile Wall Polyethylene (PE) Pipe and Fittings for Land Drainage Applications or AASHTO M294 Type S.
- B. Pipe will be dual-walled with a smooth interior and corrugated exterior.

- C. All joints will be gasket style to provide a watertight connection capable of holding a 10.8-psi internal pressure for a minimum of 10 minutes, per ASTM D3212.
- D. Fittings for PE pipe will have gasket style joints, and conform to the requirements of ASTM F2306.
- E. Tapping saddle tees/In-serta Tees may be used for lateral connections.

#### 2.02 PVC STORM DRAINAGE PIPING - SDR 35

- A. Polyvinyl Chloride (PVC) gravity pipe shall be Type I, Grade I, conforming to the requirements of ASTM Specification D 3034 for Rigid Poly (Vinyl Chloride) Sewer pipe.
- B. Solvent Cement for PVC pipe joints will not be allowed.
- C. Gasket type joints shall be made with rubber gaskets conforming to the requirements of ASTM F-477.
- D. Tapping saddle tees/In-serta Tees may be used for lateral connections.

#### 2.03 POLYPROPYLENE (PP) PIPE

- A. Polypropylene Pipe will conform to the requirements of ASTM F2881 or AASHTO M330.
- B. Joints for Polypropylene pipe shall include dual gaskets and conform to the requirements of ASTM D3212.
- C. Fittings for polypropylene pipe shall conform to ASTM F2881.
- D. Tapping saddle tees/In-serta Tees may be used for lateral connections.

#### 2.04 GRAVITY PVC PIPE FITTINGS

- A. Fittings for Polyvinyl Chloride (PVC) gravity pipe fittings shall be of PVC with material and dimensions conforming to the requirements of ASTM Specification D 3034.
- B. Gaskets for elastomeric joints shall conform to the requirements of ASTM F-477.
- C. Solvent Cement for solvent weld joints will not be allowed.

### **PART 3 EXECUTION**

#### 3.01 GENERAL

- A. Storm drainage piping shall be laid with the groove or bell end of the pipe upstream and the tongue end shall be inserted into the groove.
- B. Rubber gaskets at joints shall be installed according to the manufacturer's instructions.
- C. Proper equipment shall be provided by the Contractor for lowering the sections of pipe into place. Dropping the pipe into place will not be permitted.

#### 3.02 EXCAVATION

- A. Trenches shall be excavated to a width sufficient to allow for proper jointing of the pipe and thorough compaction of the bedding and backfill material under and around the pipe. Where feasible, trench walls shall be vertical. The completed trench bottom shall be firm for its full length and width.

B. The foundation for each type of bedding shall be adequate to furnish a uniform stable support.

### 3.03 BEDDING

A. Bedding shall be used with all storm piping.

**1. Class E bedding material (as seen in the Standard Drawing 33 41 00 – 1), will be used with all PVC, PP and PE storm drainage piping and the bedding shall meet the follow requirement:**

B. Bedding material shall consist of pit run gravel with a minimum amount of rock retained on the 1" sieve and no more than 15% passing the #200 sieve. The gravel for bedding shall be approved by the Engineer prior to its use.

### 3.04 DISPOSAL OF EXCESS MATERIAL

A. Any excess material, or material determined as unsuitable for backfill, shall be wasted at an area designated by the Engineer.

### 3.05 TESTING OF GRAVITY STORM SEWERS

#### A. TEST SECTIONS

1. The alignment tests of all gravity sewer lines shall be carried out on sections of sewer line located between manholes and/or inlets.
2. The Contractor shall be solely responsible for any and all damage to the pipeline, and to public and private property, which may result from defective material or workmanship.
3. Concrete and corrugated metal pipe will not be tested for infiltration or exfiltration, unless specifically called out in the plans.

#### B. GRAVITY SEWER LINE DISPLACEMENT AND DEFLECTION

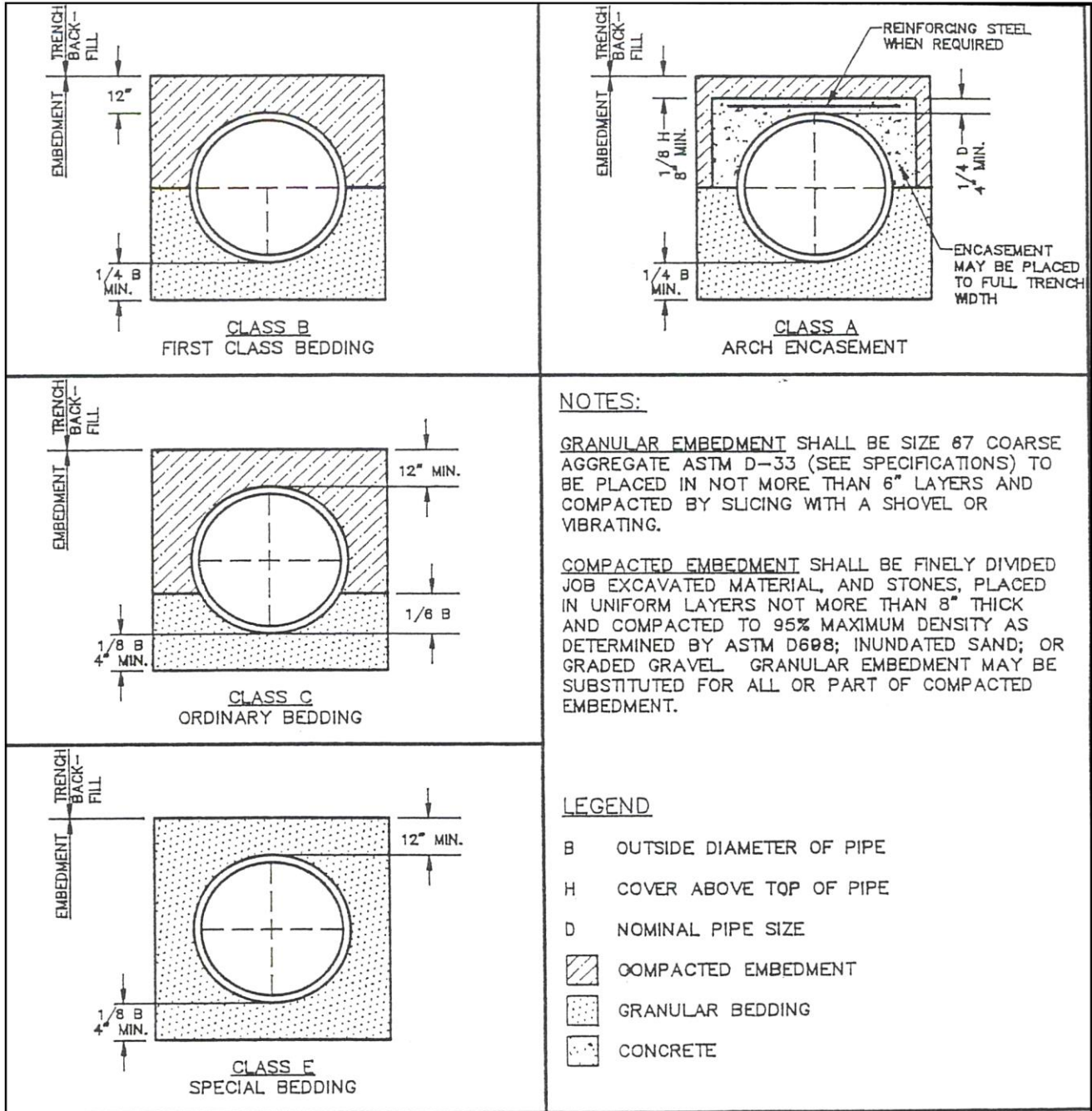
1. All tests for alignment and displacement of the gravity sewer lines will be made after the pipe has been laid and the trench backfilled and compacted as specified.
2. The Engineer's test procedure will be as follows: A light will be shined between manholes and/or inlets by means of a flashlight or by reflecting sunlight with mirrors.
3. The Engineer may require the Contractor to conduct random deflection tests between successive inlet in areas where unstable trench walls or bottoms, heavy rainfall, frozen soil, high ground water levels, deep lines or difficulty in achieving compaction is experienced.

### 3.06 CLEANING OF GRAVITY SEWER LINES

A. All lines shall be thoroughly flushed and cleaned before acceptance until all traces of construction materials, soil or other foreign matter have been removed.

B. The Contractor shall take all necessary measures to protect adjacent facilities and property. Damages caused by flushing water or water carried material shall be the responsibility of the Contractor.

C. All flushing and cleaning shall be completed prior to the initiation of the testing process described in 3.05.



**NOTES:**

**GRANULAR EMBEDMENT** SHALL BE SIZE 87 COARSE AGGREGATE ASTM D-33 (SEE SPECIFICATIONS) TO BE PLACED IN NOT MORE THAN 6" LAYERS AND COMPACTED BY SLICING WITH A SHOVEL OR VIBRATING.

**COMPACTED EMBEDMENT** SHALL BE FINELY DIVIDED JOB EXCAVATED MATERIAL, AND STONES, PLACED IN UNIFORM LAYERS NOT MORE THAN 8" THICK AND COMPACTED TO 95% MAXIMUM DENSITY AS DETERMINED BY ASTM D698; INUNDATED SAND; OR GRADED GRAVEL. GRANULAR EMBEDMENT MAY BE SUBSTITUTED FOR ALL OR PART OF COMPACTED EMBEDMENT.

**LEGEND**

- B    OUTSIDE DIAMETER OF PIPE
- H    COVER ABOVE TOP OF PIPE
- D    NOMINAL PIPE SIZE
- COMPACTED EMBEDMENT
- GRANULAR BEDDING
- CONCRETE

**EMBEDMENTS FOR CONDUITS**

HELMS AND ASSOCIATES  
CONSULTING ENGINEERS  
ABERDEEN, SOUTH DAKOTA

Standard Drawing  
33 41 00 - 1

\*\*\* END OF SECTION \*\*\*