

Project Manual

Columbia Park and Ballfield

Columbia, South Dakota 57433

April 22, 2022

CONFLUENCE

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Project #21382

**COLUMBIA PARK AND BALLFIELD
COLUMBIA, SD**

Confluence Project No. 21382

April 22, 2022

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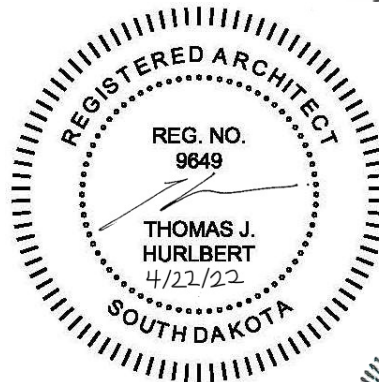
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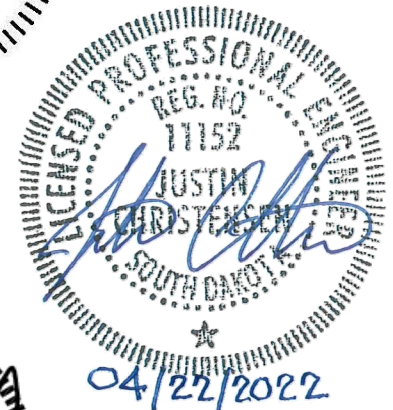
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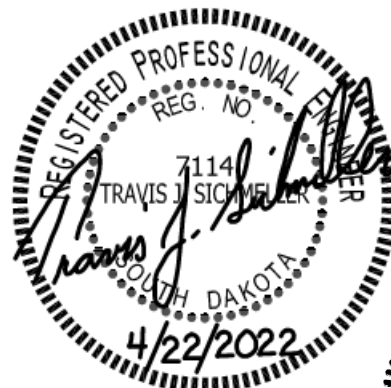
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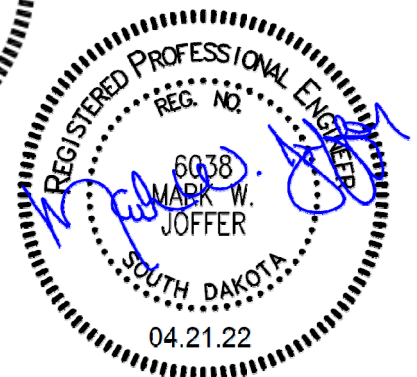
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END OF SECTION

SECTION 011000 SUMMARY

PART 1 GENERAL

1.01 PROJECT

- A. Project Name: 21382 Columbia Park & Ballfield
- B. Owner's Representative: Terry Birck.
- C. Landscape Architect: Confluence.
- D. The Project consists of the construction of new park and ballfield.

1.02 CONTRACT DESCRIPTION

- A. Contract Type: A single prime contract based on a Stipulated Price.

1.03 RELATED DOCUMENTS

- A. Instructions to Bidders for AIA Document A701-2017
- B. General Conditions of the Contract for Construction AIA A201-2017

1.04 DESCRIPTION OF ALTERATIONS WORK

- A. Scope of alterations work is indicated on drawings.

1.05 OWNER OCCUPANCY

- A. The City of Columbia intends to occupy the Project upon Substantial Completion.
- B. Cooperate with Owner to minimize conflict and to facilitate Owner's operations.

1.06 CONTRACTOR USE OF SITE AND PREMISES

- A. Construction Operations: Limited to areas noted on Drawings.
 - 1. Locate and conduct construction activities in ways that will limit disturbance to site.
 - 2. Upon completion of the project Contractor to remove all debris, grade area smooth and stabilize per local SWPPP requirements.
- B. Arrange use of site and premises to allow:
 - 1. Work by Others.
 - 2. Use of adjacent streets and right-of-way by the public.
- C. Provide access to and from site as required by law and by City of Columbia:
 - 1. Do not obstruct roadways, sidewalks, or other public ways without permit.
- D. Utility Outages and Shutdown:
 - 1. Prevent accidental disruption of utility services to other facilities.

1.07 WORK SEQUENCE

- A. Coordinate construction schedule and operations with Owner.

1.08 SPECIFICATION SECTIONS APPLICABLE TO ALL CONTRACTS

- A. Unless otherwise noted, all provisions of the sections listed below apply to all contracts. Specific items of work listed under individual contract descriptions constitute exceptions.
- B. Section 012000 - Price and Payment Procedures.
- C. Section 013000 - Administrative Requirements.
- D. Section 014000 - Quality Requirements.
- E. Section 015000 - Temporary Facilities and Controls.
- F. Section 016000 - Product Requirements.
- G. Section 017000 - Execution and Closeout Requirements.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

**SECTION 012000
PRICE AND PAYMENT PROCEDURES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Procedures for preparation and submittal of applications for progress payments.
- B. Documentation of changes in Contract Sum and Contract Time.
- C. Change procedures.
- D. Procedures for preparation and submittal of application for final payment.

1.02 RELATED REQUIREMENTS

- A. Instructions to Bidders for AIA Document A701-2017
- B. General Conditions of the Contract for Construction AIA A201-2017

1.03 SCHEDULE OF VALUES

- A. Use Schedule of Values Form: AIA G703, edition stipulated in the Agreement.
- B. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit draft to Architect for approval.
- C. Forms filled out by hand will not be accepted.
- D. Submit Schedule of Values within 15 days after date of Owner-Contractor Agreement.
- E. Format: Utilize the Table of Contents of this Project Manual. Identify each line item with number and title of the specification section. Identify site mobilization and bonds and insurance.
- F. Revise schedule to list approved Change Orders, with each Application For Payment.

1.04 APPLICATIONS FOR PROGRESS PAYMENTS

- A. Payment Period: Submit at intervals stipulated in the Agreement.
- B. Use Form AIA G702 and Form AIA G703, edition stipulated in the Agreement.
- C. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit sample to Architect for approval.
- D. Forms filled out by hand will not be accepted.
- E. 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 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.
- F. Execute certification by signature of authorized officer.
- G. Use data from approved Schedule of Values. Provide dollar value in each column for each line item for portion of work performed.
- H. List each authorized Change Order as a separate line item, listing Change Order number and dollar amount as for an original item of work.
- I. Submit one electronic copy to Architect of each Application for Payment.

1.05 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. Contractor shall prepare and submit a fixed price quotation within 5 working days.
- D. Contractor may propose a change by submitting a request for change to Architect, describing the proposed change and its full effect on the work, with a statement describing the reason for the change, and the effect on the Contract Sum and Contract Time with full documentation. Document any requested substitutions in accordance with Section 01 6000.
- E. Computation of Change in Contract Amount: As specified in the Agreement and Conditions of the Contract.
 - 1. For change requested by Architect for work falling under a fixed price contract, the amount will be based on Contractor's price quotation.
 - 2. For change requested by Contractor, the amount will be based on the Contractor's request for a Change Order as approved by Architect.
 - 3. For pre-determined unit prices and quantities, the amount will be based on the fixed unit prices.
- F. 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.
- G. Execution of Change Orders: Architect will issue Change Orders for signatures of parties as provided in the Conditions of the Contract.
- H. After execution of Change Order, promptly revise Schedule of Values and Application for Payment forms to record each authorized Change Order as a separate line item and adjust the Contract Sum.
- I. Promptly revise progress schedules to reflect any change in Contract Time, revise sub-schedules to adjust times for other items of work affected by the change, and resubmit.

1.06 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.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

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 for AIA Document A701-2017.
- B. General Conditions of the Contract for Construction AIA A201-2017.

1.03 DEFINITIONS

- A. Substitutions: Changes from Contract Documents requirements proposed by Contractor to materials, products, assemblies, and equipment.
 - 1. Substitutions for Cause: Proposed due to changed Project circumstances beyond Contractor's control.
 - 2. Substitutions for Convenience: Proposed due to possibility of offering substantial advantage to the Project.

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. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents. Burden of proof is on proposer.
 - 1. Note explicitly any non-compliant characteristics.
- C. 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.
 - 2) Owner's, Architect's, and Contractor's names.
 - b. Substitution Request Information:
 - 1) Description of Substitution.
 - 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) Warranties.
 - 3) Other salient features and requirements.
- D. 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. Owner will consider requests for substitutions only if submitted at least 7 calendar days prior to the date for receipt of bids.

3.03 SUBSTITUTION PROCEDURES DURING CONSTRUCTION

- A. Submit request for Substitution for Convenience immediately upon discovery of its potential advantage to the project, but not later than 14 calendar days prior to time required for review and approval by Architect, in order to stay on approved project schedule.
 - 1. In addition to meeting general documentation requirements, document how the requested substitution benefits the Owner through cost savings, time savings, greater energy conservation, or in other specific ways.
 - 2. Document means of coordinating of substitution item with other portions of the work, including work by affected subcontractors.
 - 3. Bear the costs engendered by proposed substitution of:
 - a. Owner's compensation to the Architect for any required redesign, time spent processing and evaluating the request.
 - b. Other unanticipated project considerations.
- B. Substitutions will not be considered under the following circumstances:
 - 1. When they are indicated or implied on shop drawing or product data submittals, without having received prior approval.

3.04 RESOLUTION

- A. Architect may request additional information and documentation prior to rendering a decision. Provide this data in an expeditious manner.
- B. Architect will notify Contractor in writing of decision to accept or reject request.

3.05 ACCEPTANCE

- A. Accepted substitutions change the work of the Project. They will be documented and incorporated into work of the project by Change Order, Construction Change Directive, Architectural Supplementary Instructions, or similar instruments provided for in the Conditions of the Contract.

3.06 CLOSEOUT ACTIVITIES

- A. See Section 017800 - Closeout Submittals, for closeout submittals.

**SECTION 013000
ADMINISTRATIVE REQUIREMENTS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. General administrative requirements.
- B. Preconstruction meeting.
- C. Progress meetings.
- D. Construction progress schedule.
- E. Number of copies of submittals.
- F. Requests for Interpretation (RFI) procedures.
- G. Submittal procedures.

1.02 RELATED REQUIREMENTS

- A. Section 016000 - Product Requirements: General product requirements.
- B. Section 017000 - Execution and Closeout Requirements: Additional coordination requirements.

1.03 GENERAL ADMINISTRATIVE REQUIREMENTS

- A. Comply with requirements of Section 017000 - Execution and Closeout Requirements for coordination of execution of administrative tasks with timing of construction activities.
- B. Make the following types of submittals to Architect:
 - 1. Requests for Interpretation (RFI).
 - 2. Requests for substitution.
 - 3. Shop drawings, product data, and samples.
 - 4. Manufacturer's instructions and field reports.
 - 5. Applications for payment and change order requests.
 - 6. Progress schedules.
 - 7. Coordination drawings.
 - 8. Correction Punch List and Final Correction Punch List for Substantial Completion.
 - 9. Closeout submittals.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PRECONSTRUCTION MEETING

- A. Architect will schedule a meeting after Notice of Award.
- B. Attendance Required:
 - 1. Owner.
 - 2. Architect.
 - 3. Contractor.
 - 4. Major subcontractors.
 - 5. City of Columbia Representatives.
- C. Agenda:
 - 1. Execution of Owner-Contractor Agreement.
 - 2. Submission of executed bonds and insurance certificates.
 - 3. Submission of list of subcontractors, list of products, schedule of values, and progress schedule.
 - 4. Submission of initial Submittal schedule.
 - 5. Designation of personnel representing the parties to Contract.
 - 6. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
 - 7. Scheduling.
 - 8. Scheduling activities of a Geotechnical Engineer.

3.02 PROGRESS MEETINGS

- A. Schedule and administer meetings throughout progress of the work at maximum interval of once every two weeks.
- B. Architect will make arrangements for meetings, prepare agenda with copies for participants, preside at meetings.
- C. Attendance Required:
 - 1. Contractor.
 - 2. Owner.
 - 3. Architect.
 - 4. Contractor's superintendent.
 - 5. Major subcontractors.
 - 6. City of Columbia Representatives.
- D. Agenda:
 - 1. Review of work progress.
 - 2. Field observations, problems, and decisions.
 - 3. Identification of problems that impede, or will impede, planned progress.
 - 4. Review of submittals schedule and status of submittals.
 - 5. Review of RFIs log and status of responses.
 - 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. Other business relating to work.

3.03 CONSTRUCTION PROGRESS SCHEDULE

- 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.
- B. If preliminary schedule requires revision after review, submit revised schedule within 5 calendar days.
- C. Within 20 days after review of preliminary schedule, submit draft of proposed complete schedule for review.
 - 1. Include written certification that major contractors have reviewed and accepted proposed schedule.
- D. Within 10 days after joint review, submit complete schedule.

3.04 REQUESTS FOR INTERPRETATION (RFI)

- A. Definition: A request seeking one of the following:
 - 1. An interpretation, amplification, or clarification of some requirement of Contract Documents arising from inability to determine from them the exact material, process, or system to be installed; or when the elements of construction are required to occupy the same space (interference); or when an item of work is described differently at more than one place in Contract Documents.
 - 2. A resolution to an issue which has arisen due to field conditions and affects design intent.
- B. Whenever possible, request clarifications at the next appropriate project progress meeting, with response entered into meeting minutes, rendering unnecessary the issuance of a formal RFI.
- C. Preparation: Prepare an RFI immediately upon discovery of a need for interpretation of Contract Documents. Failure to submit a RFI in a timely manner is not a legitimate cause for claiming additional costs or delays in execution of the work.
 - 1. Prepare a separate RFI for each specific item.
 - a. Review, coordinate, and comment on requests originating with subcontractors and/or materials suppliers.
 - b. Do not forward requests which solely require internal coordination between subcontractors.

2. Prepare in a format and with content acceptable to Architect.
 3. Combine RFI and its attachments into a single electronic file. PDF format is preferred.
- D. Content: Include identifiers necessary for tracking the status of each RFI, and information necessary to provide an actionable response.
1. Official Project name, and any additional required identifiers established in Contract Documents.
 2. Discrete and consecutive RFI number, and descriptive subject/title.
 3. Issue date, and requested reply date.
 4. Reference to particular Contract Document(s) requiring additional information/interpretation. Identify pertinent drawing and detail number and/or specification section number, title, and paragraph(s).
 5. Annotations: Field dimensions and/or description of conditions which have engendered the request.
 6. Contractor's suggested resolution: A written and/or a graphic solution, to scale, is required in cases where clarification of coordination issues is involved, for example; routing, clearances, and/or specific locations of work shown diagrammatically in Contract Documents. If applicable, state the likely impact of the suggested resolution on Contract Time or the Contract Sum.
- E. Attachments: Include sketches, coordination drawings, descriptions, photos, submittals, and other information necessary to substantiate the reason for the request.
- F. RFI Log: Prepare and maintain a tabular log of RFIs for the duration of the project.
1. Indicate current status of every RFI. Update log promptly and on a regular basis.
 2. Note dates of when each request is made, and when a response is received.
 3. Highlight items requiring priority or expedited response.
- G. Review Time: Architect will respond and return RFIs to Contractor within 5 calendar days of receipt. For the purpose of establishing the start of the mandated response period, RFIs received after 3:00 PM will be considered as having been received on the following regular working day.
- H. Responses: Content of answered RFIs will not constitute in any manner a directive or authorization to perform extra work or delay the project. If in Contractor's belief it is likely to lead to a change to Contract Sum or Contract Time, promptly issue a notice to this effect, and follow up with an appropriate Change Order request to Owner.

3.05 SUBMITTAL SCHEDULE

- A. Submit to Architect for review a schedule for submittals in tabular format.
1. Format schedule to allow tracking of status of submittals throughout duration of construction.

3.06 SUBMITTALS FOR REVIEW

- A. When the following are specified in individual sections, submit them for review:
1. Product data.
 2. Design data.
 3. Shop drawings.
 4. Samples for selection.
 5. Samples for verification.
- B. Submit to Architect for review for the limited purpose of checking for compliance with information given and the design concept expressed in Contract Documents.
- C. Samples will be reviewed for aesthetic, color, or finish selection.
- D. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article below and for record documents purposes described in Section 017800 - Closeout Submittals.

3.07 SUBMITTALS FOR PROJECT CLOSEOUT

- A. Submit Correction Punch List for Substantial Completion.

- B. Submit Final Correction Punch List for Substantial Completion.
- C. When the following are specified in individual sections, submit them at project closeout in compliance with requirements of Section 017000 - Execution and Closeout Requirements.
 - 1. Project record documents.
 - 2. Operation and maintenance data.
 - 3. Warranties.
 - 4. Other types as indicated.
- D. Submit for Owner's benefit during and after project completion.

3.08 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.
- B. Samples: Submit the number specified in individual specification sections; one of which will be retained by Architect.
 - 1. After review, produce duplicates.
 - 2. Retained samples will not be returned to Contractor unless specifically so stated.

3.09 SUBMITTAL PROCEDURES

- A. General Requirements:
 - 1. Use a single transmittal for related items.
 - 2. Submit separate packages of submittals for review and submittals for information, when included in the same specification section.
 - 3. Transmit using approved form.
 - a. Use Contractor's form, subject to prior approval by Architect.
 - 4. 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.
 - a. Submittals from sources other than the Contractor, or without Contractor's stamp will not be acknowledged, reviewed, or returned.
 - 5. Schedule submittals to expedite the Project, and coordinate submission of related items.
 - a. For each submittal for review, allow 10 calendar days excluding delivery time to and from the Contractor.
 - b. For sequential reviews involving Architect's consultants, Owner, or another affected party, allow an additional 5 calendar days.
 - 6. Incomplete submittals will not be reviewed, unless they are partial submittals for distinct portion(s) of the work, and have received prior approval for their use.
- B. Product Data Procedures:
 - 1. Submit only information required by individual specification sections.
 - 2. Collect required information into a single submittal.
 - 3. Do not submit (Material) Safety Data Sheets for materials or products.
- C. Shop Drawing Procedures:
 - 1. Prepare accurate, drawn-to-scale, original shop drawing documentation by interpreting Contract Documents and coordinating related work.
 - 2. Generic, non-project-specific information submitted as shop drawings do not meet the requirements for shop drawings.
- D. Samples Procedures:
 - 1. Transmit related items together as single package.
 - 2. Identify each item to allow review for applicability in relation to shop drawings showing installation locations.

3.10 SUBMITTAL REVIEW

- A. Submittals for Review: Architect will review each submittal, and approve, or take other appropriate action.

- B. Submittals for Information: Architect will acknowledge receipt and review. See below for actions to be taken.
- C. Architect's actions will be reflected by marking each returned submittal using virtual stamp on electronic submittals.
- D. Architect's and consultants' actions on items submitted for review:
 - 1. Authorizing purchasing, fabrication, delivery, and installation:
 - a. "Approved", or language with same legal meaning.
 - b. "Approved as Noted, Resubmission not required", or language with same legal meaning.
 - 1) At Contractor's option, submit corrected item, with review notations acknowledged and incorporated.
 - c. "Approved as Noted, Resubmit for Record", or language with same legal meaning.
 - 2. Not Authorizing fabrication, delivery, and installation:
 - a. "Revise and Resubmit".
 - 1) Resubmit revised item, with review notations acknowledged and incorporated.
 - b. "Rejected".
 - 1) Submit item complying with requirements of Contract Documents.
- E. Architect's and consultants' actions on items submitted for information:
 - 1. Items for which no action was taken:
 - a. "Received" - to notify the Contractor that the submittal has been received for record only.
 - 2. Items for which action was taken:
 - a. "Reviewed" - no further action is required from Contractor.

END OF SECTION

**SECTION 014000
QUALITY REQUIREMENTS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Submittals.
- B. Quality assurance.
- C. References and standards.
- D. Testing and inspection agencies and services.
- E. Control of installation.
- F. Mock-ups.
- G. Tolerances.
- H. Defect Assessment.

1.02 RELATED REQUIREMENTS

- A. Section 013000 - Administrative Requirements: Submittal procedures.
- B. Section 016000 - Product Requirements: Requirements for material and product quality.
- C. 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 REFERENCE STANDARDS

- A. ASTM C1077 - Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation 2017.
- B. ASTM C1093 - Standard Practice for Accreditation of Testing Agencies for Masonry 2022.
- C. ASTM D3740 - Standard Practice for Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction 2019.
- D. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection 2021.
- E. ASTM E543 - Standard Specification for Agencies Performing Nondestructive Testing 2021.
- F. ASTM E699 - Standard Specification for Agencies Involved in Testing, Quality Assurance, and Evaluating of Manufactured Building Components 2016.
- G. IAS AC89 - Accreditation Criteria for Testing Laboratories 2021.

1.04 DEFINITIONS

- A. Contractor's Professional Design Services: Design of some aspect or portion of the project by party other than the design professional of record. Provide these services as part of the Contract for Construction.
 - 1. Design Services Types Required:

- a. Design-Related: Design services explicitly required to be performed by another design professional due to highly-technical and/or specialized nature of a portion of the project. Services primarily involve engineering analysis, calculations, and design, and are not intended to alter the aesthetic aspects of the design.
- B. Design Data: Design-related, signed and sealed drawings, calculations, specifications, certifications, shop drawings and other submittals provided by Contractor, and prepared directly by, or under direct supervision of, appropriately licensed design professional.

1.05 CONTRACTOR'S DESIGN-RELATED PROFESSIONAL DESIGN SERVICES

- A. Coordination: Contractor's professional design services are subject to requirements of project's Conditions for Construction Contract.
- B. Base design on performance and/or design criteria indicated in individual specification sections.
- C. Scope of Contractor's Professional Design Services: Provide for the following items of work:
 - 1. Shelter Design: Concrete footings and structure as described on plan details.
 - 2. Concrete Mix Design: As described in Section 033000 - Cast-in-Place Concrete. No specific designer qualifications are required.
 - 3. Structural Calculations and Design: As described in Section 323223 - Segmental Retaining Walls

1.06 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Designer's Qualification Statement: Submit for Architect's knowledge as contract administrator, or for Owner's information.
 - 1. Include information for each individual professional responsible for producing, or supervising production of, design-related professional services provided by Contractor.
 - a. Full name.
 - b. Professional licensure information.
 - c. Statement addressing extent and depth of experience specifically relevant to design of items assigned to Contractor.
- C. Design Data: Submit for Architect's knowledge as contract administrator for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents, or for Owner's information.
 - 1. Include calculations that have been used to demonstrate compliance to performance and regulatory criteria provided, and to determine design solutions.
 - 2. Include required product data and shop drawings.
 - 3. Include a statement or certification attesting that design data complies with criteria indicated, such as building codes, loads, functional, and similar engineering requirements.
 - 4. Include signature and seal of design professional responsible for allocated design services on calculations and drawings.
- D. Certificates: When specified in individual specification sections, submit certification by the manufacturer and Contractor to Architect, in quantities specified for Product Data.
 - 1. Indicate material or product complies with or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
- E. Manufacturer's Instructions: When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, for the Owner's information. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.
- F. Erection Drawings: Submit drawings for Architect's benefit as contract administrator or for Owner.
 - 1. Submit for information for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents.

1.07 QUALITY ASSURANCE

- A. Designer Qualifications: Where professional engineering design services and design data submittals are specifically required of Contractor by Contract Documents, provide services of a Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located.
- B. Quality-Control Personnel Qualifications. Engage a person with requisite training and experience to implement and manage quality assurance (QA) and quality control (QC) for the project.

1.08 REFERENCES AND STANDARDS

- A. For products and workmanship specified by reference to a document or documents not included in the Project Manual, also referred to as reference standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.
- B. Comply with reference standard of date of issue current on date of Contract Documents, except where a specific date is established by applicable code.
- C. Obtain copies of standards where required by product specification sections.
- D. Maintain copy at project site during submittals, planning, and progress of the specific work, until Substantial Completion.
- E. Should specified reference standards conflict with Contract Documents, request clarification from Architect before proceeding.
- F. Neither the contractual relationships, duties, or responsibilities of the parties in Contract nor those of Architect shall be altered from Contract Documents by mention or inference otherwise in any reference document.

1.09 TESTING AND INSPECTION AGENCIES AND SERVICES

- A. Owner will employ and pay for services of an independent testing agency to perform specified testing. Work not meeting requirements of the specifications shall be retested at the expense of the Contractor.
- B. Employment of agency in no way relieves Contractor of obligation to perform Work in accordance with requirements of Contract Documents.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 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.

3.02 MOCK-UPS

- A. Before installing portions of the Work where mock-ups are required, construct mock-ups in location and size indicated for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work. The purpose of

mock-up is to demonstrate the proposed range of aesthetic effects and workmanship.

- B. Accepted mock-ups establish the standard of quality the Architect will use to judge the Work.
- C. Integrated Exterior Mock-ups: Construct integrated exterior mock-up as indicated on drawings. Coordinate installation of exterior envelope materials and products as required in individual Specification Sections. Provide adequate supporting structure for mock-up materials as necessary.
- D. Notify Architect and Owner Consultant three working days in advance of dates and times when mock-ups will be constructed.
- E. Provide supervisory personnel who will oversee mock-up construction. Provide workers that will be employed during the construction at Project.
- F. Tests shall be performed under provisions identified in this section and identified in the respective product specification sections.
- G. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes.

3.03 TOLERANCES

- A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.
- B. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from Architect before proceeding.
- C. Adjust products to appropriate dimensions; position before securing products in place.

3.04 TESTING AND INSPECTION

- A. See individual specification sections for testing and inspection required.
- B. 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.
- C. 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.
- D. 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.
- E. Re-testing required because of non-compliance with specified requirements shall be performed by the same agency on instructions by Architect.
 - F. Re-testing required because of non-compliance with specified requirements shall be paid for by Contractor.

3.05 DEFECT ASSESSMENT

- A. Replace Work or portions of the Work not complying with specified requirements.
- B. If, in the opinion of Owner, it is not practical to remove and replace the work, Owner will direct an appropriate remedy or adjust payment.

END OF SECTION

**SECTION 015000
TEMPORARY FACILITIES AND CONTROLS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Dewatering
- B. Temporary utilities.
- C. Temporary telecommunications services.
- D. Temporary sanitary facilities.
- E. Temporary Controls: Barriers, enclosures, and fencing.
- F. Security requirements.
- G. Vehicular access and parking.
- H. Waste removal facilities and services.
- I. Field offices.

1.02 DEWATERING

- A. Provide temporary means and methods for dewatering all temporary facilities and controls.
- B. Maintain temporary facilities in operable condition.

1.03 TEMPORARY UTILITIES

- A. City of Sioux Falls will provide the following:
 - 1. Electrical power and metering, consisting of connection to existing facilities and new power supply for tennis complex.
 - 2. Water supply, consisting of connection to existing facilities.
- B. Existing facilities may be used.
- C. New permanent facilities may be used.

1.04 TELECOMMUNICATIONS SERVICES

- A. Provide mobile phone with Email to Contractor's project manager and site superintendent.

1.05 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.

1.06 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 and to protect existing facilities and adjacent properties from damage from construction operations and demolition.
- B. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

1.07 FENCING

- A. Construction: Contractor's option.

1.08 SECURITY

- A. Provide security and facilities to protect Work, existing facilities, and Owner's operations from unauthorized entry, vandalism, or theft.

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. Designated existing on-site roads may be used for construction traffic.
- F. 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.

1.11 FIELD OFFICES - SEE SECTION 015213

- 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. Clean and repair damage caused by installation or use of temporary work.
- C. Restore existing facilities used during construction to original condition.
- D. Restore new permanent facilities used during construction to specified condition.

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. General product requirements.
- B. Transportation, handling, storage and protection.
- C. Product option requirements.
- D. Substitution limitations.
- E. Maintenance materials, including extra materials, spare parts, tools, and software.

1.02 RELATED REQUIREMENTS

- A. Section 012500 - Substitution Procedures: Substitutions made during procurement and/or construction phases.
- B. Section 014000 - Quality Requirements: Product quality monitoring.

1.03 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 EXISTING PRODUCTS

- A. Unforeseen historic items encountered remain the property of the Owner; notify Owner promptly upon discovery; protect, remove, handle, and store as directed by Owner.
- B. Existing materials and equipment indicated to be removed, but not to be re-used, relocated, reinstalled, delivered to the Owner, or otherwise indicated as to remain the property of the Owner, become the property of the Contractor; remove from site.
- C. Specific Products to be Reused: The reuse of certain materials and equipment already existing on the project site is required.

2.02 NEW PRODUCTS

- A. Provide new products unless specifically required or permitted by Contract Documents.
- B. See Section 014000 - Quality Requirements, for additional source quality control requirements.

2.03 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.

2.04 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 LIMITATIONS

- A. See Section 012500 - Substitution Procedures.

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. Provide protection of stored materials and products against theft, casualty, or deterioration.
- B. 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.
- C. Store and protect products in accordance with manufacturers' instructions.
- D. Store with seals and labels intact and legible.
- E. Store sensitive products in weathertight, climate-controlled enclosures in an environment favorable to product.
- F. For exterior storage of fabricated products, place on sloped supports above ground.
- G. Provide off-site storage and protection when site does not permit on-site storage or protection.
- H. Protect products from damage or deterioration due to construction operations, weather, precipitation, humidity, temperature, sunlight and ultraviolet light, dirt, dust, and other contaminants.
- I. Comply with manufacturer's warranty conditions, if any.
- J. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.
- K. Prevent contact with material that may cause corrosion, discoloration, or staining.
- L. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.
- M. 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.
- C. Pre-installation meetings.
- D. Cutting and patching.
- E. Surveying for laying out the work.
- F. Cleaning and protection.
- G. Starting of systems and equipment.
- H. Demonstration and instruction of Owner personnel.
- I. 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 REFERENCE STANDARDS

- A. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations 2022.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Cutting and Patching: Submit written request in advance of cutting or alteration that affects:
 - 1. Structural integrity of any element of Project.
 - 2. Integrity of weather exposed or moisture resistant element.
 - 3. Efficiency, maintenance, or safety of any operational element.
 - 4. Visual qualities of sight exposed elements.
 - 5. Work of Owner or separate Contractor.
- C. Project Record Documents: Accurately record actual locations of capped and active utilities.

1.05 QUALIFICATIONS

- A. For demolition work, employ a firm specializing in the type of work required.
 - 1. Minimum of three years of documented experience.

1.06 PROJECT CONDITIONS

- A. Do not subject park roads and parking lots to loaded trucks until after ground is thawed and has resumed strength to carry normal loads.
- B. Use of explosives is not permitted.
- C. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.
- D. Protect site from puddling or running water. Provide water barriers as required to protect site from soil erosion.
- E. Perform dewatering activities, as required, for the duration of the project.
- F. Dust Control: Execute work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere and over adjacent property.

- G. Erosion and Sediment Control: Plan and execute work by methods to control surface drainage from cuts and fills, from borrow and waste disposal areas. Prevent erosion and sedimentation.
 - 1. Minimize amount of bare soil exposed at one time.
 - 2. Provide temporary measures such as berms, dikes, and drains, to prevent water flow.
 - 3. Periodically inspect earthwork to detect evidence of erosion and sedimentation; promptly apply corrective measures.
- H. Noise Control: Provide methods, means, and facilities to minimize noise produced by construction operations.
 - 1. Outdoors: Limit conduct of especially noisy exterior work to the hours of 8 am to 5 pm.
- I. Pollution Control: Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations. Comply with federal, state, and local regulations.

1.07 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 indicated 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 LAYING OUT THE WORK

- A. Owner will provide construction staking.
- B. Protect survey control points prior to starting site work; preserve permanent reference points during construction.
- C. The Contractor is responsible for payment for restaking due to loss or destruction of any reference point.
- D. Maintain a complete and accurate log of control and survey work as it progresses.

3.05 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.

3.06 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 indicated.
 - 2. Report discrepancies to Architect before disturbing existing installation.
 - 3. Beginning of alterations work constitutes acceptance of existing conditions.
- B. 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.
- C. Services (Including but not limited to 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 ; 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.
- 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.
- E. Adapt existing work to fit new work: Make as neat and smooth transition as possible.
1. Where a change of plane of 1/4 inch or more occurs in existing work, submit recommendation for providing a smooth transition for Architect review and request instructions.
- F. 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.
- G. Clean existing systems and equipment.
- H. Remove demolition debris and abandoned items from alterations areas and dispose of off-site; do not burn or bury.
- I. Do not begin new construction in alterations areas before demolition is complete.
- J. Comply with all other applicable requirements of this section.

3.07 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-complying 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. Employ original installer to perform cutting for weather exposed and moisture resistant elements, and sight exposed surfaces.
- F. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.
- G. Restore work with new products in accordance with requirements of Contract Documents.
- H. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
- I. 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.

3.08 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.

3.09 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. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.
- E. 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.
- F. Remove protective coverings when no longer needed; reuse or recycle coverings if possible.

3.10 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.

3.11 DEMONSTRATION AND INSTRUCTION

- A. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at scheduled time, at equipment location.
- B. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.
- C. Provide a qualified person who is knowledgeable about the Project to perform demonstration and instruction of Owner's personnel.

3.12 ADJUSTING

- A. Adjust operating products and equipment to ensure smooth and unhindered operation.

3.13 FINAL CLEANING

- A. Execute final cleaning prior to Substantial Completion.
- B. Use cleaning materials that are nonhazardous.
- 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 debris from roofs, area drains, and drainage systems.
- E. Clean site; sweep paved areas, rake clean landscaped surfaces.
- F. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.

3.14 CLOSEOUT PROCEDURES

- A. Make submittals that are required by governing or other authorities.
 - 1. Provide copies to Architect and Owner.
- B. Notify Architect when work is considered ready for Architect's Substantial Completion inspection.
- C. 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.
- D. 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.
- E. Correct items of work listed in Final Correction Punch List and comply with requirements for access to Owner-occupied areas.
- F. Notify Architect when work is considered finally complete and ready for Architect's Substantial Completion final inspection.
- G. Complete items of work determined by Architect listed in executed Certificate of Substantial Completion.

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 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.

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.
 - 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 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; ¼-inch per 10-foot, but not more than 1-inch total. For exposed corner columns, control joint grooves, and other conspicuous lines, ¼-inch in any bay or 20 feet maximum; ½-inch maximum in 40 feet or more.
 - 2. Variation from level or grade in slab soffits, ceilings, beam soffits, and in arises ¼-inch in 10 feet, 3/8-inch in any bay or 20 feet maximum and ¾-inch in 40 feet or more. For exposed lintels, sills, parapets, horizontal grooves, and other conspicuous lines, ¼ inch in any bay or 20 feet maximum, and ½-inch in 40 feet or more.

3. Variation from position of the linear building lines and related columns, walls, and partitions, ½-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, ¼-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.

PART 4 MEASUREMENT AND PAYMENT

4.01 METHOD OF MEASUREMENT & BASIS OF PAYMENT

A. Concrete formwork will not be measured for direct payment and will be considered subsidiary work pertaining to the contract.

4.02 BASIS OF PAYMENT

A. No direct compensation will be made for this work. Payment will be included in the contract bid prices as shown on the Bid Form.

* * * 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 ± 5 ASTM D1706

Ultimate Elongation, unaged 350% ASTM D412

- B. All waterstop shall be No 6380 as manufactured by W.R. Meadows, Servicised/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 Agriculture & 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°F ±3° (25° C ±2°) and 45% to 55% R.H.]	10-25 0°F (-18° C)	ASTM D2240
Tensile Stress: [at 150% elongation, 7 day (Die C) cure at 77° F ±3° (25° C ±2°) and 45-55% R.H.]	45-psi (310 kPa) max.	ASTM D412
Elongation: [7 day cure at 77° F ±3° □ (25° C (Die C) ±2°) & 45-55 R.H.]	1000% min.	ASTM D412

TEST	LIMIT	TEST METHOD
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° F ±3° (25° C ±2°)]	No adhesive or cohesive failure, * all 3 specimens must exceed 500% extension at 0° F (-18° C)	
Bond to Concrete Mortar Concrete briquettes [air cured 7 days at 77°F ±3° □ (25° C ±2°)]	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 ±5°. 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 ± 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 $\frac{3}{8}$ inch (10 mm) nor more than $\frac{5}{8}$ 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.

PART 4 MEASUREMENT AND PAYMENT

4.01 METHOD OF MEASUREMENT

- A. The joints and waterstops will not be measured for direct payment and will be considered subsidiary work pertaining to the contract.

4.02 BASIS OF PAYMENT

- A. No direct compensation will be made for this work. Payment will be included in the contract bid prices as shown on the Bid Form.

* * * 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 (SITE)

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 Na₂O 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 CONCRET E	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%
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 ½-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.

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 $\frac{1}{8}$ -inch in 10 feet.
- B. Areas where the maximum deviation exceeds the permissible deviation by not more than $\frac{3}{8}$ 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 $\frac{3}{8}$ 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. If the Engineer accepts the deficient area without correction, a price reduction at the following rates will be deducted from the contract.
1. Ten dollars per square yard for those areas where the maximum deviation exceeds the permissible deviation by not more than 1/8 inch.
 2. Twenty dollars per square yard for those areas where the maximum deviation exceeds the permissible deviation by more than 1/8 inch but not more than 3/8 inch.
 3. Thirty dollars per square yard for those areas where the maximum deviation exceeds the permissible deviation by more than 3/8 inch.
- F. 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 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: ¾-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.

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.

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.
 - b. Euclid Chemical Company; ULTRASIL LI+: www.euclidchemical.com/#sle.
 - c. PROSOCO, Inc; Consolideck LS: www.prosoco.com/consolideck/#sle.
 - d. Surface Koatings, Inc; Aqualon L-100: www.surfkoat.com/#sle.
 - e. Basis of Design: SpecChem, LLC; LithSeal SC.
 - f. Substitutions: See Section 016000 - Product Requirements.

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. Mortar and Grout.
- C. Reinforcement and Anchorage.
- D. Accessories.

1.02 RELATED REQUIREMENTS

- A. Section 032000 - Concrete Reinforcing: Reinforcing steel for grouted masonry.
- B. Section 061000 - Rough Carpentry: Nailing strips built into masonry.
- C. Section 079200 - Joint Sealants: Sealing control and expansion joints.
- D. Section 079005 - Joint Sealers: Backing rod and sealant at control and expansion joints.

1.03 REFERENCE STANDARDS

- A. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures 2016.
- B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2019.
- C. ASTM A82/A82M - Standard Specification for Steel Wire, Plain, for Concrete Reinforcement; 2007.
- D. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2016a.
- E. ASTM A641/A641M - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire 2019.
- F. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete 2018a.
- G. ASTM C90 - Standard Specification for Loadbearing Concrete Masonry Units 2021.
- H. ASTM C129 - Standard Specification for Nonloadbearing Concrete Masonry Units 2017.
- I. ASTM C140/C140M - Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units 2022a.
- J. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar 2018.
- K. ASTM C150/C150M - Standard Specification for Portland Cement 2021.
- L. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes 2018.
- M. ASTM C270 - Standard Specification for Mortar for Unit Masonry 2019a, with Editorial Revision.
- N. ASTM C404 - Standard Specification for Aggregates for Masonry Grout 2018.
- O. ASTM C476 - Standard Specification for Grout for Masonry 2020.
- P. ASTM C780 - Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry 2020.
- Q. ASTM D226/D226M - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing 2017.
- R. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures 2016.

1.04 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. Manufacturer's Certificate: Certify that masonry units meet or exceed specified requirements.

- D. Manufacturer's Certificate: Certify that water repellent admixture manufacturer has certified masonry unit manufacturer as an approved user of water repellent admixture in the manufacture of concrete block.
- E. Test Reports: Concrete masonry manufacturer's test reports for units with integral water repellent admixture.
- F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 1. See Section 016000 - Product Requirements, for additional provisions.

1.05 QUALITY ASSURANCE

- A. Comply with provisions of TMS 402/602, except where exceeded by requirements of the contract documents.

1.06 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 depth of 8 inches.
 2. Load-Bearing Units: ASTM C90, normal weight.
 - a. Hollow block, as indicated.
 - b. Exposed Faces: Manufacturer's standard color and texture where indicated.
 - c. Exposed Faces: Special color and texture where indicated, as follows: Burnished faces- Amcon 8610 Sandstone.
 3. Non-Loadbearing Units: ASTM C129.
 - a. Hollow block.
 4. Units with Factory Embedded Steel Plates: Standard size ASTM C90 block; with factory embedded and prime painted, 7 gage, 0.1793 inch thick, commercial quality, hot rolled steel plates complying with ASTM A36/A36M.

2.02 MORTAR AND GROUT MATERIALS

- A. Portland Cement: ASTM C150/C150M, Type I; color as required to produce approved color sample.
- B. Hydrated Lime: ASTM C207, Type S.
- C. Mortar Aggregate: ASTM C144.
- D. Grout Aggregate: ASTM C404.

2.03 REINFORCEMENT AND ANCHORAGE

- A. Manufacturers:
 1. Blok-Lok Limited: www.blok-lok.com.
 2. Hohmann & Barnard, Inc; 2-Seal Tie: www.h-b.com/#sle.
 3. WIRE-BOND: www.wirebond.com/#sle.
- B. Reinforcing Steel: Type specified in Section 032000; size as indicated on drawings; galvanized finish.
- 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. Multiple Wythe Joint Reinforcement: Truss type; fabricated with moisture drip; ASTM A1064/A1064M steel wire, hot dip galvanized after fabrication to ASTM A153/153M, Class B;

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.

- F. Adjustable Multiple Wythe Joint Reinforcement: Truss type with adjustable ties or tabs spaced at 16 in on center and fabricated with moisture drip; ASTM A1064/A1064M steel wire, hot dip galvanized after fabrication to ASTM A153/153M, Class B; 0.1875 inch side rods with 0.1483 inch cross rods and adjustable components of 0.1875 inch wire; width of components as required to provide not more than 1 inch and not less than 1/2 inch of mortar coverage from each masonry face.
 - 1. Vertical adjustment: Not less than 2 inches.
 - 2. Seismic Feature: Provide lip, hook, or clip on extended leg of wall ties to engage or enclose not less than one continuous horizontal joint reinforcement wire of 0.1483 inch diameter.
 - 3. Insulation Clips: Provide clips at tabs or ties designed to secure insulation against outer face of inner wythe of masonry.
- G. Strap Anchors: Bent steel shapes configured as required for specific situations, 1-1/4 in width, 0.105 in thick, lengths as required to provide not more than 1 inch and not less than 1/2 inch of mortar coverage from masonry face, corrugated for embedment in masonry joint, hot dip galvanized to ASTM A 153/A 153M Class B.
- H. Flexible Anchors: 2-piece anchors that permit differential movement between masonry and building frame, sized to provide not more than 1 inch and not less than 1/2 inch of mortar coverage from masonry face.
 - 1. Concrete frame: Dovetail anchors of bent steel strap, nominal 1 inch width x 0.024 in thick, with trapezoidal wire ties 0.1875 inch thick, hot dip galvanized to ASTM A 153/A 153M, Class B.
 - 2. Steel frame: Crimped wire anchors for welding to frame, 0.25 inch thick, with trapezoidal wire ties 0.1875 inch thick, hot dip galvanized to ASTM A 153/A 153M, Class B.
- I. Wall Ties: Corrugated formed sheet metal, 7/8 inch wide by 0.05 inch thick, hot dip galvanized to ASTM A 153/A 153M Class B, sized to provide not more than 1 inch and not less than 1/2 inch of mortar coverage from masonry face.
- J. Two-Piece Wall Ties: Formed steel wire, 0.1875 inch thick, adjustable, eye and pintle type, hot dip galvanized to ASTM A 153/A 153M Class B, sized to provide not more than 1 inch and not less than 1/2 inch of mortar coverage from masonry face and to allow vertical adjustment of up to 1-1/4 in.
- K. 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.
 - 4. Seismic Feature: Provide lip, hook, or clip on end of wire ties to engage or enclose not less than one continuous horizontal joint reinforcement wire of 0.1483 inch diameter.
- L. Metal-to-Metal Fasteners: Self-drilling, self-tapping screws; corrosion resistant finish or hot dip galvanized to ASTM A153/A153M.
 - 1. Manufacturers:
 - a. ITW Commercial Construction North America; Teks Select Series; [_____]: www.ITWBuildex.com/#sle.
 - b. Substitutions: See Section 016000 - Product Requirements.

2.04 ACCESSORIES

- A. Preformed Control Joints: Rubber material. Provide with corner and tee accessories, fused joints.
 - 1. Manufacturers:
 - a. Blok-Lok Limited: www.blok-lok.com.

- b. Hohmann & Barnard, Inc: www.h-b.com.
 - c. WIRE-BOND: www.wirebond.com/#sle.
- B. Joint Filler: Closed cell polyvinyl chloride; oversized 50 percent to joint width; self expanding; 1 inch wide x by maximum lengths available.
 - 1. Manufacturers:
 - a. Hohmann & Barnard, Inc: www.h-b.com.
 - b. WIRE-BOND: www.wirebond.com/#sle.
- C. Building Paper: ASTM D226/D226M, Type I ("No.15") asphalt felt.
- D. Nailing Strips: Softwood lumber, preservative treated; as specified in Section 061000.
- E. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.

2.05 MORTAR AND GROUT MIXES

- A. Mortar for Unit Masonry: ASTM C270, using the Proportion Specification.
- 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.

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. Comply with requirements of TMS 402/602 or applicable building code, whichever is more stringent.

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.

3.05 PLACING AND BONDING

- A. Lay solid masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.
- B. Lay hollow masonry units with face shell bedding on head and bed joints.
- C. Buttering corners of joints or excessive furrowing of mortar joints is not permitted.
- D. Remove excess mortar and mortar smears as work progresses.
- E. Remove excess mortar with water repellent admixture promptly. Do not use acids, sandblasting or high pressure cleaning methods.
- F. Interlock intersections and external corners, except for units laid in stack bond.
- G. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.

- H. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.
- I. Cut mortar joints flush where wall tile is scheduled or resilient base is scheduled.
- J. Isolate masonry partitions from vertical structural framing members with a control joint as indicated.
- K. Isolate top joint of masonry partitions from horizontal structural framing members and slabs or decks with compressible joint filler.
- L. Lay clay tile flue linings vertically, embedded in concrete block units.
- M. Place precast chimney cap atop chimney masonry; mortar into place; seal to protruding flue.

3.06 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.
- E. Reinforce stack bonded unit joint corners and intersections with strap anchors 16 inches on center.
- F. Fasten anchors to structural framing and embed in masonry joints as masonry is laid. Unless otherwise indicated on drawings or closer spacing is indicated under specific wall type, space anchors at maximum of 36 inches horizontally and 24 inches vertically.

3.07 REINFORCEMENT AND ANCHORAGE - SINGLE WYTHE MASONRY

- A. Install horizontal joint reinforcement 8 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.
- E. Reinforce stack bonded unit joint corners and intersections with strap anchors 16 inches on center.

3.08 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. Lap joint reinforcement ends minimum 6 inches.
- E. Masonry Back-Up: Embed anchors to bond veneer at maximum 16 inches on center vertically and 36 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.
- F. 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.
- G. Seismic Reinforcement: Connect veneer anchors with continuous horizontal wire reinforcement before embedding anchors in mortar.
- H. Reinforce stack bonded unit joint corners and intersections with strap anchors 16 inches on center.

3.09 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.

3.10 GROUTED COMPONENTS

- A. Lap splices minimum 24 bar diameters.
- B. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch of dimensioned position.
- C. Place and consolidate grout fill without displacing reinforcing.

3.11 CONTROL AND EXPANSION JOINTS

- A. Do not continue horizontal joint reinforcement through control or expansion joints.
- B. Form control joint with a sheet building paper bond breaker fitted to one side of the hollow contour end of the block unit. Fill the resultant core with grout fill. Rake joint at exposed unit faces for placement of backer rod and sealant.
- C. Size control joints as indicated on drawings; if not shown, 3/4 inch wide and deep.
- D. Form expansion joint as detailed on drawings.

3.12 TOLERANCES

- A. Maximum Variation from Alignment of Columns: 1/4 inch.
- B. Maximum Variation From Unit to Adjacent Unit: 1/16 inch.
- C. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft and 1/2 inch in 20 ft or more.
- D. Maximum Variation from Plumb: 1/4 inch per story non-cumulative; 1/2 inch in two stories or more.
- E. Maximum Variation from Level Coursing: 1/8 inch in 3 ft and 1/4 inch in 10 ft; 1/2 inch in 30 ft.
- F. Maximum Variation of Mortar Joint Thickness: Head joint, minus 1/4 inch, plus 3/8 inch.
- G. Maximum Variation from Cross Sectional Thickness of Walls: 1/4 inch.

3.13 CUTTING AND FITTING

- A. Cut and fit for chases. Coordinate with other sections of work to provide correct size, shape, and location.
- B. Obtain approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

3.14 FIELD QUALITY CONTROL

- A. An independent testing agency will perform field quality control tests, as specified in Section 014000 - Quality Requirements.
- B. Concrete Masonry Unit Tests: Test each variety of concrete unit masonry in accordance with ASTM C140/C140M for conformance to requirements of this specification.
- C. Mortar Tests: Test each type of mortar in accordance with ASTM C780, testing with same frequency as masonry samples.

3.15 CLEANING

- A. Remove excess mortar and mortar droppings.
- B. Replace defective mortar. Match adjacent work.
- C. Clean soiled surfaces with cleaning solution.
- D. Use non-metallic tools in cleaning operations.

3.16 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 047200
CAST STONE MASONRY**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Architectural cast stone.

1.02 RELATED REQUIREMENTS

- A. Section 042000 - Unit Masonry: Installation of cast stone in conjunction with masonry.
- B. Section 079200 - Joint Sealants: Sealing joints indicated to be left open for sealant.

1.03 REFERENCE STANDARDS

- A. ACI 318 - Building Code Requirements for Structural Concrete 2019, with Errata (2021).
- B. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement 2020.
- C. ASTM A767/A767M - Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement 2019.
- D. ASTM A884/A884M - Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Reinforcement 2019, with Editorial Revision (2020).
- E. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete 2018a.
- F. ASTM C33/C33M - Standard Specification for Concrete Aggregates 2018.
- G. ASTM C150/C150M - Standard Specification for Portland Cement 2021.
- H. ASTM C270 - Standard Specification for Mortar for Unit Masonry 2019a, with Editorial Revision.
- I. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete 2019.
- J. ASTM C1364 - Standard Specification for Architectural Cast Stone 2019.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Test results of cast stone components made previously by the manufacturer.
- C. Shop Drawings: Include elevations, dimensions, layouts, profiles, cross sections, reinforcement, exposed faces, arrangement of joints, anchoring methods, anchors, and piece numbers.
- D. Verification Samples: Pieces of actual cast stone components not less than 6 inches square, illustrating range of color and texture to be anticipated in components furnished for the project.
- E. Full-Size Samples, For Review:
 - 1. Basic Shapes: One of each.
- F. Manufacturer's Qualification Data: Documentation showing compliance with specified requirements.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications:
 - 1. A firm with a minimum of 5 years experience producing cast stone of types required for project.
 - 2. Adequate plant capacity to furnish quality, sizes, and quantity of cast stone required without delaying progress of the work.
- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver cast stone components secured to shipping pallets and protected from damage and discoloration. Protect corners from damage.

- B. Number each piece individually to match shop drawings and schedule.
- C. Store cast stone components and installation materials in accordance with manufacturer's instructions.
- D. Store cast stone components on pallets with nonstaining, waterproof covers. Ventilate under covers to prevent condensation. Prevent contact with dirt.
- E. Protect cast stone components during handling and installation to prevent chipping, cracking, or other damage.
- F. Store mortar materials where contamination can be avoided.
- G. Schedule and coordinate production and delivery of cast stone components with unit masonry work to optimize on-site inventory and to avoid delaying the work.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Architectural Cast Stone:
 1. Premier Stoneworks, LLC: www.premier-stoneworks.com/#sle.
 2. Stone Legends: www.stonelegends.com.
 3. Substitutions: See Section 016000 - Product Requirements.

2.02 ARCHITECTURAL CAST STONE

- A. Cast Stone: Architectural concrete product manufactured to simulate appearance of natural limestone, complying with ASTM C1364.
 1. Compressive Strength: As specified in ASTM C1364; calculate strength of pieces to be field cut at 80 percent of uncut piece.
 2. Freeze-Thaw Resistance: Demonstrated by laboratory testing in accordance with ASTM C1364.
 3. Surface Texture: Fine grained texture, with no bugholes, air voids, or other surface blemishes visible from distance of 20 feet.
 4. Color: Selected by Architect from manufacturer's full range.
 5. Remove cement film from exposed surfaces before packaging for shipment.
- B. Shapes: Provide shapes indicated on drawings.
 1. Variation from Any Dimension, Including Bow, Camber, and Twist: Maximum of plus/minus 1/8 inch or length divided by 360, whichever is greater, but not more than 1/4 inch.
 2. Unless otherwise indicated on drawings, provide:
 - a. Wash or slope of 1:12 on exterior horizontal surfaces.
 - b. Drips on projecting components, wherever possible.
 - c. Raised fillets at back of sills and at ends to be built in.
- C. Reinforcement: Provide reinforcement as required to withstand handling and structural stresses; comply with ACI 318.
 1. Pieces More than 24 inches in Any Dimension: Provide full length two-way reinforcement of cross-sectional area not less than 0.25 percent of unit cross-sectional area.

2.03 MATERIALS

- A. Portland Cement: ASTM C150/C150M.
 1. For Mortar: Type I or II, except Type III may be used in cold weather.
- B. Coarse Aggregate: ASTM C33/C33M, except for gradation; granite, quartz, or limestone.
- C. Fine Aggregate: ASTM C33/C33M, except for gradation; natural or manufactured sands.
- D. Admixtures: ASTM C494/C494M.
- E. Water: Potable.
- F. Reinforcing Bars: ASTM A615/A615M, Grade 40 (40,000 psi), deformed bars, galvanized.
 1. Galvanized in accordance with ASTM A767/A767M, Class I.

- G. Steel Welded Wire Reinforcement: ASTM A1064/A1064M, galvanized or ASTM A884/A884M, epoxy coated.
- H. Embedded Anchors, Dowels, and Inserts: Type 304 stainless steel, of type and size as required for conditions.
- I. Mortar: Portland cement-lime, as specified in Section 040511 ; do not use masonry cement.
- J. Cleaner: General-purpose cleaner designed for removing mortar and grout stains, efflorescence, and other construction stains from new masonry surfaces without discoloring or damaging masonry surfaces; approved for intended use by cast stone manufacturer and by cleaner manufacturer for use on cast stone and adjacent masonry materials.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine construction to receive cast stone components. Notify Architect if construction is not acceptable.
- B. Do not begin installation until unacceptable conditions have been corrected.

3.02 INSTALLATION

- A. Install cast stone components in conjunction with masonry, complying with requirements of Section 042000.
- B. Mechanically anchor cast stone units indicated; set remainder in mortar.
- C. Setting:
 - 1. Drench cast stone components with clear, running water immediately before installation.
 - 2. Set units in a full bed of mortar unless otherwise indicated.
 - 3. Fill vertical joints with mortar.
 - 4. Fill dowel holes and anchor slots completely with mortar or non-shrink grout.

3.03 TOLERANCES

- A. Joints: Make all joints 3/8 inch, except as otherwise detailed.
 - 1. Rake mortar joints 3/4 inch for pointing.
 - 2. Remove excess mortar from face of stone before pointing joints.
 - 3. Point joints with mortar in layers 3/8 inch thick and tool to a slight concave profile.
 - 4. Leave the following joints open for sealant:
 - a. Head joints in top courses, including copings, parapets, cornices, sills, and steps.
 - b. Joints in projecting units.
 - c. Joints between rigidly anchored units, including soffits, panels, and column covers.
 - d. Joints below lugged sills and stair treads.
 - e. Joints below ledge and relieving angles.
 - f. Joints labeled "expansion joint".
- B. Installation Tolerances:
 - 1. Variation from Plumb: Not more than 1/8 inch in 10 feet or 1/4 inch in 20 feet or more.
 - 2. Variation from Level: Not more than 1/8 inch in 10 feet or 1/4 inch in 20 feet, or 3/8 inch maximum.
 - 3. Variation in Joint Width: Not more than 1/8 inch in 36 inches or 1/4 of nominal joint width, whichever is less.
 - 4. Variation in Plane Between Adjacent Surfaces (Lipping): Not more than 1/16 inch difference between planes of adjacent units or adjacent surfaces indicated to be flush with units.

3.04 REPAIR

- A. Repair chips and other surface damage noticeable when viewed in direct daylight at 10 feet.
- B. Repair with matching touch-up material provided by the manufacturer and in accordance with manufacturer's instructions.
- C. Repair methods and results subject to Architect 's approval.

3.05 CLEANING

- A. Keep cast stone components clean as work progresses.

3.06 PROTECTION

- A. Protect completed work from damage.
- B. Clean, repair, or restore damaged or mortar-splashed work to condition of new work.

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. Structural Bolts and Nuts: Carbon steel, ASTM A307, Grade A galvanized to ASTM A 153/A 153M, Class C.
- E. Welding Materials: AWS D1.1; type required for materials being welded.
- F. 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.
- G. Shop and Touch-Up Primer: Fabricator's standard, complying with VOC limitations of authorities having jurisdiction.

2.02 FABRICATION

- A. Shop fabricate to greatest extent possible.
- B. Continuously seal joined members by continuous welds. Grind exposed welds smooth.
- C. 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 061000
ROUGH CARPENTRY**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Structural dimension lumber framing.
- B. Non-structural dimension lumber framing.
- C. Sheathing.
- D. Roofing nailers.
- E. Preservative treated wood materials.
- F. Miscellaneous framing and sheathing.
- G. Miscellaneous wood nailers, furring, and grounds.

1.02 RELATED REQUIREMENTS

- A. Section 061323 - Heavy Timber Framing.
- B. Section 072500 - Weather Barriers: Water-resistive barrier over sheathing.

1.03 REFERENCE STANDARDS

- A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2016a.
- B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2020.
- C. AWPA U1 - Use Category System: User Specification for Treated Wood 2021.
- D. PS 2 - Performance Standard for Wood Structural Panels 2018.
- E. PS 20 - American Softwood Lumber Standard 2021.
- F. WCLIB (GR) - Standard Grading Rules for West Coast Lumber No. 17 2018.

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. Structural Composite Lumber: Submit manufacturer's published structural data including span tables, marked to indicate which sizes and grades are being used; if structural composite lumber is being substituted for dimension lumber or timbers, submit grading agency structural tables marked for comparison.
- D. Samples: For rough carpentry members that will be exposed to view, submit two samples, [_____]by____ inch in size illustrating wood grain, color, and general appearance.
- E. Manufacturer's Certificate: Certify that wood products supplied for rough carpentry meet or exceed specified requirements.
- F. 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.

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 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) 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 EXPOSED DIMENSION LUMBER

- A. Grading Agency: West Coast Lumber Inspection Bureau; WCLIB (GR).
- B. Sizes: Nominal sizes as indicated on drawings.
- C. Surfacing: S4S.
- D. Moisture Content: S-dry or MC19.
- E. Stud Framing (2 by 2 through 2 by 6):
 - 1. Species: Douglas Fir.
 - 2. Grade: Clear.
- F. Joist, Rafter, and Small Beam Framing (2 by 6 through 4 by 16):
 - 1. Species: Douglas Fir.
 - 2. Grade: Select.

2.03 CONSTRUCTION PANELS

- A. Roof Sheathing: Oriented strand board wood structural panel; PS 2.
 - 1. Grade: Sheathing.
 - 2. Bond Classification: Exposure 1.
 - 3. Performance Category: 5/8 PERF CAT.
 - 4. Span Rating: 40/20.
 - 5. Edges: Square.
 - 6. Exposure Time: Sheathing will not delaminate or require sanding due to moisture absorption from exposure to weather for up to 500 days.
 - 7. Provide fastening guide on top panel surface with separate markings indicating fastener spacing for 16 inches and 24 inches on center, respectively.
 - 8. Warranty: Manufacturer's standard lifetime limited warranty against manufacturing defects and that panels will not delaminate or require sanding due to moisture absorption damage from exposure to weather for up to the stated period.
- B. Wall Sheathing: Any PS 2 type.
 - 1. Bond Classification: Exposure 1.
 - 2. Grade: Sheathing.
 - 3. Span Rating: 24/16.
 - 4. Performance Category: 7/16 PERF CAT.
 - 5. Edge Profile: Square edge.

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. Joist Hangers: Hot dipped galvanized steel, sized to suit framing conditions.
 - 1. For contact with preservative treated wood in exposed locations, provide minimum G185 galvanizing complying with ASTM A653/A653M.

- C. 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.
 - b. Koppers Performance Chemicals, Inc; []: www.koppersperformancechemicals.com/#sle.
 - c. Viance, LLC: www.treatedwood.com.
 - d. Osmose, Inc: 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 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. Install sill gasket under sill plate of framed walls bearing on foundations; puncture gasket cleanly to fit tightly around protruding anchor bolts.
- C. 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. Roof Sheathing: Secure panels with long dimension perpendicular to framing members, with ends staggered and over firm bearing.
 - 1. At long edges use sheathing clips where joints occur between roof framing members.
 - 2. At long edges provide solid edge blocking where joints occur between roof framing members.
 - 3. Nail panels to framing; staples are not permitted.
- B. Wall Sheathing: Secure with long dimension perpendicular to wall studs, with ends over firm bearing and staggered, using nails, screws, or staples.

3.06 TOLERANCES

- A. Framing Members: 1/4 inch from true position, maximum.
- B. Variation from Plane (Other than Floors): 1/4 inch in 10 feet maximum, and 1/4 inch in 30 feet maximum.

3.07 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 061753
SHOP-FABRICATED WOOD TRUSSES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Shop fabricated wood trusses for roof framing.
- B. Bridging, bracing, and anchorage.

1.02 RELATED REQUIREMENTS

- A. Section 061000 - Rough Carpentry: Installation requirements for miscellaneous framing.
- B. Section 061000 - Rough Carpentry: Material requirements for blocking, bridging, plates, and miscellaneous framing.

1.03 REFERENCE STANDARDS

- A. ANSI/TPI 1 - National Design Standard for Metal-Plate-Connected Wood Truss Construction 2014.
- B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2020.
- C. TPI BCSI 1 - Building Component Safety Information Booklet: The Guide to Good Practice for Handling, Installing & Bracing of Metal Plate Connected Wood Trusses 2018.
- D. TPI DSB-89 - Recommended Design Specification for Temporary Bracing of Metal Plate Connected Wood Trusses 1989.
- E. WWPA G-5 - Western Lumber Grading Rules 2021.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's data sheets on plate connectors, bearing plates, and metal bracing components.
- C. Shop Drawings: Show truss configurations, sizes, spacing, size and type of plate connectors, cambers, framed openings, bearing and anchor details, and bridging and bracing.
 - 1. Provide shop drawings stamped or sealed by design engineer.
 - 2. Submit design calculations.
- D. Designer's Qualification Statement.
- E. Fabricator's Qualification Statement.

1.05 QUALITY ASSURANCE

- A. Designer Qualifications: Perform design by or under direct supervision of a Professional [] Engineer experienced in design of this Work and licensed in the State in which the Project is located.
- B. Fabricator Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Handle and erect trusses in accordance with TPI BCSI 1.
- B. Store trusses in vertical position resting on bearing ends.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Truss Plate Connectors:
 - 1. Alpine, an ITW Company: www.alpineitw.com/#sle.
 - 2. MiTek Industries, Inc: www.mii.com/#sle.
 - 3. Substitutions: See Section 016000 - Product Requirements.

2.02 TRUSSES

- A. Wood Trusses: Designed and fabricated in accordance with ANSI/TPI 1 and TPI DSB-89 to achieve structural requirements indicated.
 - 1. Species and Grade: Douglas Fir, WWPA G-5 Grade [_____].
 - 2. Connectors: Steel plate.
 - 3. Structural Design: Comply with applicable code for structural loading criteria.
 - 4. Roof Deflection: 1/240, maximum total load.

2.03 MATERIALS

- A. Lumber:
 - 1. Moisture Content: Between 7 and 9 percent.
 - 2. Lumber fabricated from old growth timber is not permitted.
- B. Steel Connectors: Hot-dipped galvanized steel sheet, ASTM A653/A653M Structural Steel (SS) Grade 33/230, with G90/Z275 coating; die stamped with integral teeth; thickness as indicated.
- C. Truss Bridging: Type, size and spacing recommended by truss manufacturer.

2.04 ACCESSORIES

- A. Wood Blocking, Bridging, Plates, and Miscellaneous Framing: As specified in Section 061000.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that supports and openings are ready to receive trusses.

3.02 PREPARATION

- A. Coordinate placement of bearing items.

3.03 ERECTION

- A. Install trusses in accordance with manufacturer's instructions and TPI DSB-89 and TPI BCSI 1; maintain a copy of each TPI document on site until installation is complete.
- B. Set members level and plumb, in correct position.
- C. Make provisions for erection loads, and for sufficient temporary bracing to maintain structure plumb, and in true alignment until completion of erection and installation of permanent bracing.
- D. Do not field cut or alter structural members without approval of Architect.
- E. Install permanent bridging and bracing.
- F. Install headers and supports to frame openings required.
- G. Frame openings between trusses with lumber in accordance with Section 061000.

3.04 TOLERANCES

- A. Framing Members: 1/2 inch maximum, from true position.

END OF SECTION

**SECTION 068316
FIBERGLASS REINFORCED PANELING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fiberglass reinforced plastic panels.
- B. Trim.

1.02 REFERENCE STANDARDS

- A. ASTM D256 - Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics 2010 (Reapproved 2018).
- B. ASTM D2583 - Standard Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor 2013a.
- C. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber 2021.
- D. ASTM D5319 - Standard Specification for Glass-Fiber Reinforced Polyester Wall and Ceiling Panels 2017.
- E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2021a.
- F. FDA Food Code - Chapter 6 - Physical Facilities Current Edition.
- G. FM 4880 - Evaluating the Fire Performance of Insulated Building Panel Assemblies and Interior Finish Materials 2017.

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; including sizes, patterns and colors available; and installation instructions.
- C. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 016000 - Product Requirements, for additional provisions.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. 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.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Fiberglass Reinforced Plastic Panels:
 - 1. Marlite, Inc: www.marlite.com/#sle.
 - 2. Nudo Products, Inc: www.nudo.com/#sle.
 - 3. Panolam Industries International, Inc: www.panolam.com/#sle.
 - 4. Basis of Design Glasbord by Crane Composites
 - 5. Substitutions: See Section 01 6000 - Product Requirements.

2.02 PANEL SYSTEMS

- A. Wall Panels:
 - 1. Panel Size: 4 by 10 feet.
 - 2. Panel Thickness: 0.09 inch.
 - 3. Surface Design: Embossed.
 - 4. Color: Smooth White.
 - 5. Attachment Method: Adhesive only, sealant joints, no trim.

2.03 MATERIALS

- A. Panels: Fiberglass reinforced plastic (FRP), complying with ASTM D5319.

1. Surface Burning Characteristics: Maximum flame spread index of 25 and smoke developed index of 450; when system tested in accordance with ASTM E84.
 2. Class 1 fire rated when tested in accordance with FM 4880.
 3. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
 4. Scratch Resistance: Barcol hardness score greater than 35, when tested in accordance with ASTM D2583.
 5. Impact Strength: Greater than 6 ft lb force per inch, when tested in accordance with ASTM D256.
 6. Surface Characteristics and Cleanability: Provide products that are smooth, durable, and easily cleanable, in compliance with FDA Food Code, Chapter 6 - Physical Facilities.
- B. Trim: Vinyl; color coordinating with panel.
- C. Adhesive: Type recommended by panel manufacturer.
- D. Sealant: Type recommended by panel manufacturer; white.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions and substrate flatness before starting work.
- B. Verify that substrate conditions are ready to receive the work of this section.

3.02 INSTALLATION - WALLS

- A. Install panels in accordance with manufacturer's instructions.
- B. Cut and drill panels with carbide tipped saw blades, drill bits, or snips.
- C. Apply adhesive to the back side of the panel using trowel as recommended by adhesive manufacturer.
- D. Apply panels to wall with seams plumb and pattern aligned with adjoining panels.
- E. Install panels with manufacturer's recommended gap for panel field and corner joints.
- F. Place trim on panel before fastening edges, as required.
- G. Fill channels in trim with sealant before attaching to panel.
- H. Install trim with adhesive and screws or nails, as required.
- I. Seal gaps at floor, ceiling, and between panels with applicable sealant to prevent moisture intrusion.
- J. Remove excess sealant after paneling is installed and prior to curing.

END OF SECTION

**SECTION 072100
THERMAL INSULATION**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Board insulation at perimeter foundation wall and underside of floor slabs.
- B. Batt insulation for filling perimeter window and door shim spaces and crevices in exterior wall and roof.

1.02 RELATED REQUIREMENTS

- A. Section 033000 - Cast-in-Place Concrete: Field-applied termiticide for concrete slabs and foundations.
- B. Section 061000 - Rough Carpentry: Supporting construction for batt insulation.
- C. Section 072126 - Blown Insulation: Blown-in, gravity-held fibrous insulation.

1.03 REFERENCE STANDARDS

- A. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation 2019.
- B. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing 2017.
- C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2021a.
- D. ASTM E136 - Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750°C 2019a.
- E. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Wall Assemblies Containing Combustible Components 2019.

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.

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.
 - b. Owens Corning Corporation; FOAMULAR Extruded Polystyrene (XPS) Insulation: www.ocbuildingspec.com.
 - c. Substitutions: See Section 016000 - Product Requirements.

2.04 BATT INSULATION MATERIALS

- A. Where batt insulation is indicated, either glass fiber or mineral fiber batt insulation may be used, at Contractor's option.
- B. 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. Combustibility: Non-combustible, when tested in accordance with ASTM E136, except for facing, if any.
 4. Formaldehyde Content: Zero.
 5. Facing: Aluminum foil, flame spread 25 rated; one side.
 6. Manufacturers:
 - a. CertainTeed Corporation: www.certainteed.com/#sle.
 - b. Johns Manville: www.jm.com/#sle.
 - c. Owens Corning Corporation; EcoTouch PINK FIBERGLAS Insulation: www.ocbuildingspec.com/#sle.
 7. 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.
 1. Width: 4.9 feet.
- B. Tape joints of rigid insulation in accordance with roofing and insulation manufacturers' instructions.
- C. Nails or Staples: Steel wire; electroplated or galvanized; type and size to suit application.
- D. 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 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.

3.04 BATT INSTALLATION

- A. Install insulation and vapor retarder in accordance with manufacturer's instructions.
- B. Install in exterior wall and roof spaces without gaps or voids. Do not compress insulation.

- C. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.
- D. Fit insulation tightly in cavities and tightly to exterior side of mechanical and electrical services within the plane of the insulation.

3.05 PROTECTION

- A. Do not permit installed insulation to be damaged prior to its concealment.

END OF SECTION

**SECTION 072123
LOOSE-FILL INSULATION**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Loose-fill insulation in cells of concrete masonry unit (CMU) walls.

1.02 RELATED REQUIREMENTS

- A. Section 042000 - Unit Masonry: Masonry wall system to receive loose-fill insulation.

1.03 REFERENCE STANDARDS

- A. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- B. ASTM C516 - Standard Specification for Vermiculite Loose Fill Thermal Insulation 2019.
- C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2021a.

1.04 SYSTEM DESCRIPTION

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on product characteristics, performance criteria, and product limitations.
- C. Certificates: Certify that products of this section meet or exceed specified requirements.
- D. Manufacturer's Installation Instructions: Indicate procedures for preparation and installation.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with at least three years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Vermiculite Loose-Fill Insulation:
 - 1. Schundler Company: www.schundler.com/#sle.
 - 2. Supreme Perlite Company: www.perlite.com/#sle.
 - 3. Substitutions: See Section 016000 - Product Requirements.

2.02 MATERIALS

- A. Vermiculite Loose-Fill Insulation: ASTM C516, vermiculite type, water repellent, fire resistant; flame spread/smoke developed index of 0/0, when tested in accordance with ASTM E84.
- B. Thermal Resistance [R-value]: Provided minimum values in accordance with applicable edition of ASHRAE Std 90.1 I-P for envelope requirements of building location and climate zone.

2.03 APPLICATIONS

- A. Provide loose-fill insulation in the following application(s) as indicated on drawings:
 - 1. Unit masonry wall system, refer to Section 042000 for additional information.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrate and adjacent materials are dry and ready to receive insulation.
- B. Verify wall spaces are free of mortar blockage allowing for free flow of insulation.

3.02 PREPARATION

- A. Verify holes and openings have been sealed to prevent escape of insulation.

3.03 INSTALLATION

- A. Install loose-fill insulation in accordance with manufacturer's instructions.
- B. Deposit loose-fill insulation after masonry wall has sufficiently dried to manufacturer's suggested optimum moisture content prior to covering cores with bond beams or lintels.
- C. Deposit loose-fill insulation in lifts, and do not exceed 6 feet pouring height.

3.04 PROTECTION

- A. Place temporary signs warning workers in areas that contain loose-fill insulated walls to use caution and to prevent loss of insulation when cutting into walls.

END OF SECTION

**SECTION 072126
BLOWN INSULATION**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Ceiling and Attic: Blown insulation pneumatically placed into joist spaces through access holes.

1.02 REFERENCE STANDARDS

- A. ASTM C739 - Standard Specification for Cellulosic Fiber Loose-Fill Thermal Insulation 2021a.
- B. ASTM C1015 - Standard Practice for Installation of Cellulosic and Mineral Fiber Loose-Fill Thermal Insulation 2017.

1.03 SUBMITTALS

- A. Product Data: Provide data on product characteristics, performance criteria, and limitations.
- B. Certificates: Certify that products of this section meet or exceed specified requirements.
- C. Manufacturer's Installation Instructions: Indicate procedure for preparation and installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Blown Insulation:
 - 1. CertainTeed Corporation: www.certainteed.com/#sle.
 - 2. GreenFiber: www.greenfiber.com/#sle.
 - 3. Johns Manville: www.jm.com/#sle.
 - 4. Thermafiber, Inc: www.thermafiber.com/#sle.
 - 5. Substitutions: See Section 016000 - Product Requirements.

2.02 MATERIALS

- A. Applications: Provide blown insulation in attic and ceiling as indicated on drawings.
- B. Blown Insulation: ASTM C739, cellulosic fiber type, nodulated for pour and bulk for pneumatic placement.
 - 1. Thermal Transmittance (U-value): 0.27 BTU/hr sq ft deg F, maximum.

2.03 ACCESSORIES

- A. Roof Ventilation Baffles: Prefabricated ventilation channels for placement under roof sheathing with baffles to prevent wind-washing.
 - 1. Material: Polyvinyl chloride (PVC).
 - 2. Roof Joist/Truss Spacing: 16 inch on center, nominal.
 - 3. Manufacturers:
 - a. Brentwood Industries, Inc; AccuVent Original: www.brentwoodindustries.com/#sle.
 - b. Substitutions: See Section 016000 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrate and adjacent materials are dry and ready to receive insulation.
- B. Verify that light fixtures have thermal cut-out device to restrict over-heating in soffit or ceiling spaces.
- C. Verify spaces are unobstructed to allow for proper placement of insulation.

3.02 INSTALLATION

- A. Install insulation and ventilation baffle in accordance with ASTM C1015 and manufacturer's instructions.
- B. Place insulation pneumatically to completely fill joist and rafter spaces.
- C. Place insulation against baffles, and do not impede natural attic ventilation to soffit.

- D. Place against and behind mechanical and electrical services within the plane of insulation.
- E. Completely fill intended spaces leaving no gaps or voids.

3.03 CLEANING

- A. Remove loose insulation residue.

END OF SECTION

**SECTION 072500
WEATHER BARRIERS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Air Barriers: Materials that form a system to stop passage of air through exterior walls.

1.02 DEFINITIONS

- A. Air Barrier: Air tight barrier made of material that is relatively air impermeable but water vapor permeable, both to the degree specified, with sealed seams and with sealed joints to adjacent surfaces. Note: For the purposes of this specification, vapor impermeable air barriers are classified as vapor retarders.

1.03 REFERENCE STANDARDS

- A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2021a.
- B. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials 2021.
- C. ASTM E2178 - Standard Test Method for Determining Air Leakage Rate and Calculation of Air Permeance of Building Materials 2021a.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on material characteristics.
- C. Shop Drawings: Provide drawings of special joint conditions.
- D. Manufacturer's Installation Instructions: Indicate preparation.

1.05 FIELD CONDITIONS

- A. Maintain temperature and humidity recommended by the materials manufacturers before, during and after installation.
- B. Air Barrier:
 - 1. On outside surface of sheathing of exterior walls use air barrier sheet, mechanically fastened type.

1.06 AIR BARRIER MATERIALS (WATER VAPOR PERMEABLE AND WATER-RESISTIVE)

- A. Air Barrier Sheet, Mechanically Fastened:
 - 1. Air Permeance: 0.004 cfm/sq ft, maximum, when tested in accordance with ASTM E2178.
 - 2. Water Vapor Permeance: 5 perms, minimum, when tested in accordance with ASTM E96/E96M Procedure A (Desiccant Method) at 73.4 degrees F.
 - 3. Ultraviolet (UV) and Weathering Resistance: Approved in writing by manufacturer for up to 180 days of weather exposure.
 - 4. Surface Burning Characteristics: Flame spread index of 25 or less, and smoke developed index of 50 or less, when tested in accordance with ASTM E84.
 - 5. Seam and Perimeter Tape: Polyethylene self adhering type, mesh reinforced, 2 inches wide, compatible with sheet material; unless otherwise specified.
 - 6. Manufacturers:
 - a. Carlisle Coatings and Waterproofing, Inc: www.carlisleccw.com/#sle.
 - b. DuPont de Nemours, Inc; Tyvek Commercial Wrap with Tyvek Tape: www.dupont.com/#sle.
 - c. Kimberly-Clark, distributed by Wolf Home Products: www.wolfhomeproducts.com/#sle.
 - d. National Shelter Products, Inc: www.drylinewrap.com/#sle.
 - e. VaproShield, LLC: www.vaproshield.com/#sle.
 - f. Substitutions: See Section 016000 - Product Requirements.

1.07 ACCESSORIES

- A. Sealants, Tapes, and Accessories for Sealing Weather Barrier and Sealing Weather Barrier to Adjacent Substrates: As specified or as recommended by weather barrier manufacturer.

PART 3 EXECUTION

2.01 EXAMINATION

- A. Verify that surfaces and conditions are ready to accept the work of this section.

2.02 PREPARATION

- A. Remove projections, protruding fasteners, and loose or foreign matter that might interfere with proper installation.

2.03 INSTALLATION

- A. Install materials in accordance with manufacturer's instructions.
- B. Air Barriers: Install continuous air tight barrier over surfaces indicated, with sealed seams and with sealed joints to adjacent surfaces.
- C. Mechanically Fastened Sheets - On Exterior:
 - 1. Install sheets shingle-fashion to shed water, with seams generally horizontal.
 - 2. Overlap seams as recommended by manufacturer but at least 6 inches.
 - 3. Overlap at outside and inside corners as recommended by manufacturer but at least 12 inches.
 - 4. For applications specified to be air tight, seal seams, laps, penetrations, tears, and cuts with self-adhesive tape; use only large-headed, gasketed fasteners recommended by the manufacturer.
 - 5. Install air barrier and vapor retarder underneath the jamb flashings.
 - 6. Install head flashings under weather barrier.
 - 7. At openings to be filled with frames having nailing flanges, wrap excess sheet into opening; at head, seal sheet over flange and flashing.
- D. Openings and Penetrations in Exterior Weather Barriers:
 - 1. Install flashing over sills, covering entire sill frame member, extending at least 5 inches onto weather barrier and at least 6 inches up jambs; mechanically fasten stretched edges.
 - 2. At openings to be filled with frames having nailing flanges, seal head and jamb flanges using a continuous bead of sealant compressed by flange and cover flanges with at least 4 inches wide; do not seal sill flange.
 - 3. At openings to be filled with non-flanged frames, seal weather barrier to all sides of opening framing, using flashing at least 9 inches wide, covering entire depth of framing.
 - 4. At head of openings, install flashing under weather barrier extending at least 2 inches beyond face of jambs; seal weather barrier to flashing.
 - 5. At interior face of openings, seal gap between window/door frame and rough framing, using joint sealant over backer rod.
 - 6. Service and Other Penetrations: Form flashing around penetrating item and seal to weather barrier surface.

2.04 FIELD QUALITY CONTROL

2.05 PROTECTION

- A. Do not leave materials exposed to weather longer than recommended by manufacturer.

END OF SECTION

**SECTION 074113
METAL ROOF PANELS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Architectural roofing system of preformed steel panels.
- B. Fastening system.
- C. Factory finishing.
- D. Accessories and miscellaneous components.

1.02 RELATED REQUIREMENTS

- A. Section 061000 - Rough Carpentry: Roof sheathing.
- B. Section 072100 - Thermal Insulation: Rigid roof insulation.
- C. Section 079200 - Joint Sealants: Sealing joints between metal roof panel system and adjacent construction.

1.03 REFERENCE STANDARDS

- A. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures Most Recent Edition Cited by Referring Code or Reference Standard.
- B. 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 2018a.
- 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 E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2021a.

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. Storage and handling requirements and recommendations.
 - 2. Installation methods.
 - 3. Specimen warranty.
- C. Shop Drawings: Include layouts of roof panels, details of edge and penetration conditions, spacing and type of connections, flashings, underlayments, and special conditions.
 - 1. Show work to be field-fabricated or field-assembled.
- D. Selection Samples: For each roofing system specified, submit color chips representing manufacturer's full range of available colors and patterns.
- E. Verification Samples: For each roofing system specified, submit samples of minimum size 12 inches square, representing actual roofing metal, thickness, profile, color, and texture.
 - 1. Include typical panel joint in sample.
- F. Manufacturer Qualification Statement: Provide documentation showing metal roof panel fabricator is accredited under IAS AC472.
- G. Warranty: Submit specified 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 the manufacture of roofing systems similar to those required for this project.
 - 1. Not less than 5 years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Store roofing panels on project site as recommended by manufacturer to minimize damage to panels prior to installation.

1.07 WARRANTY

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. Finish Warranty: Provide manufacturer's special warranty covering failure of factory-applied exterior finish on metal roof panels and agreeing to repair or replace panels that show evidence of finish degradation, including significant fading, chalking, cracking, or peeling within specified warranty period of 5 year period from date of Substantial Completion.
- C. Waterproofing Warranty: Provide manufacturer's warranty for weathertightness of roofing system, including agreement to repair or replace roofing that fails to keep out water within specified warranty period of 5 years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Metal Roof Panels:
 - 1. Basis of Design: UC-14 by Firestone Building Products LLC: www.firestonebpc.com.
 - 2. Metl-Span, a Division of NCI Group, Inc: www.metlspan.com.
 - 3. Petersen Aluminum Corporation: www.pac-clad.com.
 - 4. Substitutions: See Section 016000 - Product Requirements.

2.02 ARCHITECTURAL METAL ROOF PANELS

- A. Architectural Metal Roofing: Provide complete engineered system complying with specified requirements and capable of remaining weathertight while withstanding anticipated movement of substrate and thermally induced movement of roofing system.
- B. Metal Panels: Factory-formed panels with factory-applied finish.
 - 1. Steel Panels:
 - a. Steel Thickness: Minimum 24 gage (0.024 inch).
 - 2. Profile: Standing seam, with minimum 1.75 inch seam height; concealed fastener system for field seaming with special tool.
 - 3. Length: Full length of roof slope, without lapped horizontal joints.
 - 4. Width: Maximum panel coverage of 18 inches.

2.03 ATTACHMENT SYSTEM

- A. Concealed System: Provide manufacturer's standard stainless steel or nylon-coated aluminum concealed anchor clips designed for specific roofing system and engineered to meet performance requirements, including anticipated thermal movement.

2.04 FABRICATION

- A. Panels: Provide factory or field fabricated panels with applied finish and accessory items, using manufacturer's standard processes as required to achieve specified appearance and performance requirements.
- B. Joints: Provide captive gaskets, sealants, or separator strips at panel joints to ensure weathertight seals, eliminate metal-to-metal contact, and minimize noise from panel movements.

2.05 PANEL FINISH

- A. Fluoropolymer Coating System: Manufacturer's standard multi-coat thermocured coating system, including minimum 70 percent fluoropolymer color topcoat with minimum total dry film thickness of 0.9 mil; color and gloss to match sample.

2.06 ACCESSORIES AND MISCELLANEOUS ITEMS

- A. Miscellaneous Sheet Metal Items: Provide flashings, trim, moldings, closure strips, caps, and equipment curbs of the same material, thickness, and finish as used for the roofing panels. Items completely concealed after installation may optionally be made of stainless steel.

- B. Rib and Ridge Closures: Provide prefabricated, close-fitting components of steel with corrosion resistant finish or combination steel and closed-cell foam.
 - 1. Seam Sealant: Factory-applied, non-skinning, non-drying type.
- C. Underlayment: Self-adhering rubber-modified asphalt sheet complying with ASTM D1970/D1970M; 22 mil total thickness; with strippable release film and woven polypropylene sheet top surface.
 - 1. Sheet Thickness: 22 mil (0.022 inch) minimum total thickness.
 - 2. Self Sealability: Passing nail sealability test specified in ASTM D1970/D1970M.
 - 3. Low Temperature Flexibility: Passing test specified in ASTM D1970/D1970M.
 - 4. Water Vapor Permeance: 0.067 perm, maximum, when tested in accordance with ASTM E96/E96M Procedure A (desiccant method).

2.07 FABRICATION

- A. Panels: Fabricate panels and accessory items at factory, using manufacturer's standard processes as required to achieve specified appearance and performance requirements.
- B. Joints: Factory-install captive gaskets, sealants, or separator strips at panel joints to provide weathertight seals, eliminate metal-to-metal contact, and minimize noise from panel movements.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Do not begin installation of preformed metal roof panels 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. Broom clean wood sheathing prior to installation of roofing system.
- B. Coordinate roofing work with provisions for roof drainage, flashing, trim, penetrations, and other adjoining work to assure that the completed roof will be free of leaks.
- C. Remove protective film from surface of roof panels immediately prior to installation. Strip film carefully, to avoid damage to prefinished surfaces.
- D. Separate dissimilar metals by applying a bituminous coating, self-adhering rubberized asphalt sheet, or other permanent method approved by roof panel manufacturer.
- E. Where metal will be in contact with wood or other absorbent material subject to wetting, seal joints with sealing compound and apply one coat of heavy-bodied bituminous paint.

3.03 INSTALLATION

- A. Overall: Install roofing system in accordance with approved shop drawings and panel manufacturer's instructions and recommendations, as applicable to specific project conditions. Anchor all components of roofing system securely in place while allowing for thermal and structural movement.
 - 1. Install roofing system with concealed clips and fasteners, except as otherwise recommended by manufacturer for specific circumstances.
 - 2. Minimize field cutting of panels. Where field cutting is absolutely required, use methods that will not distort panel profiles. Use of torches for field cutting is absolutely prohibited.
- B. Accessories: Install all components required for a complete roofing assembly, including flashings, gutters, downspouts, trim, moldings, closure strips, preformed crickets, caps, equipment curbs, rib closures, ridge closures, and similar roof accessory items.
- C. Roof Panels: Install panels in strict accordance with manufacturer's instructions, minimizing transverse joints except at junction with penetrations.

3.04 CLEANING

- A. Clean exposed sheet metal work at completion of installation. Remove grease and oil films, excess joint sealer, handling marks, and debris from installation, leaving the work clean and unmarked, free from dents, creases, waves, scratch marks, or other damage to the finish.

3.05 PROTECTION

- A. Do not permit storage of materials or roof traffic on installed roof panels. Provide temporary walkways or planks as necessary to avoid damage to completed work. Protect roofing until completion of project.
- B. Touch-up, repair, or replace damaged roof panels or accessories 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 072500 - Weather Barriers: Weather barrier under wall panels.
- B. Section 092116 - Gypsum Board Assemblies: Wall panel substrate.

1.03 REFERENCE STANDARDS

- A. ASTM A792/A792M - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process 2021a.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate dimensions, layout, joints, construction details, methods of anchorage.
- C. Samples: Submit one samples of wall panel, 12 inch by 12 inch in size illustrating finish color, sheen, and texture.

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.

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. Correct defective work within a 20 year period after the Date of Substantial Completion for degradation of panel finish, including color fading caused by exposure to weather.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Basis of Design Metal Panels: PAC-CLAD; Product : Flush Wall Panel 12".
- B. Basis of Design Metal Panels: Lux Architectural Panel; Product: 6" V-Groove.
- C. Basis of Design Soffit Panels: PAC-CLAD; Product: Flush Soffit Wide Vent.

2.02 MANUFACTURED METAL PANELS

- A. Wall Panel System: Factory fabricated prefinished metal panel system, site assembled.
 - 1. Provide exterior 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.
- B. Exterior Panels: Flush Wall Panel
1. Profile: Vertical. Flat
 2. Material: Aluminum-Zinc Alloy-Coated Steel Sheet, 22 gage, 0.0299 inch minimum thickness.
 3. Exterior Finish: Modified silicone-polyester two-coat system
 4. Panel Width: 12"
 5. Panel Thickness: 1-3/4"
 6. Color: As selected by Architect from manufacturer's full line.
- C. Exterior Panels: V-Groove
1. Profile: Horizontal. Beveled face edge with preformed interlocking joints
 2. Material: Aluminum-Zinc Alloy-Coated Steel Sheet, 24 gage, .0239 inch minimum thickness.
 3. Exterior Finish: PVDF painted
 4. Panel Width: 6"
 5. Color: As selected by Architect from manufacturer's full line.
 - 6.
- D. Soffit Panels:
1. Profile: PAC-CLAD Flush Panel - 12".
 2. Material: Precoated aluminum sheet, 20 gage, 0.032 inch minimum thickness.
 3. Venting: Wide Vent.
 4. Trim: Matching J trim.
 5. Color: As selected by Architect from manufacturer's full line.
- E. Subgirt Framing Assembly:
1. Profile as indicated; to attach panel system to building.
- F. Internal and External Corners: Same material, thickness, and finish as exterior sheets; profile to suit system; shop cut and factory mitered to required angles.
- G. 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.
- H. Anchors: Galvanized steel or Stainless steel.

2.03 MATERIALS

- A. Precoated Steel Sheet: Aluminum-zinc alloy-coated steel sheet, ASTM A792/A792M, Commercial Steel (CS)) or Forming Steel (FS), with AZ50/AZM150 coating; continuous-coil-coated on exposed surfaces with specified finish coating and on panel back with specified panel back coating.

2.04 ACCESSORIES

- A. 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.

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 and soffits 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. Use concealed fasteners unless otherwise approved by Architect.
- G. 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.

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 076200
SHEET METAL FLASHING AND TRIM**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fabricated sheet metal items, including flashings and counterflashings.
- B. Sealants for joints within sheet metal fabrications.
- C. Accessories.

1.02 RELATED REQUIREMENTS

- A. Section 061000 - Rough Carpentry: Wood nailers for sheet metal work.
- B. 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) 2021.
- B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2020.
- 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.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.
- C. 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

- 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 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. Connect downspouts to downspout boots, and seal connection watertight.
- F. 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 079005 JOINT SEALERS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Precompressed foam sealers.

1.02 REFERENCE STANDARDS

- A. ASTM C834 - Standard Specification for Latex Sealants 2017.
- B. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications 2022.
- C. ASTM C920 - Standard Specification for Elastomeric Joint Sealants 2018.
- D. ASTM C1193 - Standard Guide for Use of Joint Sealants 2016.
- E. ASTM D2240 - Standard Test Method for Rubber Property--Durometer Hardness 2015 (Reapproved 2021).

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate the work with other sections referencing this section.

1.04 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.

1.05 FIELD CONDITIONS

- A. Maintain temperature and humidity recommended by the sealant manufacturer during and after installation.

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.
- 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.
 - 2. BASF Construction Chemicals-Building Systems: www.buildingsystems.basf.com.
 - 3. Bostik Inc: www.bostik-us.com.
 - 4. ARDEX Engineered Cements: www.ardexamericas.com.
 - 5. Dow Corning Corporation: www.dowcorning.com.
 - 6. Hilti, Inc: www.us.hilti.com.
 - 7. Momentive Performance Materials, Inc (formerly GE Silicones): www.momentive.com.
 - 8. Pecora Corporation: www.pecora.com.
 - 9. The QUIKRETE Companies: www.quikrete.com.
 - 10. Red Devil: www.reddevil.com.
 - 11. Tremco Global Sealants: www.tremcosealants.com.
 - 12. Sherwin-Williams Company: www.sherwin-williams.com.
 - 13. Sika Corporation: www.usa-sika.com.
 - 14. W.R. Meadows, Inc: www.wrmeadows.com.
 - 15. Substitutions: See Section 016000 - Product Requirements.
- B. Prefomed Compressible Foam Sealers:

1. EMSEAL Joint Systems, Ltd: www.emseal.com.
2. Sandell Manufacturing Company, Inc: www.sandellmfg.com.
3. Dayton Superior Corporation: www.daytonsuperior.com.
4. Tremco Global Sealants: www.tremcosealants.com.
5. Substitutions: See Section 016000 - Product Requirements.

2.02 SEALANTS

- A. General Purpose Exterior Sealant: Polyurethane; ASTM C920, Grade NS, Class 25 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.
 - b. BASF Construction Chemicals-Building Systems: www.buildingsystems.basf.com.
 - c. Pecora Corporation; 898NST Sanitary Silicone Sealant - Class 50: www.pecora.com.
 - d. Tremco Global Sealants; [____]: 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.
 - b. Pecora Corporation; AIS-919 Acoustical and Insulation Latex Sealant: www.pecora.com.
 - c. BASF Construction Chemicals-Building Systems: www.buildingsystems.basf.com.
 - d. Tremco Global Sealants: www.tremcosealants.com.
 - e. Hilti, Inc.; CP 506 Smoke and Acoustical Sealant: 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; ASTM D 1667, closed cell PVC; 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 CLEANING

- A. Clean adjacent soiled surfaces.

3.05 PROTECTION

- A. Protect sealants until cured.

END OF SECTION

**SECTION 081113
HOLLOW METAL DOORS AND FRAMES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Thermally insulated hollow metal doors with frames.

1.02 RELATED REQUIREMENTS

- A. Section 087100 - Door Hardware.

1.03 REFERENCE STANDARDS

- A. ADA Standards - Americans with Disabilities Act (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 2018.
- D. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100) 2017.
- 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 2020.
- 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 2018a.
- 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.
- L. NAAMM HMMA 861 - Guide Specifications for Commercial Hollow Metal Doors and Frames 2014.
- M. SDI 117 - Manufacturing Tolerances for Standard Steel Doors and Frames 2019.

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.
- D. Installation Instructions: Manufacturer's published instructions, including any special installation instructions relating to this project.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

- C. 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.
 - 2. De La Fontaine Inc: www.delafontaine.com/#sle.
 - 3. Republic Doors: www.republicdoor.com.
 - 4. Steelcraft, an Allegion brand: www.allegion.com/#sle.
 - 5. 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. Exterior Door Top Closures: Flush end closure channel, with top and door faces aligned.
 - 4. Door Edge Profile: Manufacturers standard for application indicated.
 - 5. Typical Door Face Sheets: Flush.
 - 6. Finish: Factory primed, for field finishing.
- B. 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 Core Material: Manufacturers standard core material/construction and in compliance with requirements.
 - a. Foam Plastic Insulation: Manufacturer's standard board insulation with maximum flame spread index (FSI) of 75, and maximum smoke developed index (SDI) of 450 in accordance with ASTM E84, and completely enclosed within interior of door.
 - 3. Door Thickness: 1-3/4 inch, nominal.
 - 4. Galvanizing: Components hot-dipped zinc-iron alloy-coated (galvanized) in accordance with ASTM A653/A653M, with manufacturer's standard coating thickness.
 - 5. Insulating Value: U-value of 0.50, when tested in accordance with ASTM C1363.

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: Face welded type.
 - 1. Weatherstripping: Separate, see Section 087100.
- D. Mullions for Pairs of Doors: Fixed, with profile similar to jambs.
- E. 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. Louvers: Roll formed aluminum with overlapping frame; finish same as door components ; factory-installed.
 - 1. Style: Standard straight slat blade.
 - 2. Provide bug screen.
 - 3. Fasteners: Concealed fasteners.
- 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. Install doors and frames in accordance with manufacturer's instructions and related requirements of specified door and frame standards or custom guidelines indicated.
- B. Coordinate frame anchor placement with wall construction.
- C. Grout frames in masonry construction, using hand trowel methods; brace frames so that pressure of grout before setting will not deform frames.
- D. Install door hardware as specified in Section 087100.
- E. Comply with glazing installation requirements of Section 088000.

3.04 TOLERANCES

- A. Clearances Between Door and Frame: Comply with related requirements of specified frame standards or custom guidelines indicated in accordance with SDI 117 or NAAMM HMMA 861.
- B. 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 083313
COILING COUNTER DOORS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Non-fire-rated coiling counter doors and operating hardware.
- B. Electric motor operation; wiring from electric circuit disconnect to operator to control station.

1.02 RELATED REQUIREMENTS

- A. Section 061000 - Rough Carpentry: Rough openings.
- B. Section 079200 - Joint Sealants: Sealing joints between frames and adjacent construction.
- C. 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. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2020.
- D. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes 2021.
- E. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric) 2021.
- F. ITS (DIR) - Directory of Listed Products current edition.
- G. NEMA MG 1 - Motors and Generators 2018.
- H. UL (DIR) - Online Certifications Directory Current Edition.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Submit manufacturer's standard literature showing materials and details of construction and finish. Include data on electrical operation.
- C. Shop Drawings: Indicate rough and actual opening dimensions, anchorage methods, hardware locations, and installation details.
- D. Samples: Submit two slats, 4 inch long, illustrating shape, color and finish texture.
- E. Manufacturer's Instructions: Indicate installation sequence and installation, adjustment, and alignment procedures.
- F. Operation and Maintenance Data: Indicate modes of operation, lubrication requirements and frequency, and periodic adjustments required.
- G. Project Record Documents: Include as-built electrical diagrams for electrical operation and connection to fire alarm system.

1.05 QUALITY ASSURANCE

- A. Products Requiring Electrical Connection: Listed and classified by UL (DIR) as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Coiling Counter Doors:
 - 1. Alpine Overhead Doors, Inc: www.alpinedoors.com/#sle.
 - 2. C.H.I. Overhead Doors: www.chiohd.com/#sle.
 - 3. Raynor Garage Doors: www.raynor.com/#sle.

4. Substitutions: See Section 016000 - Product Requirements.

2.02 COILING COUNTER DOORS

- A. Coiling Counter Doors, Non-Fire-Rated: Aluminum slat curtain.
 1. Mounting: Between jambs, within prepared opening.
 2. Nominal Slat Size: 1-1/4 inches wide.
 3. Slat Profile: Flat, perforated.
 4. Finish, Aluminum: Anodized.
 5. Guides: Formed track; same material and finish unless otherwise indicated.
 6. Hood Enclosure: Manufacturer's standard; primed steel.
 7. Manual hand chain lift operation.
 8. Electric operation.
 9. Locking Devices: Slide bolt on inside.

2.03 MATERIALS

- A. Curtain Construction: Interlocking, single thickness 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: Fitted with angles to provide reinforcement and positive contact in closed position.
 3. Aluminum Slats: ASTM B221 (ASTM B221M), aluminum alloy Type 6063; minimum thickness 0.05 inch.
- B. Guide Construction: Continuous, of profile to retain door in place, with mounting brackets of same metal.
 1. Aluminum Guides: Extruded aluminum channel, with wool pile runners along inside.
- C. Hood Enclosure: Internally reinforced to maintain rigidity and shape.
- D. Lock Hardware:
 1. For motor operated units, additional lock or latching mechanisms are not required.
 2. Latch Handle: Manufacturer's standard.
 3. Slide Bolt: Provide on single-jamb side, extending into slot in guides, with padlock on one side.
- E. Roller Shaft Counterbalance: Steel pipe and torsion steel spring system, capable of producing torque sufficient to ensure smooth operation of curtain from any position and capable of holding position at mid-travel; with adjustable spring tension; requiring 25 lb nominal force to operate.

2.04 ELECTRIC OPERATION

- A. Operator, Controls, Actuators, and Safeties: Listed and classified by ITS (DIR), UL (DIR), or testing agency acceptable to authorities having jurisdiction (AHJ) as suitable for purpose specified and indicated.
 1. Provide interlock switches on motor operated units.
- B. Electric Operators:
 1. Mounting: Side mounted.
 2. Motor Enclosure: NEMA MG 1.
 3. Motor Rating: As recommended by manufacturer; continuous duty.
 4. Motor Voltage: 110-120 VAC, single phase, 60 Hz.
 5. Opening Speed: 6 inches per second.
 6. Manual override in case of power failure.
- C. Control Station: Standard three button (OPEN-STOP-CLOSE) momentary control for each electrical operator.
 1. Controls: 24 VAC circuit.
 2. Surface mounted.
- D. Safety Edge: Located at bottom of curtain, full width, electro-mechanical sensitized type, wired to stop operator upon striking object, hollow neoprene covered.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that opening sizes, tolerances and conditions are acceptable.

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 perimeter trim as indicated.

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 ft 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 083613
SECTIONAL DOORS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Overhead sectional doors, electrically operated.
- B. Operating hardware and supports.
- C. Electrical controls.

1.02 RELATED REQUIREMENTS

- A. Section 055000 - Metal Fabrications: Steel channel opening frame.
- B. Section 061000 - Rough Carpentry: Rough wood framing for door opening.
- C. Section 079005 - Joint Sealers: Perimeter sealant and backup materials.
- D. Section 087100 - Door Hardware: Lock cylinders.
- E. Section 260583 - Wiring Connections.

1.03 REFERENCE STANDARDS

- A. ANSI A135.4 - Basic Hardboard 2012 (Reaffirmed 2020).
- B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2020.
- 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 B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes 2021.
- F. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric) 2021.
- G. 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).
- H. DASMA 102 - American National Standard Specifications for Sectional Doors 2018.
- I. ITS (DIR) - Directory of Listed Products current edition.
- J. NEMA MG 1 - Motors and Generators 2018.
- K. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- L. UL (DIR) - Online Certifications Directory Current Edition.
- M. 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. Shop Drawings: Indicate opening dimensions and required tolerances, connection details, anchorage spacing, hardware locations, and installation details.
- C. Product Data: Show component construction, anchorage method, and hardware.
- D. Samples: Submit two panel finish samples, 12x12 inch in size, illustrating color and finish.
- E. Manufacturer's Installation Instructions: Include any special procedures required by project conditions.
- F. Operation Data: Include normal operation, troubleshooting, and adjusting.

- G. Maintenance Data: Include data for motor and transmission, shaft and gearing, lubrication frequency, spare part sources.
- H. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of experience.
- B. Installer Qualifications: Company specializing in performing work of type specified and with at least three years documented experience.
- C. Comply with applicable code for motor and motor control requirements.
- D. Products Requiring Electrical Connection: Listed and classified by UL (DIR), as suitable for purpose specified.

1.06 WARRANTY

- A. See Section 017800 - Closeout Submittals for warranty requirements.
- B. Correct defective Work within a five year period after Date of Substantial Completion.
- C. Warranty: Include coverage for electric motor and transmission.
- D. Provide five year manufacturer warranty for electric operating equipment.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Sectional Doors:
 - 1. C.H.I. Overhead Doors: www.chiohd.com.
 - 2. Clopay Building Products: www.clopaydoor.com/#sle.
 - 3. Clopay Corporation: www.clopaydoor.com.
 - 4. Wayne-Dalton, a Division of Overhead Door Corporation: www.wayne-dalton.com.
 - 5. Substitutions: See Section 016000 - Product Requirements.

2.02 STEEL DOOR COMPONENTS

- 1. Performance: Withstand positive and negative wind loads equal to 1.5 times design wind loads specified by local code without damage or permanent set, when tested in accordance with ASTM E330/E330M, using 10 second duration of maximum load.
- 2. Exterior Finish: Factory finished with acrylic baked enamel; color as selected by Architect.
- 3. Interior Finish: Factory finished with acrylic baked enamel; color as selected from manufacturers standard line.
- 4. Glazed Lights: four glazed lights per panel, two rows; set in place with resilient glazing channel.
- B. Door Panels: Steel construction; outer steel sheet of 20 gage, 0.0359 inch minimum thickness, flat profile; inner steel sheet of 20 gage, 0.0359 inch minimum thickness, flat profile; core reinforcement sheet steel roll formed to channel shape, rabbeted weather joints at meeting rails; polyurethane insulation.
- C. Glazing: Annealed float glass; insulated; clear; 1/2 inch thick.

2.03 DOOR COMPONENTS

- A. Track: Rolled galvanized steel, 0.090 inch minimum thickness; 3 inch wide, continuous one piece per side; galvanized steel mounting brackets 1/4 inch thick.
- B. Hinge and Roller Assemblies: Heavy duty hinges and adjustable roller holders of stainless steel; floating hardened steel bearing rollers, located at top and bottom of each panel, each side.
- C. Lift Mechanism: Torsion spring on cross head shaft, with braided stainless steel lifting cables.
- D. Jamb Weatherstripping: Roll formed steel section full height of jamb, fitted with resilient weatherstripping, placed in moderate contact with door panels.

2.04 MATERIALS

- A. Sheet Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with G60/Z180 coating, plain surface.

2.05 ELECTRICAL OPERATION

- A. Operator, Controls, Actuators, and Safeties: Comply with UL 325; provide products listed by a testing agency acceptable to authorities having jurisdiction or UL.
- B. Electrical Characteristics:
 - 1. Mounting: Center mounted draw bar assembly.
 - 2. 1/3 hp; manually operable in case of power failure, transit speed of 12 inches per second.
 - 3. 120 volts, single phase, 60 Hz.
- C. Motor: NEMA MG 1, Type 1.
- D. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70.
- E. 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.
- F. Disconnect Switch: Factory mount disconnect switch in control panel.
- G. Electric Operator: trolley style, adjustable safety friction clutch; brake system actuated by independent voltage solenoid controlled by motor starter; enclosed gear driven limit switch; enclosed magnetic cross line reversing starter; mounting brackets and hardware.
- H. Safety Edge: At bottom of door panel, full width; electro-mechanical sensitized type, wired to stop door upon striking object; hollow neoprene covered to provide weatherstrip seal.
 - 1. Manufacturers:
 - a. Miller Edge, Inc: www.MillerEdge.com/#sle.
 - b. Substitutions: See Section 016000 - Product Requirements.
- I. Control Station: Standard three button (open-close-stop) momentary type control for each electric operator.
 - 1. 24 volt circuit.
 - 2. Surface mounted.
 - 3. Locate at inside door jamb.
- J. Provide interconnection to security system.
- K. Radio Control Antenna Detector:
- L. Hand Held Transmitter: Digital control, resettable. 2 per operator.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that wall openings are ready to receive work and opening dimensions and tolerances are within specified limits.

3.02 PREPARATION

- A. Prepare opening to permit correct installation of door unit to perimeter air and vapor barrier seal.
- B. Apply primer to wood frame.

3.03 INSTALLATION

- A. Install door unit assembly in accordance with manufacturer's instructions.
- B. Anchor assembly to wall construction and building framing without distortion or stress.
- C. Securely brace door tracks suspended from structure. Secure tracks to structural members only.
- D. Fit and align door assembly including hardware.

3.04 TOLERANCES

- A. Maximum Variation from Plumb: 1/16 inch.
- B. Maximum Variation from Level: 1/16 inch.
- C. Longitudinal or Diagonal Warp: Plus or minus 1/8 inch from 10 ft straight edge.
- D. Maintain dimensional tolerances and alignment with adjacent work.

3.05 ADJUSTING

- A. Adjust door assembly for smooth operation and full contact with weatherstripping.
- B. Have manufacturer's field representative present to confirm proper operation and identify adjustments to door assembly for specified operation.

3.06 CLEANING

- A. Clean doors and frames and glazing.
- B. Remove temporary labels and visible markings.

3.07 PROTECTION

- A. Protect installed products from damage until Date of Substantial Completion.
- B. Do not permit construction traffic through overhead door openings after adjustment and cleaning.

END OF SECTION

**SECTION 08 71 00
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. Thresholds and Weather-stripping (Aluminum frame seals to be provided by aluminum door supplier)
- 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 08 Section "Hollow Metal Doors and Frames".

1.4 REFERENCES

- A. Publications of agencies and organizations listed below form a part of this specification section to the extent referenced.
 - 1. DHI - Recommended Locations for Builders' Hardware.
 - 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. ANSI ICC500 – Standard for the Design and Construction of Storm Shelters
 - 10. IBC 2018 - International Building Code 2018 Edition (as 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 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. 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.
- G. 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
- H. Furnish hinges with width to accommodate trim and allow for 180-degree swing.
- I. 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.
- J. 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. 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>Falcon</u>	<u>Corbin</u>	<u>Precision</u>
1. Wide Stile, Push Pad	25 Series	ED5000-M110 Series	2000 Series
2. Wide Stile, Electric Latch Retraction	MEL 25 Series	ED5000S-MELR-M110 Series	ELR-2000 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. On full glass doors there shall be no exposed fasteners on the back of the mechanism visible through the glass.

D. All exit devices shall be provided with flush end caps to reduce potential damage from impact.

E. 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.

F. 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.

G. Coordinate with related trades to ensure adequate clearance and reinforcement is provided in doors and frames. Provide thru bolts as required.

H. Refer to hardware groups for exit device applications utilizing the option of: "less bottom rod and floor strike" (LBR)

I. All exit devices shall be provided with optional trim designs to match other lever and pull designs used on the project.

J. 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.
- K. Provide glass bead kits as required to accommodate door conditions. Screws shall not be visible through full glass doors.
- L. Where specified, provide compatible keyed mullions with cylinder for pairs of doors.
- M. 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.
- N. 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>Falcon</u>	<u>Dorma</u>	<u>Corbin</u>
1. Grade 1 Mortise	MA Series DG	C800 Series LR	ML2000 NSA
2. Grade 1 Cylindrical	T Series D	M900 Series LR	CL3300 NZD
- 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. 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
- D. Provide guarded latch bolts for all locksets, and latch bolts with throw to maintain fire rating of both single and paired door assemblies.
- E. Provide strike with lip length adequate to clear surrounding trim.
- F. Provide wrought boxes for strikes at inactive doors, wood frames, and metal frames without integral mortar covers.
- G. 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:
 - 1.

<u>Norton</u>	<u>Dorma</u>	<u>Falcon</u>
R7500 / PR7500	8900 / 8900 SPA	SC70A/SC70A FA HD
- 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 aluminum cylinders.
- G. 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.

2.10 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.

2.11 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.

2.12 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 |
- B. Furnish a stop or holder for all doors. Furnish floor stops or hinge pin stops only where specifically specified.
- 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. Do not provide holder function for labeled doors.

2.13 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. Adhesive Edge Seal | 188S | S771 | 5060 | **** |
| 4. Sweep (Brush) | 8192 | 18061_NB | B606 | 964 |
| 5. 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.

2.14 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.

2.15 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. Closers	689 (Aluminum)
9. Protective Plates	630 (US32D - Satin Stainless Steel)
10. Overhead Stops	630 (US32D - Satin Stainless Steel)
11. Wall Stops and Holders	630 (US32D - Satin Stainless Steel)
12. Thresholds	719 (Mill Aluminum)
13. Weather-strip, Sweeps Drip Caps	Aluminum Anodized
14. Miscellaneous	626 (US26D - Satin Chromium)

2.16 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. Install all hardware in accordance with the approved hardware schedule and manufacturer's instructions for installation and adjustment.
- C. Set units level, plumb and true to the line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.
- D. Provide blocking or reinforcement for all hardware mounted to drywall construction, including wall mounted door stops and holders.
- E. Drill and countersink units which are not factory-prepared for anchorage fasteners. Space fasteners and anchors in accord with industry standards.
- F. Drill appropriate size pilot holes for all hardware attached to wood doors and frames.
- G. Shim doors as required to maintain proper operating clearance between door and frame.
- 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.
- 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.

HARDWARE GROUP NO. 1 DOORS 101, 103, 201 & 204

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGE	AS REQUIRED	IVE
1	EA	CLASSROOM DEADBOLT	B663	SCH
1		TOE PULL	STEP-N-PULL	BYO
1	EA	PUSH PLATE	8200 4" X 16"	IVE
1	EA	PULL PLATE	8302 10" 4" X 16"	IVE
1	EA	SURFACE CLOSER	4050 REG OR PA AS REQ	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	IVE
1	EA	WALL STOP	WS406	IVE
1	EA	RAIN DRIP	142	ZER
1	SET	WEATHERSTRIPPING	429	ZER
1	EA	DOOR SWEEP	8192	ZER
1	EA	THRESHOLD	8655	ZER

DOORS TO BE PUSH/PULL OPERATION WHEN UNLOCKED VIA KEY ON EXTERIOR SIDE FOR EVENTS. DEADBOLT THROWN BY KEY OUTSIDE AND RETRACTED BY THUMBTURN INSIDE. THUMBTURN CANNOT THROW BOLT, ONLY RETRACT BOLT. SELF CLOSING.

HARDWARE GROUP NO. 02 DOOR 203A, 202

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGE	AS REQUIRED	IVE
1	EA	CLASSROOM LOCK	ND70	SCH
1	EA	SURFACE CLOSER	4050 REG W/HO	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	IVE
1	EA	RAIN DRIP	142	ZER
1	SET	WEATHERSTRIPPING	429	ZER
1	EA	DOOR SWEEP	8192	ZER
1	EA	THRESHOLD	8655	ZER
1	EA	WS	WS406	IVE

DOOR LOCKED OR UNLOCKED VIA KEY. FREE EGRESS AT ALL TIMES. SELF CLOSING WITH HOLD OPEN IN CLOSER ARM.

HARDWARE GROUP NO. 03 DOOR 102

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGE	AS REQUIRED	IVE
1	EA	MORTISE LOCK	L9456P 06A 626	SCH
2	EA	FLUSH BOLT	626	IVE
2	EA	OH STOP	90SJ	GLY
1	EA	RAIN DRIP	142	ZER
1	SET	WEATHERSTRIPPING	429	ZER
1	EA	DOOR SWEEP	8192	ZER
1	EA	THRESHOLD	8655	ZER

DOOR LOCKED OR UNLOCKED VIA KEY. FREE EGRESS AT ALL TIMES.

**SECTION 096500
RESILIENT FLOORING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Resilient base.

1.02 RELATED REQUIREMENTS

- A. Section 033000 - Cast-in-Place Concrete: Restrictions on curing compounds for concrete slabs and floors.

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 F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring 2021.
- C. ASTM F1066 - Standard Specification for Vinyl Composition Floor Tile 2004 (Reapproved 2018).
- D. ASTM F1861 - Standard Specification for Resilient Wall Base 2021.
- E. ASTM F2169 - Standard Specification for Resilient Stair Treads 2015 (Reapproved 2020).
- F. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source 2019.

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 Wall Base: 5% of linear feet of each type and color.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in installing specified flooring with minimum three years experience and approved by flooring manufacturer.

1.06 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.

1.07 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 STAIR COVERING

2.02 RESILIENT BASE

- A. Resilient Base: ASTM F1861, Type TS rubber, vulcanized thermoset; top set Style B, Cove.
 - 1. Manufacturers: Basis of Design: VPI Corporation
 - a. Burke Flooring: www.burkeflooring.com/#sle.
 - b. Johnsonite, a Tarkett Company: www.johnsonite.com/#sle.
 - c. Roppe Corp: www.roppe.com/#sle.
 - d. Substitutions: See Section 016000 - Product Requirements.
 - 2. Height: 4 inch.
 - 3. Thickness: 0.125 inch.
 - 4. Finish: Matte.
 - 5. Color: Burnt Umber.
 - 6. Manufacturers: Basis of Design: Johnsonite
 - a. Burke Flooring: www.burkemercer.com.
 - b. Roppe Corp: www.roppe.com.

2.03 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.

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.

3.02 PREPARATION

- A. Prepare floor substrates as recommended by flooring and adhesive manufacturers.
- B. Remove subfloor ridges and bumps. Fill minor low spots, cracks, joints, holes, and other defects with subfloor filler to achieve smooth, flat, hard surface.
- C. Prohibit traffic until filler is fully cured.
- D. Clean substrate.

3.03 INSTALLATION - GENERAL

- A. Install in accordance with manufacturer's written instructions.

3.04 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.
- D. Scribe and fit to door frames and other interruptions.

3.05 INSTALLATION - STAIR COVERINGS

- A. Install stair coverings in one piece for full width and depth of tread.
- B. Adhere over entire surface. Fit accurately and securely.

3.06 CLEANING

- A. Remove excess adhesive from floor, base, and wall surfaces without damage.
- B. Clean in accordance with manufacturer's written instructions.

3.07 PROTECTION

- A. Prohibit traffic on resilient flooring for 48 hours after installation.

END OF SECTION

**SECTION 096700
FLUID-APPLIED FLOORING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fluid-applied flooring and base.

1.02 RELATED REQUIREMENTS

- A. Section 079200 - Joint Sealants: Sealing joints between fluid-applied flooring and adjacent construction and fixtures.

1.03 REFERENCE STANDARDS

- A. ASTM D570 - Standard Test Method for Water Absorption of Plastics 1998 (Reapproved 2018).

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; sizes, patterns and colors available.
- C. Samples: Submit two samples, 4 by 4 inch in size illustrating color and pattern for each floor material for each color specified.
- D. Manufacturer's Installation Instructions: Indicate special procedures.
- E. Maintenance Data: Include maintenance procedures, recommended maintenance materials, procedures for stain removal, repairing surface, and suggested schedule for cleaning.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
- B. Applicator Qualifications: Company specializing in performing the work of this section.
 - 1. Minimum three years of documented experience.
 - 2. Approved by manufacturer.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Store resin materials in a dry, secure area.
- B. Store materials for three days prior to installation in area of installation to achieve temperature stability.

1.07 FIELD CONDITIONS

- A. Maintain minimum temperature in storage area of 55 degrees F.
- B. Maintain ambient temperature required by manufacturer 72 hours prior to, during, and 24 hours after installation of materials.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Fluid-Applied Flooring: Basis of Design: Dur-A-Chip by Dur-A-Flex
 - 1. BASF Construction Chemicals-Building Systems: www.buildingsystems.basf.com.
 - 2. Concrete Solutions by Rhino Linings: www.concretesolutions.com.
 - 3. Crossfield Products Corp: www.crossfieldproducts.com.
 - 4. Key Resin Company: www.keyresin.com.
 - 5. Sherwin-Williams Company: General Polymers Brand: www.generalpolymers.com/#sle.
 - 6. Sika Corporation: www.sikafloorusa.com/#sle.
 - 7. Tennant Quartz DB.
 - 8. Tnemec Deco Flake 224.
 - 9. Laticrete Spartacote Epoxy Flooring.
 - 10. Rustoleum Epoxy Flooring.
 - 11. Substitutions: See Section 016000 - Product Requirements.

2.02 MATERIALS

- A. Fluid-Applied Flooring Type EPX-1: Epoxy base coat(s) with embedded decorative chips.
 - 1. Top Coat: Aliphatic Urethane- Dur-A-Flex Armor Top.
 - 2. Thickness: 1/8 inch, nominal, when dry.
 - 3. Texture: Slip resistant.
 - 4. Sheen: Matte.
 - 5. Color: As selected by Architect from manufacturer's full range.
 - 6. Products:
 - a. DUR-A-FLEX- DUR-A-CHIP Floor System.
 - b. Substitutions: See Section 016000 - Product Requirements.

2.03 ACCESSORIES

- A. Divider Strips: Extruded anodized aluminum, 1/8 inch thick, height to match flooring thickness, with anchoring features; Clear anodized color.
- B. Base Caps, and Separator Strips: Match divider strips, with projecting base of 1/8 inch.
- C. Cant Strips: Molded of flooring resin material.
- D. Subfloor Filler: White premix latex; type recommended by flooring material manufacturer.
- E. Primers and Adhesives: Waterproof; types recommended by flooring manufacturer.

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 flooring.
- 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 flooring.
- C. Verify that sub-floor surfaces are dust-free and free of substances that could impair bonding of materials to sub-floor surfaces.
- D. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

- A. Remove sub-floor ridges and bumps. Fill low spots, cracks, joints, holes, and other defects with sub-floor filler.
- B. Apply, trowel, and float filler to achieve smooth, flat, hard surface. Grind irregularities above the surface level. Prohibit traffic until filler is cured.
- C. Vacuum clean substrate.
- D. Apply primer to surfaces required by flooring manufacturer.

3.03 INSTALLATION - FLOORING

- A. Apply in accordance with manufacturer's instructions.
- B. Apply each coat to minimum thickness indicated.
- C. Finish to smooth level surface.

3.04 PROTECTION

- A. Prohibit traffic on floor finish for 48 hours after installation.
- B. Barricade area to protect flooring until fully cured.

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 2019.
- 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.
 - 2. Duron, Inc: www.duron.com/#sle.
 - 3. Glidden Professional, a product of PPG Architectural Coatings: www.gliddenprofessional.com.
 - 4. Benjamin Moore & Co: www.benjaminmoore.com/#sle.
 - 5. PPG Paints: www.ppgpaints.com/#sle.
 - 6. Pratt & Lambert Paints: www.prattandlambert.com/#sle.
 - 7. Sherwin-Williams Company: 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 Mgl-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 101400 SIGNAGE

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Room and door signs.

1.02 REFERENCE STANDARDS

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. Manufacturer's Qualification Statement.
- H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

1.05 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.

1.06 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 Phoenix Collection with back plate.
 - 1. Best Sign Systems, Inc: www.bestsigns.com/#sle.
 - 2. Cosco Industries (ADA signs): www.coscoarchitecturalsigns.com/#sle.
 - 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.

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 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.

**SECTION 102113.19
PLASTIC TOILET COMPARTMENTS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Solid plastic toilet compartments.
- B. Urinal screens.

1.02 REFERENCE STANDARDS

- A. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar 2015.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Coordinate the work with placement of support framing and anchors in walls and ceilings.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate partition plan, elevation views, dimensions, details of wall supports, door swings.
- C. Product Data: Provide data on panel construction, hardware, and accessories.
- D. Samples: Submit two samples of partition panels, 2 by 2 inch in size illustrating panel finish, color, and sheen.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Solid Plastic Toilet Compartments:
 - 1. Ampco Products, Inc: www.ampco.com/#sle.
 - 2. Metpar Corp: www.metpar.com/#sle.
 - 3. Partition Systems International of South Carolina; PolyLife HDPE Toilet Partitions: www.psisc.com/#sle.
 - 4. Bradmar by Bradley Corporation.
 - 5. Basis of Design: Hiny Hiders by Scranton Products
 - 6. Substitutions: Section 016000 - Product Requirements.

2.02 PLASTIC TOILET COMPARTMENTS

- A. Toilet Compartments: Factory fabricated doors, pilasters, and divider panels made of solid molded high density polyethylene (HDPE), floor-mounted headrail-braced.
 - 1. Color: Stainless.
 - 2. Finish: Hammered.
- B. Doors:
 - 1. Thickness: 1 inch.
 - 2. Width: 24 inch. Out swinging
 - 3. Width for Handicapped Use: 36 inch, out-swinging.
 - 4. Height: 55 inch.
- C. Panels:
 - 1. Thickness: 1 inch.
 - 2. Height: 55 inch.
- D. Pilasters:
 - 1. Thickness: 1 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.

2.03 ACCESSORIES

- A. Pilaster Shoes: Formed chromed steel with polished finish, 3 in high, concealing ceiling fastenings.
 - 1. Provide ceiling attachment using two adjustable hanging studs, attached to above-ceiling framing.
- B. Head Rails: Extruded aluminum, anti-grip profile.
- C. Pilaster Brackets: Polished stainless steel.
- D. Wall Brackets: Continuous type, polished stainless steel.
- E. Attachments, Screws, and Bolts: Stainless steel , tamper proof type.
 - 1. For attaching panels and pilasters to brackets: Through-bolts and nuts ; tamper proof.
- F. Hardware: Natural anodized aluminum:
 - 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 102800
TOILET, BATH, AND LAUNDRY ACCESSORIES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Commercial toilet accessories.
- B. Accessories for toilet rooms, showers, and utility rooms.
- C. Utility room accessories.
- D. Grab bars.

1.02 RELATED REQUIREMENTS

- A. Section 102113.19 - Plastic Toilet Compartments.

1.03 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. 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 2015a (Reapproved 2019).
- D. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar 2015.
- E. ASTM B456 - Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium 2017.
- F. ASTM C1036 - Standard Specification for Flat Glass 2021.
- G. ASTM C1503 - Standard Specification for Silvered Flat Glass Mirror 2018.
- H. ASTM F2285 - Standard Consumer Safety Performance Specification for Diaper Changing Tables for Commercial Use 2004, with Editorial Revision (2016).

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Commercial Toilet, Shower, and Bath Accessories: Basis of Design Bobrick Washroom Equipment, Inc.
 - 1. AJW Architectural Products: www.ajw.com.
 - 2. ASI - American Specialties, Inc: www.americanspecialties.com.
 - 3. Bradley Corporation: www.bradleycorp.com.
 - 4. Substitutions: Section 016000 - Product Requirements.
- B. Diaper Changing Stations:
 - 1. American Specialties, Inc: www.americanspecialties.com/#sle.
 - 2. Bradley Corporation: www.bradleycorp.com/#sle.
 - 3. Diaper Deck & Company: www.diaperdeck.com/#sle.
 - 4. Koala Kare Products: www.koalabear.com/#sle.
 - 5. Safe-Strap Company, Inc: www.diaperdepot.com/#sle.

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. Keys: Provide 2 keys for each accessory to Owner; master key lockable accessories.
- C. Stainless Steel Sheet: ASTM A666, Type 304.

- D. Stainless Steel Tubing: ASTM A269/A269M, Grade TP304 or TP316.
- 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: Satin finish, unless otherwise noted.
- B. Chrome/Nickel Plating: ASTM B456, SC 2, polished finish, unless otherwise noted.
- C. Baked Enamel: Pretreat to clean condition, apply one coat primer and minimum two coats epoxy baked enamel.
- D. Powder-Coated Steel: Clean, degrease, and neutralize. Follow immediately with a phosphatizing treatment, prime coat, and two finish coats of powder coat enamel.
- E. Galvanizing for Items Other than Sheet: Comply with ASTM A123/A123M; galvanize ferrous metal and fastening devices.
- F. Shop Primed Ferrous Metals: Pretreat and clean, spray apply one coat primer and bake.

2.04 COMMERCIAL TOILET ACCESSORIES

- A. Toilet Paper Dispenser: Double roll, surface-mounted, stainless steel unit with pivot hinge, tumbler lock.
 - 1. Products:
 - a. Bobrick B-265.
 - b. Substitutions: Section 016000 - Product Requirements.
- B. Paper Towel Dispenser: Folded paper type, stainless steel, surface-mounted, with viewing slots on sides as refill indicator and tumbler lock.
 - 1. Capacity: 400 C-fold minimum.
 - 2. Products:
 - a. Bobrick B-262.
- C. 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 gauge refill indicator, tumbler lock.
 - 1. Minimum Capacity: 40 ounces.
 - 2. Products:
 - a. Bobrick B-2111.
- D. Mirrors: 1/4 inch thick annealed float glass; ASTM C1036.
 - 1. Backing: Full-mirror sized, minimum 0.03 inch galvanized steel sheet and nonabsorptive filler material.
 - 2. Products:
 - a. Bobrick B-165.
 - b. Substitutions: Section 016000 - Product Requirements.
- E. Grab Bars: Stainless steel, smooth surface.
 - 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. Finish: Satin.
 - d. Length and Configuration: As indicated on drawings.
- 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.

2.05 DIAPER CHANGING STATIONS

- A. Diaper Changing Station: Wall-mounted folding diaper changing station for use in commercial toilet facilities, meeting or exceeding ASTM F2285.
 - 1. Material: Stainless steel.
 - 2. Mounting: Surface.
 - 3. Color: As selected.
 - 4. Minimum Rated Load: 250 pounds.
 - 5. Products:
 - a. Bobrick KB 110-SSWM.

2.06 UTILITY ROOM ACCESSORIES

- A. Mop and Broom Holder: 0.05 inch thick stainless steel, Type 304, hat-shaped channel.
 - 1. Holders: Three spring-loaded rubber cam holders.
 - 2. Length: 36 inches.
- B. 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. Mop/broom holders: Three spring-loaded rubber cam holders at shelf front.
 - 2. 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. 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 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. 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.
 - 2. Kidde, a unit of United Technologies Corp: www.kidde.com/#sle.
 - 3. Nystrom, Inc: www.nystrom.com/#sle.
 - 4. Potter-Roemer: www.potterroemer.com/#sle.
 - 5. Pyro-Chem, a Tyco Business: www.pyrochem.com/#sle.
 - 6. Strike First Corporation of America; Water Fire Extinguisher: www.strikefirstusa.com.
 - 7. Substitutions: See Section 016000 - Product Requirements.
 - 8. Ansul, a Tyco Business: www.ansul.com/#sle.
 - 9. JL Industries, Inc: www.jlindustries.com.
 - 10. Larsen's Manufacturing Co: www.larsensmfg.com/#sle.
 - 11. Potter-Roemer: www.potterroemer.com/#sle.
 - 12. Pyro-Chem, a Tyco Business: www.pyrochem.com/#sle.
 - 13. Strike First Corporation of America; EL-Elite Architectural Series Fire Extinguisher Cabinet, Non-Fire Rated: 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.

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 105617
WALL MOUNTED STANDARDS AND SHELVING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Aluminum shelf standards, brackets, and accessories.
- B. Steel shelf support brackets.
- C. Shelves.
- D. See drawings for locations and configurations.

1.02 REFERENCE STANDARDS

- A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum 2020.
- B. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix) 2021.
- C. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix) 2021.
- D. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes 2021.
- E. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric) 2021.

1.03 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Manufacturer's data sheets on each product to be used.
- C. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.
- D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 016000 - Product Requirements for additional provisions.
 - 2. Extra Brackets: Two of each size of standard straight bracket.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Store products under cover and elevated above grade.
- B. Store products in manufacturer's unopened packaging until ready for installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Aluminum Shelf Standards, Brackets, and Accessories:
 - 1. Basis of Design: Rakks/Rangine Corporation; C-standards, Universal brackets, and 6063-T6 extruded aluminum shelves: www.rakks.com/#sle.
 - 2. Substitutions: See Section 016000 - Product Requirements.

2.02 COMPONENTS

- A. Aluminum Shelf Standards, Brackets, and Accessories:
 - 1. Aluminum Components: ASTM B221 (ASTM B221M), alloy 6063, temper as indicated, with anodized finish complying with to AAMA 611, or powder coating complying with AAMA 2603 or AAMA 2604 for select colors.

2. Wall-Mounted Shelf Standards: Channel type extruded aluminum standards mounted on walls and designed to hold shelf support brackets inserted into channel ends or access slots and slid to desired position.
 - a. Material: Extruded aluminum, ASTM B221 6063-T6 alloy and temper.
 - b. Lengths: As indicated on drawings.
 - c. Finish: Clear anodized.
 - d. Mounting: Surface.
- B. Shelving:
 1. Aluminum Shelves: Extruded aluminum sections with textured flat top and bottom ribs; ASTM B221 6063-T6 alloy and temper; finished on all surfaces.
 - a. Shelf Capacity: Uniform distributed load of 50 psf, minimum.
 - b. Shelf Deflection: 1/4 inch in 36 inches, maximum, under specified uniform load.
 - c. Shelf Thickness: 6/10 inch.
 - d. Shelf Length: As indicated on drawings.
 - e. Shelf Depth: To meet depths shown on drawings utilizing 4" and 6" sections.
 - f. Finish: Clear anodized.
- C. Fasteners: Screws as recommended by manufacturer for intended application or as otherwise required by project conditions. Finish of exposed to view fasteners to match finish of standards and other components.

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.
- B. Mount standards or brackets to solid backing capable of supporting intended loads.
- C. Install brackets, shelving, and accessories.

3.04 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

**SECTION 107300
SPECIALTIES MANUFACTURER OF PROTECTIVE COVERS**

PART 1 - GENERAL

1.01 DESCRIPTION OF PRODUCT

- A. Shelter Type: 12'X12' Rectangle Gable style shelter with Standing Seam roof panels.
- B. Roof Slope: 4:12
- C. Roof Decking: 2x6 Pre-finished tongue and groove.
- D. Clear height under Tie Beam (UTB): 8'-0". This is the clearance under the tie beam which spans between the columns.

1.02 REFERENCES

- A. REFERENCED STANDARDS
 - 1. AISC – American Institute of Steel Construction
 - a. AISC Steel Construction Manual – 14th edition
 - b. AISC 360-10 Specification for Structural Steel Buildings
 - 2. ASTM – American Society for Testing and Materials
 - a. ASTM A36/A36M – Standard Specification for Carbon Structural Steel; 2008
 - b. ASTM A325 – Standard Specification for Structural Steel Bolts, Heat Treated, 120/105 ksi Minimum Tensile Strength; 2010
 - c. ASTM A563 – Standard Specification for Carbon and Alloy Steel Nuts; 2007a
 - d. ASTM A500 – Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2010a
 - e. ASTM A653/A653M – Standard Specification for Sheet Steel, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process; 2010
 - f. ASTM A792/A792M – Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy Coated by the Hot-Dip Process; 2010
 - g. ASTM F1554 – Standard Specification for Anchor Bolts, Steel, 36, 50 and 105 KSI Yield Strength; 2007a
 - 3. AWS – American Welding Society
 - a. D1.1
 - b. D1.3
 - c. D1.8
 - 4. OSHA – Occupational Safety and Health Administration
 - a. Steel Erection Standard 29 CFR 1926.750 Part R
 - 5. SSPC – Steel Structures Painting Council
 - a. SSPC-SP 2 – Hand Tool Cleaning; 2004
 - b. SSPC-SP 10/NACE No. 2 – Near White Blast Cleaning; 2007
 - 6. ISO – International Organization for Standardization

1.03 SYSTEM DESCRIPTION

- A. The structure shall be a pre-engineered package and shall be shipped as a pre-cut (excluding standing seam roof panels) and pre-fabricated package that shall include the structural framing members, roof panels, fasteners, and roof trim as well as job-specific installation instructions. The structure will be shipped in an un-assembled package for ease of shipment and minimum shipping charges.

1.04 SUBMITTALS

- A. Submit a minimum of four (4) sets of submittal drawings and (2) sets of structural calculations signed and sealed by a Professional Engineer licensed in the state of South Dakota.
- B. PRODUCT DESIGN REQUIREMENTS:
 - 1. The structure shall meet the following design requirements:
 - a. Building Code: IBC 2018 South Dakota Building Code
 - b. Ground Snow Load: 50 p.s.f.

- c. Live Load: 20 p.s.f.
- d. Wind Speed: 90 m.p.h. Exp "C"
- e. Seismic Design Category: D

C. SUBMITTAL REQUIREMENTS

- 1. Calculations:
 - a. Design according to the requirements of the national, state, or local building codes as indicated in Section 1.04.B.
 - b. Calculations shall include all member designs for each different member type.
 - c. Connection design for each different connection that will determine the design of the bolts, welds, plate thickness, and anchorage to the foundation.
 - d. Foundation design shall be for the loads applied, not a generic foundation design while taking into account all soils information.
- 2. Submittal Drawings:
 - a. Anchor bolt layout with all appropriate dimensions for installation.
 - b. Site-specific foundation design.
 - c. Isometric as well as elevation and plan views of the farming members along with the member sizes and locations indicated on the drawings.
 - d. Connection details for every connection on the frame.
 - e. Roof panel connections and trim installation details.
 - f. All accessories on the structure shall have an installation detail as well as connection details.

D. FOUNDATION DESIGN

- 1. The foundation design shall be supplied by the manufacturer.
- 2. Anchor bolts shall be supplied by the manufacturer.
- 3. Foundation materials and labor shall be provided by the structure contractor.

1.05 QUALITY ASSURANCE

A. MANUFACTURER QUALIFICATIONS

- 1. The product shall be designed, engineered, and fabricated at a facility operated and directly supervised by the manufacturer.
- 2. The manufacturer shall have a minimum of 15 years in steel shelter fabrication.
- 3. Full Time on Staff Quality Assurance Manager.
- 4. All welders must be AWS certified for welding steel structures.
- 5. Membership in the American Welding Society (AWS).
- 6. Membership in the American Institute of Steel Construction (AISC).
- 7. Full Time on Staff Licensed Engineer.
- 8. Published Quality Control System manual.
- 9. Quality Control System must pass an annual audit by a Third Part Agency.
- 10. ISO 9001 certification for Powder Coating System.

1.06 FIELD OR SITE CONDITIONS

- A. Foundations shall be installed per the installation drawings.
 - 1. All foundations shall be cast at the same elevation unless specifically noted on the installation drawings.
- B. Anchor bolts shall be placed in the foundation as per the installation drawings utilizing the anchor bolt template supplied with the anchor bolts.
 - 1. Anchor bolts shall be installed per the dimensions and orientation shown on the drawings.

1.07 MANUFACTURER WARRANTY

- A. Shelter shall have a 10-year limited warranty on the steel framing members.
- B. Shelter shall have a 10-year limited warranty on the powder-coated elements.
- C. For all Metal Roofing there will be a pass-through warranty direct from the metal Roofing supplier, a warranty shall be provided on request.

PART 2 - MATERIALS

2.01 SHELTER SYSTEM AND MATERIALS

- A. MANUFACTURERS:
- B. Acceptable Manufacturer: ICON Shelter Systems, Inc., 1455 Lincoln Rd., Holland, MI, 49423. Email: info@iconshelters.com, Website: www.iconshelters.com.
- C. Pricing for this specific project and specified shelter can be requested from:
 - 1. Kyle Beckstead
 - a. 2131 16th St.
 - b. Fargo, ND 58102
 - c. 701-551-9210
 - d. kyle@parkandplayusa.com
- D. The product shall be designed and fabricated at a facility operated and directly supervised by the manufacturer.

2.02 SUBSTITUTION LIMITATIONS:

- A. Substitutions must be approved a minimum of ten (10) business days prior to bid. All approved manufacturers shall be notified on writing before the bid date and shall not be allowed to bid without written notification. Any approval of an alternate manufacturer shall be through an official bid addendum prior to the bid date.
- B. Alternate suppliers shall meet the requirements, qualifications and provide proof of certifications listed under Section 1.05 QUALITY ASSURANCE.
- C. Alternate suppliers shall provide documentation that the powder-coat system being provided meets or exceeds the powder-coat system listed under Section 2.03(H)(1).

2.03 PRODUCT REQUIREMENTS AND MATERIALS:

- A. GENERAL:
 - 1. The pre-engineered and pre-fabricated package of parts shall be pre-cut and packaged unless noted otherwise. These packages will include all parts and pieces necessary to field assemble the shelter at the job site. The shelter shall be shipped in knocked down format to minimize shipping expenses. Field labor will be kept to a minimum with no on-site welding required.
- B. CONCRETE FOR FOUNDATIONS:
 - 1. Concrete shall have a minimum 28-day compressive strength of 2,500 psi unless noted otherwise on the foundation detail.
 - 2. Reinforcing steel shall be ASTM A615, Grade 60.
- C. COLUMNS:
 - 1. Hollow Structural Section (HSS) columns shall meet ASTM A500, Grade B with a minimum wall thickness of 3/16" (0.1875").
 - 2. Unless the columns are directly buried in the foundation the columns shall attach to the foundation with a minimum of four (4) anchor rods and shall meet OSHA Steel Erection Standard 29 CFR 1926.755(a)(1).
- D. STRUCTURAL FRAMING:
 - 1. All Hollow Structural Sections (HSS) shall meet ASTM A500, Grade B. "I" Beams, tapered columns, or open channel sections shall not be accepted for primary members.
- E. COMPRESSION RINGS:
 - 1. Compression rings shall be made of ASTM A36 structural plate or of structural channel welded together to form the ring. All connections not requiring compression rings shall use ASTM A500, Grade B HSS sections for these connections.
- F. CONNECTION REQUIREMENTS:
 - 1. Anchor rods shall be ASTM F1554, Grade 36 unless otherwise noted.
 - 2. Structural fasteners shall be ASTM A325 high strength bolts and A563 nuts.
 - 3. All structural fasteners shall be hidden within the framing members whenever possible.
 - 4. No field welding shall be required to finish the construction of the shelter.

5. Manufacturer shall supply extra fasteners.
- G. ROOFING MATERIALS:
1. Standing seam roofing is to match architectural. See specification section 074113.
 2. All roof panel angles shall be cut in the field.
 3. Trim includes panel ridge caps, hip caps, eave "J" trim, splice channels, rake trim, roof peak cap, and corner trim as applicable for the model selected. Trim may need to be field cut to length. Please refer to the installation drawings for additional information and detail.
 4. Ridge, hip, and valley caps shall be pre-formed with a single central bend to match the roof slope and shall be hemmed on both edges.
 5. Roof peak caps shall be pre-fabricated with no field assembly required.
 6. Roofing is attached to sub-framing with clips.
- H. FACTORY FRAME FINISH:
1. E-COAT/ POWDERCOAT:
 - a. The steel shall be shot-blasted to the specification of SSPC-SP10 near-white blast cleaning. SSPC-SP2 hand tool cleaning will not be an acceptable alternative.
 - b. The shot-blasted parts are then washed with zinc-phosphate in an eight (8) stage washer.
 - c. The steel is then immersed in a liquid epoxy and coated through an electrodeposition process (E-coat), this is coated both inside and out to a uniform cover of 0.7-0.9 mils. The E-coat totally encapsulates the part for superior corrosion protection.
 - d. The parts are then coated with a color coat of TGIC polyester powder and then one clear coat for a final finish thickness of 8 to 12 mils.

PART 3 - EXECUTION

3.01 STORAGE AND HANDLING

- A. When the shelter arrives at the jobsite protect the products from weather, sunlight and damage.
- B. When unloading, pad the forks and use other precautions to protect the powder-coated finish. Do not use chains to move the materials, use straps. Handle all materials carefully in the field to avoid scratching the powder-coat finish.
- C. Contractor shall store the product elevated from the soil to allow full air circulation around the materials as do not introduce mold, decay, fungi or insects into or on the materials. One end of the materials shall be elevated higher than the other end if storage will be longer than a few days as to allow the water to run off the materials.

3.02 INSTALLATION OF MATERIALS

- A. The shelter shall be placed on prepared foundations that were designed by the manufacturer (unless otherwise noted). Materials for these foundations are not supplied by the manufacturer but by the foundation installation contractor. Foundation shall be constructed to all local building code requirements and per good construction practices for the specific site conditions.
 1. In accordance with OSHA Steel Erection Standard 29 CFR 1926.750 Part R, anchor rods shall be installed for proper column stability and shall have a minimum of four (4) anchor bolts per column. Therefore, no single anchor rod column base connections shall be allowed.
- B. The contractor shall install all parts and pieces per the manufacturer's supplied installation instructions and these specifications.
- C. The interface with other work required is to be coordinated by the customer or the customer's agent. Some designs may have electrical or plumbing requirements that are not supplied by manufacturer.
- D. Tolerances on structural steel members are set according to the AISC Code of Standard Practice for Steel Buildings and Bridges and have been used for the fabrication of this product. These tolerances will not and cannot be increased. No field slotting or opening of holes will be allowed without proper guidance from the manufacturer's Engineering Department.

3.03 REPAIR

- A. No field modifications or corrections are allowed without authorization from the manufacturer's Engineering Department.

END OF SECTION

**SECTION 107500
FLAGPOLES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Aluminum Flagpoles.

1.02 RELATED REQUIREMENTS

- A. Section 033000 - Cast-in-Place Concrete: Concrete base and foundation construction.

1.03 REFERENCE STANDARDS

- A. AASHTO M 36 - Standard Specification for Corrugated Steel Pipe, Metallic-Coated, for Sewers and Drains 2016 (Reapproved 2020).
- B. ASTM B241/B241M - Standard Specification for Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube 2016.
- C. NAAMM FP 1001 - Guide Specifications for Design Loads of Metal Flagpoles 2007.

1.04 SUBMITTALS

- A. Product Data: Provide data on pole, accessories, and configurations.
- B. Shop Drawings: Indicate detailed dimensions, base details, anchor requirements, and imposed loads.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Spiral wrap flagpole with protective covering and pack in protective shipping tubes or containers.
- B. Protect flagpole and accessories from damage or moisture.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Flagpoles:
 - 1. American Flagpole: www.americanflagpole.com/#sle.
 - 2. Concord Industries, Inc: www.concordindustries.com/#sle.
 - 3. Pole-Tech Co, Inc: www.polettech.com/#sle.
 - 4. Substitutions: See Section 016000 - Product Requirements.

2.02 FLAGPOLES

- A. Flagpoles: Designed in accordance with NAAMM FP 1001
 - 1. Material: Aluminum.
 - 2. Design: Cone tapered.
 - 3. Mounting: Ground mounted type.
 - 4. Outside Butt Diameter: 6 inches.
 - 5. Outside Tip Diameter: 3.5 inches.
 - 6. Nominal Wall Thickness: 0.156".
 - 7. Nominal Height: 25'; measured from nominal ground elevation.
 - 8. Halyard: Interior type.
- B. Performance Requirements:
 - 1. Wind Pressure Loading on Flagpole with Flag: Resistant without permanent deformation to 90 miles/hr wind speed, in accordance with NAAMM FP 1001; the factor of safety used is 2.5.

2.03 POLE MATERIALS

- A. Aluminum: ASTM B241/B241M , 6063 alloy , T6 temper.

2.04 ACCESSORIES

- A. Finial Ball: Stainless steel, 6 inch diameter.

- B. Truck Assembly: Cast aluminum; revolving, stainless steel ball bearings, non-fouling.
- C. Flag: 5 ft by 8 ft size, nylon fabric, brass grommets, hemmed edges.

2.05 OPERATORS

- A. Internal Rope w/Cam Cleat

2.06 MOUNTING COMPONENTS

- A. Foundation Tube Sleeve: AASHTO M 36, corrugated 16 gage, 0.0598 inch steel, galvanized, depth as indicated on detail or greater if required to meet design criteria.
- B. Pole Base Attachment: Flush; aluminum base with base cover.

2.07 FINISHING

- A. Aluminum: Natural Satin Finish: Provide directional-sanded satin finish (AA-M33); buff complying with AA-M20..

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that concrete foundation is ready to receive work and dimensions are as indicated on shop drawings.

3.02 INSTALLATION

- A. Install flagpole , base assembly, and fittings in accordance with manufacturer's instructions.
- B. Install foundation plate and centering wedges for flagpoles base set in concrete base and fasten.

3.03 TOLERANCES

- A. Maximum Variation From Plumb: 1 inch.

3.04 ADJUSTING

- A. Adjust operating devices so that halyard and flag function smoothly.

END OF SECTION

**SECTION 116813
PLAYGROUND EQUIPMENT**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Concrete footings for playground equipment.
- B. Playground equipment.

1.02 RELATED REQUIREMENTS

- A. Section 033000 - Cast-in-Place Concrete: Footings for playground equipment.

1.03 DEFINITIONS

- A. Play Event: A piece of playground equipment that supports one or more play activities.
- B. Use Zone: Area under and around a play event within which the ground surfacing must meet fall impact attenuation requirements of ASTM F1292 when tested at the fall height specified for the play event.
- C. Fall Height: Vertical distance between the finished elevation of the designated play surface and the finished elevation of the protective surfacing beneath it, as defined in ASTM F1487.
- D. Protective Surfacing: Resilient ground surfacing. The characteristics of the protective surfacing are based on the fall height of the playground equipment. Changes in either the surfacing or the fall height, particularly reducing the resilience of the protective surfacing or increasing the fall height, will reduce safety-related performance.
- E. Subgrade: Surface of the ground on which the protective surfacing is installed; the subbase for the protective surfacing is installed over the subgrade.

1.04 REFERENCE STANDARDS

- A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.
- B. ASTM A135/A135M - Standard Specification for Electric-Resistance-Welded Steel Pipe 2021.
- C. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes 2021a.
- D. ASTM A513/A513M - Standard Specification for Electric-Resistance-Welded Carbon and Alloy Steel Mechanical Tubing 2020a.
- E. ASTM B26/B26M - Standard Specification for Aluminum-Alloy Sand Castings 2018, with Editorial Revision.
- F. ASTM B108/B108M - Standard Specification for Aluminum-Alloy Permanent Mold Castings 2019.
- G. ASTM B179 - Standard Specification for Aluminum Alloys in Ingot and Molten Forms for Castings from All Casting Processes 2018.
- 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 C94/C94M - Standard Specification for Ready-Mixed Concrete 2021b.
- K. ASTM D648 - Standard Test Method for Deflection Temperature of Plastics Under Flexural Load in the Edgewise Position 2018.
- L. ASTM D3363 - Standard Test Method for Film Hardness by Pencil Test 2020.
- M. ASTM D6662 - Standard Specification for Polyolefin-Based Plastic Lumber Decking Boards 2017.
- N. ASTM F1292 - Standard Specification for Impact Attenuation of Surfacing Materials Within the Use Zone of Playground Equipment 2018, with Editorial Revision (2020).

- O. ASTM F1487 - Standard Consumer Safety Performance Specification for Playground Equipment for Public Use 2021.
- P. CPSC Pub. No. 325 - Public Playground Safety Handbook 2015.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Proposals for Substitutions: Substitutions that will increase fall height, platform height, or maximum equipment height will not be considered; submit shop drawings with proposed modifications clearly identified and sufficient information to determine compliance with specified criteria.
- C. Product Data: For manufactured equipment, provide manufacturer's product data showing materials of construction, compliance with specified standards, installation procedures, safety limitations, and the number of users permitted.
- D. Shop Drawings: Detailed scale drawings showing play event layout, Use Zone perimeters, and fall height for each play event.
- E. Samples: For each item that a color must be selected, provide color chart showing full range of colors and finishes.
- F. Maintenance Data: Provide manufacturer's recommended maintenance instructions and list of replaceable parts for each equipment item, with address and phone number of source of supply.
- G. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.06 QUALITY ASSURANCE

- A. Maintain one copy of the latest edition of ASTM F1487 and CPSC Pub. No. 325 at project site.
- B. Manufacturer Qualifications: Company regularly engaged in manufacturing materials and products specified in this section, with not less than Fifteen years of documented experience.
 - 1. Provide documentation showing that playground equipment similar to that specified has been installed in at least ten sites and in successful service for at least five years; provide addresses.
- C. Installer Qualifications: Company certified by manufacturer for training and experience installing play events and equipment.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, handle, and store equipment to project site in accordance with manufacturer's recommendations.
- B. Store materials in a dry, covered area, elevated above grade.

1.08 WARRANTY

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of playground equipment that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures.
 - b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
- C. Warranty Period: Two years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Playground Equipment:
 - 1. Landscape Structures, Inc.; www.playlsi.com

- a. Contact: Ken Follman, Dakota Fence; 800-726-4064, www.dakotafence.com
 - 2. Kompan; www.kompan.com
 - 3. GameTime, Inc.; www.gametime.com
 - 4. Miracle Recreation; www.miracle-recreation.com
 - 5. Substitutions: See Section 016000 - Product Requirements.
- B. Basis-of-Design Product: The design for each piece of playground equipment is based on the product named. Subject to compliance with requirements, provide either the named product or a comparable product by one of the other manufacturers specified.

2.02 PLAYGROUND EQUIPMENT - GENERAL

- A. Design Assumptions: Because the safety of the playground depends on strict compliance with design criteria, this information is provided for Contractor's information.
- 1. Playground has been designed for children ages 5 through 12.
 - 2. If deviations from specified dimensions, especially fall heights, is required, obtain approval prior to proceeding; follow approval request procedure as specified for substitutions.
- B. Mount equipment on concrete footings, unless otherwise indicated.
- 1. Playground protective surfacing constitutes a resilient layer installed over a subbase (non-resilient) that is installed over subgrade; top of footings and anchorage devices is to be covered by full depth of resilient portion of protective surfacing.
 - 2. Provide supports as required to mount equipment at proper height above finish and subgrades to allow installation of sufficient depth of protective surfacing; portion of support below top of surfacing must comply with specified requirements for equipment.
 - 3. Paint portion of support that is intended to be installed below top surface of protective surfacing a different color, or mark in other permanent way, so that installers and maintainers of protective surfacing can easily determine whether sufficient depth has been installed.
- C. Provide permanent label for each equipment item stating age group that equipment was designed for, manufacturer identification, and warning labels in accordance with ASTM F1487.

2.03 PLAYGROUND EQUIPMENT

- A. Comply with ASTM F1487 and CPSC Pub. No. 325; provide equipment complying with specified requirements for relevant age group(s).
- 1. Provide components having factory-drilled holes; do not use components with extra holes that will not be filled by hardware or covered by other components.
- B. Play Structure:
- 1. Basis-of-Design Product: As noted on plans.
 - 2. Color: As selected by Architect from manufacturer's full range.

2.04 MATERIALS

- A. Steel Pipe and Tube: Comply with ASTM A135/A135M, ASTM A500/A500M, or ASTM A513/A513M; hot-dipped galvanized and free of excess weld and spatter.
- 1. Tensile Strength: 45,000 psi, minimum.
 - 2. Yield Point: 33,000 psi, minimum.
 - 3. Galvanizing: Hot-dip metal components in zinc after fabrication, in accordance with ASTM A123/A123M; remove tailings and sharp protrusions and burnish edges.
- B. Extruded Aluminum: ASTM B221 or ASTM B221M, Alloy 6061, 6062, or 6063.
- 1. Tensile Strength: 39,000 psi, minimum.
 - 2. Yield Point: 36,500 psi, minimum.
- C. Cast Aluminum: ASTM B26/B26M, ASTM B108/B108M, or ASTM B179.
- D. Chain: Corrosion resistant zinc plated steel; minimum size 4/0; polyvinyl chloride (PVC) coating.
- E. Rope Cable: Strands of steel cable with UV-stabilized polypropylene synthetic covering; ends capped to prevent fraying.

- F. Hardware: Provide without hazardous protrusions, corners, or finishes, and that require tools for removal after installation; countersunk fasteners are preferred.
 - 1. Use stainless steel for metal-to-metal connections; select type to minimize galvanic corrosion of materials connected by hardware.
 - 2. Use stainless steel for wood-to-wood and wood-to-metal connections.
 - 3. Use stainless steel with plastic components.
 - 4. Bearings: Self lubricating.
 - 5. Hooks, Including S-Hooks: Closed loop; maximum gap 0.04 inches, less than the thickness of a dime.
 - 6. Rails, Loops, and Hand Bars: Same metal as item is mounted on or aluminum; with powder coating.
 - 7. Anchors: In accordance with manufacturer's recommendations.
- G. Opaque Plastic: Molded homogeneous plastic or wood-polymer composite lumber; do not use plastic as major load bearing members; use as deck boards, panels, and railings is acceptable.
 - 1. Homogeneous Plastic: Ultraviolet (UV) and color stabilized polyethylene without applied surface coating; color through entire thickness.
 - 2. Wood-Polymer Composite Lumber: Comply with ASTM D6662; factory finished.
 - 3. Decks and Platforms: Non-slip surface texture.
 - 4. Maximum Deflection: 1/360 of span, when tested in accordance with ASTM D648, with a uniform live load of 40 pounds/ft.
 - 5. Deck Board Span: 12 inches on center, maximum, spanning minimum of 3 joists.
 - 6. Panel Thickness: 3/16 inch, minimum.
 - 7. Panel Edges: 3/16 inch radius, minimum.
- H. Powder Coating for Steel: Electrostatically applied and oven cured polyester powder over electrostatic zinc coating.
- I. Polyvinyl Chloride (PVC) Coating: Ultraviolet (UV) stabilized and mold-resistant; slip-resistant finish; prime parts to be coated with clear acrylic thermosetting solution, and preheat prior to dipping in liquid PVC.
 - 1. Thickness: 0.08 inch, minimum, plus/minus 0.02 inch.
 - 2. Hardness: 85 durometer, when tested in accordance with ASTM D3363.
- J. Concrete: ASTM C94/C94M ready mix concrete; 28 days strength of 3,000 psi.

PART 3 EXECUTION

3.01 VERIFICATION OF CONDITIONS

- A. Verify that playground area has been graded to subgrade elevations required and that excess soil, rocks, and debris have been removed.
- B. Verify that playground equipment footings have been installed in proper locations and at proper elevations.
- C. Verify location of underground utilities and facilities in playground area; damage to underground utilities and facilities will be repaired at Contractor's expense.

3.02 PREPARATION

- A. Stake location of playground elements, including Use Zone perimeters, perimeter of protective surfacing, access and egress points, hard surfaces, walls, fences, and structures, and planting locations.
- B. Stake layout of entire Use Zone perimeter before starting any work and before subbase under resilient surfacing is laid.
 - 1. Verify that Use Zone perimeters do not overlap hard surfaces, whether currently installed or not.
 - 2. Verify that Use Zones are free of obstructions that would extend into resilient portion of protective surfacing.
 - 3. If conflicts or obstructions exist, notify Architect.

4. Do not proceed until revised drawings have been provided, showing corrected layout, and obstructions have been removed.

3.03 INSTALLATION

- A. Coordinate work with preparation for and installation of protective surfacing specified in Section 321816.13; install protective surfacing after playground equipment installation.
- B. Install concrete footings with top surface a minimum of 1/2 inch below required subgrade elevation.
- C. Install in accordance with CPSC Pub. No. 325, ASTM F1487, manufacturer's instructions, and requirements of authorities having jurisdiction (AHJ).
- D. Anchor equipment securely below bottom elevation of resilient surfacing layer.
- E. Install without sharp points, edges or protrusions, entanglement hazards, pinch, crush, or shear points.
- F. Do not modify play events on site without written approval of manufacturer.
- G. Install required signage if not factory-installed.

3.04 FIELD QUALITY CONTROL

- A. Owner or Owner's representative will inspect playground equipment after installation to verify that playground meets specified design safety and accessibility requirements.
- B. Repair or replace rejected work until compliance is achieved.

3.05 CLEANING

- A. Restore adjacent existing areas that have been damaged from the construction.
- B. Clean playground equipment of construction materials, dirt, stains, filings, and blemishes due to shipment or installation; clean in accordance with manufacturer's instructions, using cleaning agents as recommended by manufacturer.
- C. Clean playground area of excess construction materials, debris, and waste.
- D. Remove excess and waste material and dispose of off-site in accordance with requirements of authorities having jurisdiction (AHJ).

3.06 PROTECTION

- A. Protect installed products until Date of Substantial Completion.
- B. Replace damaged products before Date of Substantial Completion.

END OF SECTION

**SECTION 116833
ATHLETIC FIELD EQUIPMENT**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Outdoor basketball equipment.
- B. Pickleball court equipment.

1.02 RELATED REQUIREMENTS

- A. Section 033000 - Cast-in-Place Concrete: Footings for field equipment.

1.03 ABBREVIATIONS

1.04 REFERENCE STANDARDS

1.05 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meetings: Convene a meeting one week before starting this work to discuss coordination between various installers.
 - 1. Notify Architect at least two weeks prior to meeting.

1.06 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide athletic field equipment manufacturer's product data indicating materials of construction, compliance with specified standards, installation procedures, and necessary safety limitations.
- C. Shop Drawings: Submit detailed scale drawings showing athletic field equipment and perimeter layout.
- D. Samples: Submit color chart for each item that color must be selected showing full range of colors and finishes.
- E. Maintenance Data: Submit manufacturer's recommended maintenance instructions and list of replaceable parts for each athletic field equipment item, along with supplier's address and phone number.
- F. Manufacturer's Qualification Statement.
- G. Installer's Qualification Statement.
- H. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.07 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, handle, and store equipment on project site in accordance with manufacturer's recommendations.
- B. Store materials in a dry, covered area, and elevated above grade.

1.09 WARRANTY

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. Provide minimum 5 year manufacturer warranty for athletic field equipment.

PART 2 PRODUCTS

2.01 ATHLETIC FIELD EQUIPMENT - GENERAL

2.02 OUTDOOR BASKETBALL EQUIPMENT

- A. Manufacturer:
 1. Bison Inc..
 2. Substitutions: See Section 016000 - Product Requirements.
- B. Model: #PR98UHT; Ultimate Hangtime Adjustable System
 1. 42" x 72" polycarbonate backboard.
 2. Outdoor flex rim.
 3. Include crank lock.
- C. Warranty: 10-year limited on pole; lifetime on backboard.

2.03 PICKLEBALL COURT EQUIPMENT

- A. Manufacturer:
 1. Douglas Sports: <https://douglas-sports.com/>.
 2. Substitutions: See Section 016000 - Product Requirements.
- B. Outdoor Pickleball Posts:
 1. Model: Premier RD-36 pickleball posts item #63070p with three inch (3") round pickleball posts and three inch (3") corresponding ground sleeves (model gs-24, item #63424)
 2. Finish: black powder coat finish
- C. Pickleball Net:
 1. Model: PN-30, Item #20103)

2.04 DISC GOLF BASKET

- A. Manufacturer:
 1. DGA: <https://discgolf.com/>.
 2. Substitutions: See Section 016000 - Product Requirements.
- B. Model: Mach5
 1. 24 Strands And 3 Successive Rows Of Heavy-Duty Chain

2.05 MATERIALS

- A. Hardware: Provide design without hazardous protrusions, corners, or finishes, and requiring tools for removal after installation; countersunk fasteners are preferred.
 1. Use stainless steel for metal-to-metal connections; select type to minimize galvanic corrosion of materials connected by hardware.
 2. Use stainless steel for wood-to-wood and wood-to-metal connections.
 3. Use stainless steel with plastic components.
 4. Hooks, Including S-Hooks: Closed loop; maximum gap 0.04 inches.
 5. Rails and Loops: Same metal as item is mounted on, or aluminum; with powder coating.
 6. Anchors: In accordance with manufacturer's recommendations.
- B. Concrete: As specified in Section 033000.

PART 3 EXECUTION

3.01 VERIFICATION OF CONDITIONS

- A. Verify that athletic field equipment footings have been installed in proper locations and at proper elevations.

3.02 PREPARATION

- A. Stake location of athletic field equipment elements, including necessary athletic field perimeters, surfacing, access and egress points, hard surfaces, walls, fences, and/or structures.
- B. Stake layout of athletic field equipment perimeter in accordance with approved shop drawings before starting any work.
 1. Verify that athletic field perimeters do not overlap hard surfaces, whether currently installed or not.
 2. Verify that athletic fields are free of obstructions.
 3. If conflicts or obstructions are found, notify Architect.

4. Do not proceed with this work until revised drawings have been provided, showing corrected layout, and that any obstructions have been removed or corrections to layout have been made.

3.03 INSTALLATION

- A. Install athletic field equipment in accordance with manufacturer's instructions, and rules and regulations of specified athletic association indicated for this work.
- B. Install athletic field equipment without sharp points, edges, or protrusions; entanglement hazards or pinch, crush, or shear points.

3.04 CLEANING

- A. Clean athletic field equipment of construction materials, dirt, stains, filings, and blemishes due to shipment or installation; clean in accordance with manufacturer's instructions, using cleaning agents as recommended by manufacturer.
- B. Clean athletic field area of excess construction materials, debris, and waste.
- C. Remove excess and waste material and dispose of off-site in accordance with requirements of authorities having jurisdiction.

3.05 PROTECTION

- A. Protect installed products until Date of Substantial Completion.
- B. Replace damaged products before Date of Substantial Completion.

END OF SECTION

SECTION 123600 COUNTERTOPS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Wall-hung counters and vanity tops.

1.02 REFERENCE STANDARDS

- A. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar 2015.

1.03 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 .
- D. Verification Samples: For each finish product specified, minimum size 6 inches square, representing actual product, color, and patterns.
- E. Installation Instructions: Manufacturer's installation instructions and recommendations.
- F. Maintenance Data: Manufacturer's instructions and recommendations for maintenance and repair of countertop surfaces.

1.04 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.

1.05 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.

1.06 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. Stainless Steel Countertops: , Type 304, stainless steel sheet; 16 gauge, 0.0625 inch nominal sheet thickness.
 - 1. Finish: 4B satin brushed finish.
 - 2. Exposed Edge Shape: Bullnose with return; 5/8 inch radius, return to face of case; reinforced with hardwood or steel.
 - 3. Back and End Splashes: Same material; welded 1/4 inch radius coved joint to countertop; square top edge with 1 inch wide top surface and minimum 1/2 inch turndown.
 - 4. Splash Dimensions: 4 inch high by 1 inch thick, unless otherwise indicated.

2.02 MATERIALS

- A. Adhesives: Chemical resistant waterproof adhesive as recommended by manufacturer of materials being joined.
- B. Joint Sealant: Mildew-resistant silicone sealant, clear.

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. Stainless Steel: Fabricate tops up to 144 inches long in one piece including nosings and back and end splashes; accurately fitted mechanical field joints in lengths over that dimension are permitted.
 - 1. Weld joints; grind smooth and polish to match.
 - 2. Provide stainless steel hat channel stiffeners, welded or soldered to underside, where indicated on drawings.
 - 3. Provide wall clips for support of back/end splash turndowns.
 - 4. Sound Deadening: Apply water resistant, fire resistant sound deadening mastic to entire bottom surface.

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. Attach stainless steel countertops using stainless steel fasteners and clips.
- B. 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

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DIVISION 23 – HEATING, VENTILATION AND AIR CONDITIONING

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DOMESTIC PLUMBING WORK SHALL INCLUDE:

SECTION 22 0700, 22 4000
& SECTIONS 22 0500, & 22 0510 AS APPLIES

VENTILATION AND AIR CONDITIONING WORK SHALL INCLUDE:

SECTION 23 0700, 23 7000
& SECTIONS 23 0500, & 23 0510 AS APPLIES

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.

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, gas, and sewer work with local utility, owner, and other contractors to minimize disruption and downtime. Clarification to the Bidding – ANY AND ALL CHARGES ASSESSED BY THE 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

- A. Furnish verbal and engineer approved written instructions to Owner on all systems. Instruction shall include operating procedures, adjustments, and periodic maintenance. Furnish a copy of the written instructions and attach a letter to the Engineer, prior to final inspection, signed by Owner, attesting to date and satisfaction of instructions.

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 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 owner's 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 contractor's 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 Construction Manager. Before making any cuts, verify exact locations and sizes with the Construction Manager 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.
- 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. Moistened 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. The Mechanical Contractor shall test and balance all mechanical systems.

- E. A complete test shall be made of each system, adjusting fan speeds, dampers and registers so as to get the air flow called for on the plans. Pulleys shall be adjusted or changed so as to get the total air flow from each fan unit. Any additional dampers, which may be required to balance the system shall be furnished and installed by this contractor. After balancing each system, the contractor shall take readings of air flow from each opening and submit the tabulation to the engineer for approval. Tabulation shall show register size, required CFM, measured velocity and actual CFM. Balance report shall be included in the O&M Manuals.

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 equipment, 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 laminated three-layer plastic with engraved white 1/2 inch letters, and screwed or riveted to the equipment. Manufactured by Brady, Champion America, Inc., Seton.
- B. Piping shall be identified as to contents and flow direction with plastic, color coded, snap-on Seton labels. Pipes shall be labeled at each equipment connection, locate identification not to exceed 40 feet on straight runs including rises and drops, adjacent to each valve, and at each side of penetration of structure or enclosure, and at each obstruction.
- C. Valve tags shall be brass with stamped letters, tag size 1-1/2" minimum in diameter.
- D. Color coated tacks shall be installed on the ceiling grid to indicate all valves or equipment in accessible ceiling requiring service.

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. Floor Drains: Wade, Zurn, Smith, Josam, Ancon, Watts.
2. Valves: Crane, Hammond, Watts, Rockwell, Milwaukee Valve Co., Mueller.
3. Plumbing Fixtures: American Standard, Kohler, Crane, Elkay, Just, Zurn, Fita
4. Fixture Brass: American Standard, Kohler, Zurn, Sloan, T & S Brass, Chicago, Bradley, Swan, Woodford Mfg.
5. Flush Valves: Zurn AquaVantage, Sloan, American Standard
6. Lav Premolded Insulation Kit: Plumberex, Truebro
7. Toilet Seats: Kohler, Church, Beneke, Bemis, Olsonite
8. Bottle Fillers & Drinking Fountains: Elkay
9. Electric Water Heaters: AO Smith, Bradford White, PVI, Lochinvar, State Industries
10. Thermostatic Mixing Valves: Honeywell, Lawler, Watts
11. Domestic Water Expansion Tank: B&G, Taco, Wessels, Watts, Armstrong, Thrush
12. Triplex Iron Filtration System: Water Control Corp

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: Plumbing, and HVAC.
- 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. 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.
- B. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.
- C. 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.
- D. 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.
- E. 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.

- F. All mechanical systems shall be tested and cleaned as required by Authority Having Jurisdiction.
- G. 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.
- H. Upon completion of the work, the Contractor shall notify the A/E and make arrangements for a final inspection. Contactor shall provide A/E with copy of all required balance reports prior to the final inspection.
- I. After the final inspection is made, the Contractor will receive a list of items requiring adjustment, correction, replacement, or completion.
- J. 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 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. 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 welder shall be qualified in accordance with ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
- C. Plastic vent piping is not allowed above any ceiling in a return air plenum.
- D. 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.

- B. General: Refer to Part 3 "Piping Applications" Article for applications of pipe and fitting materials.

2.2 DOMESTIC WATER SERVICE

- A. Domestic water piping below ground shall be soft drawn copper water tube: ASTM B 88, Types K, water tube, annealed temper.
 - 1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings.
- B. Furnish and install sleeves, 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/tanks/structures such that all the underground service can be located.

2.3 SANITARY WASTE, AND VENT 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.
 - 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.
 - 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 and shall confirm that depth of existing sewer is such that the building sewer services will drain into it by gravity. If existing sewer is not deep enough, the contractor shall notify the engineer at once.

2.4 DOMESTIC WATER (HOT, AND COLD WATER) IN BUILDING ABOVE GROUND

- A. Piping shall be by Type "L" hard drawn copper water tube. Fittings wrought copper, solder joints. Joints 95-5 or lead free solder.
- B. In irrigation shed only: domestic cold water piping shall be uninsulated Aquatherm Green Pipe non-MF SDR 11 provided the contractor is trained and following all manufacturer's recommendations thus fulfilling all available Aquatherm warranty coverage.

2.5 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.

2.6 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.

2.7 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.

2.8 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.

2.9 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.

2.10 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 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.

3.1 PIPING APPLICATIONS

- A. Coordinate applications below with materials specified in this Section.
- B. Aboveground/Belowground Domestic Cold Water Piping in irrigation shed only to be Aquatherm Green Pipe non-MF SDR 11.
- C. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.
- D. Installers shall be trained and certified to install the pipe according to the manufacturer's guidelines. Contact your local Aquatherm representative for training.
- E. Install listed pipe materials and joining methods below in the following applications:
- F. Underground Piping: Polypropylene (PP-R) piping in non-MF SDR 11 or MF SDR 7.4 per manufacturer's instructions and ASTM D2774.
- G. Aboveground: Polypropylene (PP-R) piping in non-MF SDR 11 or MF SDR 7.4 based on the required minimum pressure rating and use temperature, in accordance with manufacturer's instructions and ASTM F2389.
- H. Installation must be accomplished with the proper tools for installing Aquatherm piping following manufacturer's instructions.
- I. Install hydronic piping level and plumb.
- J. 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.
- K. Fusion welding of joints:
 - 1. Electrofusion joints shall not be acceptable.
 - 2. Install fittings and joints using socket-fusion, or butt-fusion as applicable for the fitting or joint type. All fusion-weld joints shall be made in accordance with the pipe and fitting manufacturer's specifications and product standards.
 - 3. Fusion-weld tooling, and welding machines shall be as specified by the pipe and fittings manufacturer.
 - 4. Prior to joining, the pipe and fittings shall be prepared in accordance with ASTM F 2389 and the manufacturer's specifications.
 - 5. Joint preparation, setting and alignment, fusion process, cooling times and working pressure shall be in accordance with the pipe and fitting manufacturer's specifications.

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.

3.3 PIPING INSTALLATIONS

- A. Fire stopping shall be provided to both be compatible with the Aquatherm Piping and meet the requirements of ASTM E 814 or ULC S115 , "Fire Tests of Through-Penetration Firestops". Pipe insulations or fire resistive coating shall be removed where the pipe passes through a fire stop and, if required by the firestop manufacturer, for 3 inches beyond the firestop outside of the fire barrier.
- B. When installed in systems with pumps in excess of 7.5 HP, piping shall be protected from excessive heat generated by operating the pump at shut-off conditions. Where the possibility exists that the pump will operate with no flow, the protection method shall be a temperature relief valve or comparable level of protection, set to a maximum temperature of 185°F.
- C. Locate groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.
- D. 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.
- E. Install piping at a uniform grade of 0.2 percent upward in direction of flow. Install condensate piping at a uniform grade of ¼ inch per foot downward in direction of flow.
- F. Reduce pipe sizes using eccentric reducer fitting installed with level side up.
- G. Install branch connections to mains using tee fittings in main pipe, with the takeoff coming out the bottom of the main pipe. For up-feed risers, install the takeoff coming out the top of the main pipe.
- H. 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.
- I. Install flanges on valves, apparatus, and equipment having 2-1/2-inch NPS (DN65) and larger connections.
- J. Install flexible connectors at inlet and discharge connections to pumps (except in-line pumps) and other vibration-producing equipment.
- K. 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.
- L. Anchor piping for proper direction of expansion and contraction.
- M. Aquatherm piping shall be installed in accordance with Aquatherm's installation requirements to ensure warranty compliance.

3.4 HANGERS AND SUPPORTS

- A. Install the following pipe supports:
 - 1. Vertical Piping: MSS Type 8 or 42, clamps.
 - 2. Individual, Straight, Horizontal Piping Runs:
 - a. Adjustable, steel clevis hangers.
 - b. Clamps on strut trapeze.
 - c. Clamps on strut attached to structure.
 - d. Clamps attached directly to the structure.
 - 3. Base of Vertical Piping: MSS Type 52, spring hangers.
- B. Support vertical piping and tubing at base and at each floor. For piping 2" (63mm) or smaller, install mid-story guides.

- C. Install hangers and supports at intervals specified in the applicable Plumbing Code and/or as recommended by pipe manufacturer.
- D. Hangers and supports shall also be provided within 1-foot of every change of direction and within 1-foot of any pipe fittings and valves.
- E. For hot water piping, provide clamps and supports that are felt or rubber/vinyl coated or lined.
- F. For cold water piping supports and clamps may be bare metal. Ensure that the clamp or support does not have sharp edges that may scrape or gouge the piping.
- G. Use care when installing riser clamps to not over tighten the clamps to cause indentation of the pipe. Riser clamps shall be isolated from the building structure by placing felt or rubber pads between the clamp and the structure.
- H. All piping support materials shall be new and manufactured for the specific purpose of supporting systems, equipment, pipes and accessories. No improvised pipe support solutions shall be allowed.
- I. Piping systems shall not have direct contact with the building structure. Provide isolation at tub and shower valves and pipes passing through studs, joists or plates.
- J. 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.

3.5 PRESSURE TESTING

- K. While still accessible all piping shall be pressure/leak tested to the manufacturer's standards.
- L. Tests shall be carried out using water, compressed air or a mixture of the two. The test pressure shall be as indicated in the pressure leak testing procedures required by the manufacturer.
- M. Any leaks detected shall be repaired at the contractor's expense by removing the leaking part and replacing with new parts welded per the pipe manufacturer's guidelines. See www.aquatherm.com for additional details and forms.

3.6 INSPECTING AND CLEANING

- N. The pipes shall be flushed with cold water after finishing the installation. Flush the system until the water runs clear of debris and dirt.

- O. Inspect and test piping systems following procedures of authorities having jurisdiction and as specified by the piping system manufacturer.
- P. Clean and disinfect water distribution piping following procedures of the manufacturer and/or the authority having jurisdiction.

3.2 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 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 SUMMITTALS

- 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.

PART 2 - PRODUCTS

2.1 DOMESTIC COLD, AND HOT 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 HP, 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 Zeston 2000 PVC (1lb/cu. ft. density).
- D. 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.
- E. Provide sheet metal insulation shields at all hanger locations.

- F. Provide with valve stem extensions on cold water valves and fully encompass cold water valves in insulation.

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 pip

ing. 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.

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. Domestic Water Systems Including Service Stub Outs
 - 2. Lawn Irrigation Stub Outs
 - 3. Plumbing Fixtures
 - 4. Soil, Waste, Sanitary Drainage, and Vent Piping
- B. The plumbing work shall be installed in strict accordance with all applicable local, state, national plumbing regulations, and authority having jurisdiction.

- C. **All plumbing shall be installed with piping graded and drain valves located at low points in the piping system to facilitate the winterization of the system. Gravity drainage to be provided and in addition, provisions shall be installed to drain piping system using compressed air. Prior to installation, plumbing contractor shall meet with owner's representative & engineer to discuss winterization strategy. Plumbing contractor shall submit winterization instructions with O&M's to owner/engineer.**

1.3 SUBMITTALS

- A. Shop drawings as specified in Section 22 0500 shall include the following:
 - 1. Domestic Water Service Stub Out Piping
 - 2. Lawn Irrigation Service Stub Out Piping (See detail for Materials)
 - 3. Domestic Water System Piping
 - 4. Sanitary Waste & Vent System Piping
 - 5. Dual Check Back Flow Prevention Assemblies
 - 6. Triplex Iron Filtration System
 - 7. Plumbing Fixtures including Carriers
 - 8. Floor Drains
 - 9. Floor Sinks
 - 10. Cleanouts
 - 11. Shock Absorbers
 - 12. Electric Water Heaters
 - 13. Domestic Water System Expansion Tanks
 - 14. Thermostatic Mixing Valves (at tank & at fixtures)

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 DOMESTIC WATER SERVICE STUB OUTS

- A. Provide new water service stub outs 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. 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.

2.3 SANITARY SEWER SERVICES

- A. Provide new sewer services 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.

2.4 TRIPLEX IRON FILTRATION SYSTEM

- A. General: System shall be a Water Control Corporation model IFL-16 Commercial Iron Filtration system, designed to handle a peak flow rate of 33 gpm at a pressure loss not exceeding 4 psi. System will have an iron removal capacity sufficient to allow for regeneration no more than once every 3 days.
- B. Resin Tanks: The system shall incorporate 1 resin tank, a minimum of 16 inches in diameter. The tank volume shall be sufficient to allow a minimum freeboard space of 50 percent of the resin depth for adequate expansion of the resin during backwashing. The resin tank shall be designed for an operating pressure up to 125 psi and shall be manufactured of fiberglass reinforced polyester, reinforced with a continuous roving glass filament overwrap. Tank shall have a molded polypropylene base for support.
- C. Distributor System: The resin tank shall be equipped with a hub and lateral type distributor system, with a plastic riser pipe and a fine slotted bottom distributor assembly.
- D. Media: The resin tank shall be provided with 3 cubic feet of high capacity Zeolite media each tank. The media shall be manufactured to comply with the food additive regulation, paragraph 121.1148 of the Food and Drug Administration.
- E. Automatic Controls: The resin tank shall incorporate a top mounted control valve. The control valve shall be of all brass construction, multi-port for maximum flow, and have a 2 inch NPT inlet and outlet connection. The control valve shall be motor driven, top mounted, mechanically activated design with three positions to accomplish the regeneration steps of backwash, air bath, and service. The control will be fitted with an air injector assembly, and a self adjusting backwash flow control. System regeneration shall be controlled by an integral 12-day time clock.

- F. Electrical Requirements: Valve (1 total per tank) shall be pre-wired with a 2-prong plug, complete with in-line 5 Amp breaker, for GFI wall outlet connection. Unit shall operate at 120 VAC, 1.3 Amps FLA, 60 Hz.
- G. Drain Requirements: The contractor shall provide a mechanical room floor drain, sized to adequately handle 15 GPM of backwash effluent.
- H. Warranty: WCC shall warrant the control valve, plastic brine tank(s) and fiberglass-reinforced resin tank(s) to be free of manufacturers defects for the lesser of 18 months from shipment or 12 months from system startup. Full warranty details available for review at www.watercontrolinc.com.
- I. Install per manufacturer's recommendations.

2.5 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.

2.6 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.

2.7 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.

2.8 CLEANOUTS

- 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.

2.9 ROOF JACKET

- A. Roof extension from soil, waste, and vent pipes shall be extended at least 12 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.

2.10 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. Indicate installed locations on as-built drawings.

2.11 ELECTRIC HOT WATER HEATERS

- A. Furnish and install water heaters where shown on the Drawings. Type, size, and performance shall be as tabulated in the schedule and on the drawings. Equip tank with ASME rated temperature pressure relief valve. Unit shall be UL listed and exceed the minimum efficiency requirements of ASHRAE/IES 90.1b-1992. Provide & install thermostatic mixing valve and other accessories as scheduled on the plans.

2.12 WATER SYSTEM EXPANSION TANKS

- A. Furnish and install water system expansion tanks where indicated. Domestic water system expansion tanks shall have characteristics as scheduled.

2.13 THERMOSTATIC MIXING VALVE AT SOURCES

- A. Furnish and install point of distribution Honeywell AMX thermostatic mixing valve or equal where shown on plans.
- B. Furnish and install point of use thermostatic mixing valves at fixtures where shown on plans.

2.14 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.
- C. All plumbing shall be installed with piping graded and drain valves located at low points in the piping system to facilitate the winterization of the system. Gravity drainage to be provided and in addition, provisions shall be installed to drain piping system using compressed air. Prior to installation, plumbing contractor shall meet with owner’s representative & engineer to discuss winterization strategy. Plumbing contractor shall submit winterization instructions with O&M’s to owner/engineer.

2.15 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.

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.

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. Clarification to the Bidding - ANY AND ALL CHARGES ASSESSED BY THE 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

- A. Furnish verbal and engineer approved written instructions to Owner on all systems. Instruction shall include operating procedures, adjustments, and periodic maintenance. Furnish a copy of the written instructions and attach a letter to the Engineer, prior to final inspection, signed by Owner, attesting to date and satisfaction of instructions.

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 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 owner's 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 contractor's 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 Construction Manager. Before making any cuts, verify exact locations and sizes with the Construction Manager 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.
- 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. The Mechanical Contractor shall test and balance all mechanical systems.
- E. A complete test shall be made of each system, adjusting fan speeds, dampers and registers so as to get the air flow called for on the plans. Pulleys shall be adjusted or changed so as to get the total air flow from each fan unit. Any additional dampers, which may be required to balance the system shall be furnished and installed by this contractor. After balancing each system, the contractor shall take readings of air flow from each opening and submit the tabulation to the engineer for approval. Tabulation shall show register size, required CFM, measured velocity and actual CFM. Balance report shall be included in the O&M Manuals.

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 equipment, 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 laminated three-layer plastic with engraved white 1/2 inch letters, and screwed or riveted to the equipment. Manufactured by Brady, Champion America, Inc., Seton.
- B. Piping shall be identified as to contents and flow direction with plastic, color coded, snap-on Seton labels. Pipes shall be labeled at each equipment connection, locate identification not to exceed 40 feet on straight runs including rises and drops, adjacent to each valve, and at each side of penetration of structure or enclosure, and at each obstruction.
- C. Valve tags shall be brass with stamped letters, tag size 1-1/2" minimum in diameter.
- D. Color coated tacks shall be installed on the ceiling grid to indicate all valves or equipment in accessible ceiling requiring service.

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. Registers, Grilles, & Diffusers: Metalaire, E.H. Price, Tuttle & Bailey, Titus, Krueger, Nailor, Hart & Cooley, Anemostat, Nailor, J & J Register, Air Specialties Express/Carnes
 - 2. Exhaust Fan: Penn, Greenheck, Loren Cook, ACME, ILG Air Specialties Express/Carnes, Soler & Balau, Twin City Fan, Aerovent

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: Plumbing, and HVAC.
- 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. 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.
- B. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.
- C. 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.
- D. 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.
- E. 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.
- F. All mechanical systems shall be tested and cleaned as required by Authority Having Jurisdiction.
- G. 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.
- H. 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.
- I. After the final inspection is made, the Contractor will receive a list of items requiring adjustment, correction, replacement, or completion.
- J. 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. 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 welder shall be qualified in accordance with ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
- C. Plastic vent piping is not allowed above any ceiling in a return air plenum.
- D. 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 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.

3.2 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 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 exhaust air ducts.
 - 2. 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 SUMMITTALS

- 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.

PART 2 - PRODUCTS

2.1 DUCTWORK INSULATION

- A. RIGID BOARD DUCT INSULATION: 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: 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: Provide staples, bands, wires, tape, anchors, corner angles and similar accessories as recommended by insulation manufacturer for applications indicated.
- D. DUCTWORK INSULATION COMPOUNDS: 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. Insulation thickness and type shall be as follows:

1. Rectangular & Round Exhaust Air Duct Insulation shall be exterior insulated and 2" thick (all exhaust ductwork in mechanical rooms).
2. Exposed ductwork must use rigid insulation.

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 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 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 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.

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. This contractor to be responsible for all cooling condensate drainage piping for FC-1, & FC-2.

1.3 SUBMITTALS

- A. Shop Drawings: Shop drawings as specified in Section 23 0500 shall include the following:
 - 1. In-Line Exhaust Fans
 - 2. Louvers (3 hard copies of color charts)
 - 3. Registers, Grilles, and Diffusers

PART 2 - PRODUCTS

2.1 INTERNAL DUCT INSULATION

- A. See HVAC Systems Insulation.
- B. 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. 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.
- B. 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	Galvanized Sheet
Diameter of Round	Steel Gauge Number
<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

- C. 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.
- D. 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.
- E. 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.
- F. 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.
- G. Where interior duct insulation is required, increase the duct size to maintain the free area shown on the Drawings.
- H. Provide exterior insulated internal 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 and louvers. Drip pans to be soldered watertight.
- I. 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.
- J. 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.
- K. 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.
- L. 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.

- M. 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.
- N. All ductwork visible through the face of a register or grille shall be painted with a flat black paint.
- O. 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.
- P. Concealed low pressure round ductwork may be rigid spiral ductwork or snaplock type with adjustable elbows.
- Q. All exposed ductwork in the specified areas to be PAINTGRIP and shall be United, Semco, Norlock, Foremost or equal, rigid spiral duct and fittings.
- 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. 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.

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 Elgen Super Standoff with 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. Slope final 6" of adjacent duct to louver and seal bottom 3" watertight.
- 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, fire 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.

2.6 CURBS AND FLASHING

- A. Furnish and install curbs where shown on the Drawings.
- B. All roof mounted equipment and curbs shall match color of asphalt shingles or metal roof By Metal Roof Alternate. Color to be selected by Architect.
- C. By Metal Roof Alternate, the metal roofing contractor will provide and install metal roof curb to maintain roofing warranty. It shall be the responsibility of this ventilation contractor to provide mechanical equipment info, help the metal building contractor with dimensions/pitch, and review the metal building contractor's curbs prior to him ordering/constructing, and help coordinate exact location.
- D. Curb on all roof-mounted equipment shall be fully insulated.
- E. Curbs on equipment with fresh air intake shall be minimum 18" high.
- F. Flashing will be provided under the General Contract.
- G. Roofing work to be by the roofing contractor.
- H. Coordinate the roof slope with construction manager prior to submitting shop drawings.

2.7 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.

2.8 STATIONARY LOUVERS

- A. Furnish and install louver 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.

2.9 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.

END OF SECTION 23 7000

SECTION 260000 – SUMMARY OF WORK

1.1 GENERAL

1.2 RELATED DOCUMENTS

The following specification sections are included as part of this specification package.

1. Section 260000, Summary of Work
 2. Section 260010, Basic Procedural Methods
 3. Section 260050, Basic Electrical Materials and Methods
 4. Section 260519, Low-Voltage Conductors and Cables
 5. Section 260526, Grounding and Bonding for Electrical Systems
 6. Section 260533, Raceways and Boxes for Electrical Systems
 7. Section 262416, Panelboards
 8. Section 262726, Wiring Devices
 9. Section 262813, Fuses
 10. Section 262816, Enclosed Switches and Circuit Breakers
 11. Section 265668, Exterior Athletic Lighting
- A. The Project consists of; providing all necessary electric materials and labor as required for the successful electrical construction associated with a new Park and Ballfield.
1. Project Location: Columbia, SD
 2. Owner: City of Columbia
- B. Contract Documents, were prepared for the Project by PE Group, Inc., 225 North Main Avenue, PO Box 567, Parker, SD 57053-0567.
- C. Use of the Site: Limit use of premises to areas indicated. Do not disturb portions of the site beyond the areas indicated.
1. Allow for Owner occupancy and use by the public
 2. Keep driveways and entrances clear. Do not use these areas for parking or material storage. Schedule deliveries to minimize on-site storage of materials and equipment.

PART 2 - PRODUCTS (Not Applicable)

PART 3 -EXECUTION

3.1 SCOPE OF WORK

1. Provide all material and labor necessary to complete the work indicated on/in the project drawings and specifications documents. This shall include, but not be limited to, the following:

- a. Furnish and install new 120/240V, 1 phase 3 wire electric services, 120/240V Electric Gear, Raceway Systems, Wiring Systems, Concrete, Electrical Devices, startup services, Crane Rental. and other Electrical Systems/services as required.
2. Coordinate electric service work with local electric utility. Any and all costs assessed by the electric utility to provide service to this facility shall be included in the Electrical Contractor's bid.

PART 4 – SPECIAL INFORMATION/REQUIREMENT

4.1 RESOLUTION OF DISCREPANCIES

1. If discrepancies are found to exist between the project drawings and project specifications, the more restrictive and obligatory document shall prevail as the project requirement.
2. If discrepancies are found to exist between the requirements of these Electrical Specifications and the Specification Front End Documents (Bidding Requirements-Agreement, Bonds, and Closeout Documents-Project Forms-Conditions of the Contract, etc.), the more restrictive and obligatory document/section(s) shall prevail as the project requirement.

END OF SECTION 260000

SECTION 260010 - BASIC PROCEDURAL METHODS

This Section of Specification contains several subsections. These subsections are listed below:

- I. REQUEST FOR PRIOR APPROVAL
- II. SHOP DRAWINGS AND PRODUCT DATA
- III. REFERENCE STANDARDS AND DEFINITIONS
- IV. PROJECT RECORD DOCUMENTS
- V. OPERATION AND MAINTENANCE DATA
- VI. WARRANTIES

I. REQUEST FOR PRIOR APPROVAL

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. The only products and manufacturers allowed to be used under this contract are those that are specified, those listed as approved equals in the contract documents or those given “prior approval” during the bidding stage of this project.
- B. This Section includes administrative and procedural requirements pertaining to requests for prior approval to bid and utilize products that are not specifically specified or listed as an equal in the original construction documents.

1.3 SUBMITTAL PROCEDURES

- A. 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. The procedure for this submittal is listed below.
 - 1. 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 for the product.
 - 2. Literature shall be submitted so that engineer receives it no later than 8 days prior to bid date.
 - 3. All approvals will be in the form of an addendum issued to all plan holders.

4. If product is not listed as approved in an addendum prior to opening of the bid, the contractor shall provide the product(s) specified or listed as equals in the original contract drawings or specifications.

II. SHOP DRAWINGS, AND PRODUCT DATA

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for the submittal of shop drawings.

- B. Shop Drawings include, but are not limited to, the following:

1. Fabrication drawings.
2. Installation drawings.
3. Setting diagrams.
4. Shopwork manufacturing instructions.
5. Templates and patterns.
6. Schedules.
7. Wiring Diagrams.

- C. Standard generic information prepared without specific reference to the project is not shop drawings.

- D. Product Data include, but are not limited to, the following:

1. Manufacturer's product specifications.
2. Manufacturer's installation instructions.
3. Standard color charts.
4. Catalog cuts.
5. Roughing-in diagrams and templates.
6. Standard wiring diagrams.
7. Printed performance curves.
8. Operational range diagrams.
9. Mill reports.
10. Standard product operating and maintenance manuals.
11. Field samples.

1.3 SUBMITTAL PROCEDURES

- A. Shop drawings shall be submitted in electronic, pdf format.**

- B. Shop drawings shall include on information pertinent to this particular project. Vendor general

information and sales fliers shall be excluded from shop drawing submittal.

- C. No individual shop drawing submittal for a particular specification section (i.e Panelboards, Lighting, etc.) shall exceed 50 pages in length. **Shop drawings that do not comply with this requirement will be returned to the contractor.**
- D. SHOP DRAWINGS SHALL BE REVIEWED BY THE ELECTRICAL CONTRACTOR PRIOR TO SUBMITTAL TO ENGINEER. ELECTRICAL CONTRACTOR SHALL PROVIDE PROOF OF SUCH REVIEW BY SUBMITTING SHOP DRAWINGS WITH CONTRACTOR'S SIGNED REVIEW STAMP. IN ADDITION, THE ELECTRICAL CONTRACTOR SHALL NOTE IN WRITING ANY CHANGES REQUIRED AS A RESULT OF HIS/HER REVIEW.

FAILURE TO SUBMIT SHOP DRAWINGS WITH PROOF OF ELECTRICAL CONTRACTOR'S REVIEW AS DESCRIBED ABOVE WILL LIKELY LEAD TO AN EXTENDED SHOP DRAWING REVIEW PROCESS.

- E. Coordination: Coordinate preparation and processing of submittals with performance of construction activities. Transmit each submittal to the Engineer sufficiently in advance of scheduled performance of related construction activities to avoid delay
 - 1. Coordinate transmittal of different types of submittals for the same element of the Work and different elements of related parts of the Work to avoid delay in processing because of the Engineer's need to review submittals concurrently for coordination.
 - a. The Engineer reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are forthcoming.
 - 2. Processing: To avoid the need to delay installation as a result of the time required to process submittals, allow sufficient time for submittal review, including time for resubmittals.
 - a. Allow 2 weeks for the Engineer's initial review of each submittal. Allow additional time if the Engineer must delay processing to permit coordination with subsequent submittals. The Engineer will advise the Contractor when a submittal being processed must be delayed for coordination.
 - b. Where necessary to provide an intermediate submittal, process the intermediate submittal in the same manner as the initial submittal.
 - c. Allow 2 weeks for reprocessing each submittal.
 - d. The Engineer will not authorize an extension of time because of the Contractor's failure to transmit submittals to the Engineer sufficiently in advance of the Work to permit processing.
- E. Submittal Preparation: Place a permanent label or title block on each submittal for identification.
 - 1. Indicate name of the firm or entity that prepared each submittal on the label or title block.
 - 2. Provide a space approximately 4 by 5 inches (100 by 125 mm) on the label or beside the title block to record the Contractor's review and approval markings and the action taken by the Engineer.
 - 3. Include the following information on the label for processing and recording action taken.
 - a. Project name.

- b. Date.
 - c. Name and address of the Engineer.
 - d. Name and address of the Contractor.
 - e. Name and address of the subcontractor.
 - f. Name and address of the supplier.
 - g. Name of the manufacturer.
 - h. Number and title of appropriate Specification Section.
 - i. Drawing number and detail references, as appropriate.
 - j. Similar definitive information as necessary.
- F. Submittal Transmittal: Package each submittal appropriately for transmittal and handling. Transmit each submittal by use of a transmittal form. The Engineer will return submittals received from sources other than the Electrical Contractor.
- 1. Record relevant information and requests for data on the transmittal form. On the form, or an attached separate sheet, record deviations from requirements of the Contract Documents, including minor variations and limitations.
 - 2. Include the Contractor's certification stating that information submitted complies with requirements of the Contract Documents.
- G. Submit newly prepared information, drawn accurately to scale. Do not reproduce Contract Documents or copy standard printed information as the basis of Shop Drawings.
- 1. Include the following information on Shop Drawings:
 - a. Dimensions.
 - b. Identification of products and materials included.
 - c. Compliance with specified standards.
 - d. Notation of coordination requirements.
 - e. Notation of dimensions established by field measurement.
 - 2. Submit Coordination Drawings where required for integration of different construction elements. Show construction sequences and relationships of separate components where necessary to avoid conflicts in utilization of the space available.
 - 3. Do not allow Shop Drawing copies that do not contain an appropriate final stamp or other marking indicating the action taken by the Engineer to be used in construction.
 - 4. Sheet Size: Except for templates, patterns, and similar full-size Drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches (215 by 280 mm) but no larger than 30 by 40 inches (750 by 1000 mm).
 - 5. Submittal: Submit 10 black-line prints for the Engineer's review.
 - a. The Contractor shall mark up and retain one of the prints returned as a "Record Document."

1.5 PRODUCT DATA

- A. Collect Product Data into a single submittal for each element of construction or system.

Mark each copy to show which choices and options are applicable to the Project.

1. Where Product Data includes information on several similar products, some of which are not required for use on the Project, mark copies clearly to indicate which products are applicable.
2. Where Product Data must be specially prepared for required products, materials, or systems because standard printed data are not suitable for use, submit as Shop Drawings not Product Data.
3. Include the following information in Product Data:
 - a. Manufacturer's printed recommendations.
 - b. Compliance with recognized trade association standards.
 - c. Compliance with recognized testing agency standards.
 - d. Application of testing agency labels and seals.
 - e. Notation of dimensions verified by field measurement.
 - f. Notation of coordination requirements.
4. Do not submit Product Data until compliance with requirements of the Contract Documents has been confirmed.

1.6 ENGINEER'S ACTION

- A. Except for submittals for the record or for information, where action and return of submittals is required, the Engineer will review each submittal, mark to indicate the action taken, and return.
 1. Compliance with specified characteristics is the Contractor's responsibility and not considered part of the Engineer's review and indication of action taken.
- B. Action Stamp: The Engineer will stamp each submittal with a uniform, action stamp. The Engineer will mark the stamp appropriately to indicate the action taken, as follows:
 1. Final Unrestricted Release: Where submittals are marked "No Exceptions Noted," the Work covered by the submittal may proceed provided it complies with requirements of the Contract Documents. Final acceptance will depend on that compliance.
 2. Final-but-Restricted Release: When submittals are marked "See Attached Comments," the Work covered by the submittal may proceed provided it complies with both the Engineer's notations or corrections on the submittal and requirements of the Contract Documents. Final acceptance will depend on that compliance.
 3. Returned for Resubmittal: When submittal is marked "Rejected," do not proceed with the Work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Revise or prepare a new submittal according to the Engineer's notations. Resubmit without delay. Repeat if necessary to obtain a different action mark.
 - a. Do not permit submittals marked "Rejected" to be used at the Project Site or elsewhere where construction is in progress.

III. REFERENCE STANDARDS AND DEFINITIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 DEFINITIONS

- A. General: Basic contract definitions are included in the Conditions of the Contract.
- B. "Indicated": The term "indicated" refers to graphic representations, notes, or schedules on the Drawings; or to other paragraphs or schedules in the Specifications and similar requirements in the Contract Documents. Terms such as "shown," "noted," "scheduled," and "specified" are used to help the user locate the reference. Location is not limited.
- C. "Directed": Terms such as "directed," "requested," "authorized," "selected," "approved," "required," and "permitted" mean directed by the Engineer, requested by the Engineer, and similar phrases.
- D. "Approved": The term "approved," when used in conjunction with the Engineer's action on the Contractor's submittals, applications, and requests, is limited to the Engineer's duties and responsibilities as stated in the Conditions of the Contract.
- E. "Regulations": The term "regulations" includes laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, as well as rules, conventions, and agreements within the construction industry that control performance of the Work.
- F. "Furnish": The term "furnish" means to supply and deliver to the Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
- G. "Install": The term "install" describes operations at the Project site including the actual unloading, temporary storage, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.
- H. "Provide": The term "provide" means to furnish and install, complete and ready for the intended use.
- I. "Installer": An installer is the Contractor or another entity engaged by the Contractor, either as an employee, subcontractor, or contractor of lower tier, to perform a particular construction activity, including installation, erection, application, or similar operations. Installers are required to be experienced in the operations they are engaged to perform.
 - 1. The term "experienced," when used with the term "installer," means having successfully completed a minimum of five previous projects similar in size and scope to this Project; being familiar with the special requirements indicated; and having complied with requirements of authorities having jurisdiction.

- J. "Project site" is the space available to the Contractor for performing construction activities, either exclusively or in conjunction with others performing other work as part of the Project. The extent of the Project site is shown on the Drawings and may or may not be identical with the description of the land on which the Project is to be built.
- K. "Testing Agencies": A testing agency is an independent entity engaged to perform specific inspections or tests, either at the Project site or elsewhere, and to report on and, if required, to interpret results of those inspections or tests.

1.3 SPECIFICATION FORMAT AND CONTENT EXPLANATION

- A. Specification Format: These Specifications are organized into Divisions and Sections based on the 26-division format and CSI/CSC's "Master Format" numbering system.
- B. Specification Content: These Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
 - 1. Abbreviated Language: Language used in the Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be interpolated as the sense requires. Singular words shall be interpreted as plural and plural words interpreted as singular where applicable as the context of the Contract Documents indicates.
 - 2. Imperative mood and streamlined language are generally used in the Specifications. Requirements expressed in the imperative mood are to be performed by the Contractor. At certain locations in the Text, subjective language is used for clarity to describe responsibilities that must be fulfilled indirectly by the Contractor or by others when so noted.
 - a. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.

1.4 INDUSTRY STANDARDS

- A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.
- B. Publication Dates: Comply with the standards in effect as of the date of the Contract Documents.
- C. Conflicting Requirements: Where compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer uncertainties and requirements that are different but apparently equal to the Architect for a decision before proceeding.
 - 1. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of the requirements. Refer uncertainties to the Engineer for a decision before proceeding.

- D. Copies of Standards: Each entity engaged in construction on the Project must be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.
1. Where copies of standards are needed to perform a required construction activity, the Contractor shall obtain copies directly from the publication source and make them available on request.
- E. Abbreviations and Names: Trade association names and titles of general standards are frequently abbreviated. Where abbreviations and acronyms are used in the Specifications or other Contract Documents, they mean the recognized name of the trade association, standards- generating organization, authorities having jurisdiction, or other entity applicable to the context of the text provision. Refer to Gale Research's "Encyclopedia of Associations" or Columbia Books' "National Trade & Professional Associations of the U.S.," which are available in most libraries.
- F. Abbreviations and Names: Trade association names and titles of general standards are frequently abbreviated. The following abbreviations and acronyms, as referenced in the Contract Documents, mean the associated names. Names and addresses are subject to change and are believed, but are not assured, to be accurate and up-to-date as of the date of the Contract Documents.

AIA	The American Institute of Architects 1735 New York Ave., NW Washington, DC 20006-5292	(202) 626-7300
ANSI	American National Standards Institute 11 West 42nd St., 13th Floor New York, NY 10036-8002	(212) 642-4900
ETL	ETL Testing Laboratories, Inc. c/o ITS/Warnock Hersey P.O. Box 2040 3933 U.S. Route 11, Industrial Park Cortland, NY 13045	(800) 345-3851 (607) 753-6711
ICEA	Insulated Cable Engineers Association, Inc. P.O. Box 440 South Yarmouth, MA 02664	(508) 394-4424
IEC	International Electrotechnical Commission (Available from ANSI) 11 West 42nd St., 13th Floor New York, NY 10036-8002	(212) 642-4900
IEEE	Institute of Electrical and Electronic Engineers 345 E. 47th St. New York, NY 10017-2394	(212) 705-7900

IESNA	Illuminating Engineering Society of North America 120 Wall St., 17th Floor New York, NY 10005-4001	(212) 248-5000
NECA	National Electrical Contractors Association 3 Bethesda Metro Center, Suite 1100 Bethesda, MD 20814-5372	(301) 657-3110
NEI	National Elevator Industry 185 Bridge Plaza North, Suite 310 Fort Lee, NJ 07024	(201) 944-3211
NEMA	National Electrical Manufacturers Association 2101 L St., NW, Suite 300 Washington, DC 20037	(202) 457-8400
NETA	InterNational Electrical Testing Association P.O. Box 687 Morrison, CO 80465-1526	(303) 697-8441
NFPA	National Fire Protection Association One Batterymarch Park P.O. Box 9101 Quincy, MA 02269-9101	(800) 344-3555 (617) 770-3000
NRTL	Nationally Recognized Testing Lab	
FAA	Federal Aviation Administration (U.S. Department of Transportation) 800 Independence Ave., SW Washington, DC 20591	(202) 366-4000
FCC	Federal Communications Commission 1919 M St., NW Washington, DC 20554	(202) 418-0126
FDA	Food and Drug Administration 5600 Fishers Lane Rockville, MD 20857	(301) 443-1544
GSA	General Services Administration F St. and 18th St., NW Washington, DC 20405	(202) 708-5082

NIST National Institute of Standards and Technology
(U.S. Department of Commerce)
Building 101, #A1134
Rte. I-270 and Quince Orchard Rd.
Gaithersburg, MD 20899 (301) 975-2000

OSHA Occupational Safety and Health Administration
(U.S. Department of Labor)
200 Constitution Ave., NW
Washington, DC 20210 (202) 219-8148

1.5 GOVERNING REGULATIONS AND AUTHORITIES

- A. Copies of Regulations: Obtain copies of the following regulations and retain at the Project site to be available for reference by parties who have a reasonable need:

1.6 SUBMITTALS

- A. Permits, Licenses, and Certificates: For the Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

IV. PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for Project Record Documents.
- B. Project Record Documents required include the following:
 1. Marked-up copies of Contract Drawings.
 2. Marked-up copies of Shop Drawings.
 3. Newly prepared drawings.
 4. Marked-up copies of Specifications, addenda, and Change Orders.
 5. Marked-up Product Data submittals.

6. Field records for variable and concealed conditions.
7. Record information on Work that is recorded only schematically.

1.3 RECORD DRAWINGS

- A. Markup Procedure: During construction, maintain a set of blue- or black-line white prints of Contract Drawings and Shop Drawings for Project Record Document purposes.
 1. Mark these Drawings to show the actual installation where the installation varies from the installation shown originally. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later. Items required to be marked include, but are not limited to, the following:
 - a. Revisions to details shown on the Drawings.
 - b. Locations and depths of underground utilities.
 - c. Revisions to routing of piping and conduits.
 - d. Revisions to electrical circuitry.
 - e. Actual equipment locations.
 - f. Locations of concealed internal utilities.
 - g. Changes made by change order or Construction Change Directive.
 - h. Changes made following the Architect/Engineer's written orders.
 - i. Details not on original Contract Drawings.
 2. Mark record prints of Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately. Where Shop Drawings are marked, show cross-reference on Contract Drawings location.
 3. Mark record sets with red erasable colored pencil. Use other colors to distinguish between changes for different categories of the Work at the same location.
 4. Mark important additional information that was either shown schematically or omitted from original Drawings.
 5. Note Construction Change Directive numbers, alternate numbers, change-order numbers, and similar identification.
- B. Responsibility for Markup: The individual or entity who obtained record data, whether the individual or entity is the Installer, subcontractor, or similar entity, shall prepare the markup on record drawings.
 1. Accurately record information in an understandable drawing technique.
 2. Record data as soon as possible after obtaining it. Record and check the markup prior to enclosing concealed installations.
 3. At time of Substantial Completion, submit record drawings to the Architect for the Owner's records. Organize into sets and bind and label sets for the Owner's continued use.

1.4 RECORD SPECIFICATIONS

- A. During the construction period, maintain 3 copies of the Project Specifications, including addenda and modifications issued, for Project Record Document purposes.
 - 1. Mark the Specifications to indicate the actual installation where the installation varies from that indicated in Specifications and modifications issued. Note related project record drawing information, where applicable. Give particular attention to substitutions, selection of product options, and information on concealed installations that would be difficult to identify or measure and record later.
 - a. In each Specification Section where products, materials, or units of equipment are specified or scheduled, mark the copy with the proprietary name and model number of the product furnished.
 - b. Record the name of the manufacturer, supplier, installer, and other information necessary to provide a record of selections made and to document coordination with record Product Data submittals and maintenance manuals.
 - c. Note related record Product Data, where applicable. For each principal product specified, indicate whether record Product Data has been submitted in maintenance manual instead of submitted as record Product Data.
 - 2. Upon completion of markup, submit record Specifications to the Architect for the Owner's records.
 - 3. Each prime contractor is responsible for marking up Sections that contain its own Work.
 - a. The Contractor for General Construction is responsible for collecting marked-up record Sections from each of the other prime contractors. The Contractor for General Construction is also responsible for collating these Sections in proper numeric order with its own Sections to form a complete set of record Specifications.
 - b. The Contractor for General Construction is responsible for submitting the complete set of record Specifications as specified.

1.5 RECORD PRODUCT DATA

- A. During the construction period, maintain one copy of each Product Data submittal for Project Record Document purposes.
 - 1. Mark Product Data to indicate the actual product installation where the installation varies substantially from that indicated in Product Data submitted. Include significant changes in the product delivered to the site and changes in manufacturer's instructions and recommendations for installation.
 - 2. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 - 3. Note related Change Orders and markup of record Drawings, where applicable.
 - 4. Upon completion of markup, submit a complete set of record Product Data to the Architect for the Owner's records.
 - 5. Where record Product Data is required as part of maintenance manuals, submit marked-up Product Data as an insert in the manual instead of submittal as record Product Data.

PART 3 - EXECUTION

3.1 RECORDING

- A. Post changes and modifications to the Documents as they occur. Do not wait until the end of the Project.

V. OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for operation and maintenance manuals, including the following:
 - 1. Preparing and submitting operation and maintenance manuals for building operating systems and equipment.
 - 2. Preparing and submitting instruction manuals covering the care, preservation, and maintenance of architectural products and finishes.
 - 3. Instruction of the Owner's operating personnel in the operation and maintenance of building systems and equipment.

1.3 QUALITY ASSURANCE

- A. Maintenance Manual Preparation: In preparation of maintenance manuals, use personnel thoroughly trained and experienced in operation and maintenance of equipment or system involved.
 - 1. Where maintenance manuals require written instructions, use personnel skilled in technical writing where necessary for communication of essential data.
 - 2. Where maintenance manuals require drawings or diagrams, use draftsmen capable of preparing drawings clearly in an understandable format.
- B. Instructions for the Owner's Personnel: Use experienced instructors thoroughly trained and experienced in operation and maintenance of equipment or system involved to instruct the Owner's operation and maintenance personnel.

1.4 SUBMITTALS

- A. Submittal Schedule: Comply with the following schedule for submitting operation and maintenance manuals:

1. Submit 1 copy of data in final form at least 15 days before final inspection. The Engineer will return this copy after final inspection, with comments.
 2. After final inspection, make corrections or modifications to comply with the Engineer's comments. Submit the specified number of copies of each approved manual within 15 days of receipt of the Engineer's comments.
- B. Form of Submittal: Prepare operation and maintenance manuals in the form of an instructional manual for use by the Owner's operating personnel. Organize into suitable sets of manageable size. Where possible, assemble instructions for similar equipment into a single binder.
1. Binders: For each manual, provide heavy-duty, commercial-quality, 3-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to receive 8-1/2-by-11-inch (115-by-280-mm) paper. Provide a clear plastic sleeve on the spine to hold labels describing contents. Provide pockets in the covers to receive folded sheets.
 - a. Where 2 or more binders are necessary to accommodate data, correlate data in each binder into related groupings according to the Project Manual table of contents. Cross-reference other binders where necessary to provide essential information for proper operation or maintenance of the piece of equipment or system.
 - b. Identify each binder on front and spine, with the printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, date, and subject matter covered. Indicate volume number for multiple volume sets of manuals.
 2. Dividers: Provide heavy paper dividers with celluloid-covered tabs for each separate Section. Mark each tab to indicate contents. Provide a typed description of the product and major parts of equipment included in the Section on each divider.
 3. Protective Plastic Jackets: Provide protective, transparent, plastic jackets designed to enclose diagnostic software for computerized electronic equipment.
 4. Text Material: Where maintenance manuals require written material, use the manufacturer's standard printed material. If manufacturer's standard printed material is not available, provide specially prepared data, neatly typewritten, on 8-1/2-by-11-inch (115-by-280-mm), 20-lb/sq. ft. (75-g/sq. m) white bond paper.
 5. Drawings: Where maintenance manuals require drawings or diagrams, provide reinforced, punched binder tabs on drawings and bind in with text.
 - a. Where oversize drawings are necessary, fold drawings to the same size as text pages and use as a foldout.
 - b. If drawings are too large to be used practically as a foldout, place the drawing, neatly folded, in front or rear pocket of binder. Insert a typewritten page indicating drawing title, description of contents, and drawing location at the appropriate location in the manual.

1.5 MANUAL CONTENT

- A. In each manual include information specified in the individual Specification Section and

the following information for each major component of building equipment and its controls:

1. General system or equipment description.
 2. Design factors and assumptions.
 3. Copies of applicable Shop Drawings and Product Data.
 4. System or equipment identification, including:
 - a. Name of manufacturer.
 - b. Model number.
 - c. Serial number of each component.
 5. Operating instructions.
 6. Emergency instructions.
 7. Wiring diagrams.
 8. Inspection and test procedures.
 9. Maintenance procedures and schedules.
 10. Precautions against improper use and maintenance.
 11. Copies of warranties.
 12. Repair instructions including spare parts listing.
 13. Sources of required maintenance materials and related services.
 14. Manual index.
- B. Organize each manual into separate Sections for each piece of related equipment. As a minimum, each manual shall contain a title page; a table of contents; copies of Product Data, supplemented by Drawings and written text; and copies of each warranty, bond, and service contract issued.
1. Title Page: Provide a title page in a transparent, plastic envelope as the first sheet of each manual. Provide the following information:
 - a. Subject matter covered by the manual.
 - b. Name and address of the Project.
 - c. Date of submittal.
 - d. Name, address, and telephone number of the Contractor.
 - e. Name and address of the Architect.
 - f. Cross-reference to related systems in other operation and maintenance manuals.
 2. Table of Contents: After title page, include a typewritten table of contents for each volume, arranged systematically according to the Project Manual format. Include a list of each product included, identified by product name or other appropriate identifying symbol and indexed to the content of the volume.
 - a. Where a system requires more than one volume to accommodate data, provide a comprehensive table of contents for all volumes in each volume of the set.
 3. General Information: Provide a general information Section immediately following table of contents, listing each product included in the manual, identified by product name. Under each product, list the name, address, and telephone number of the subcontractor or Installer and the maintenance contractor. Clearly delineate the extent

of responsibility of each of these entities. Include a local source for replacement parts and equipment.

4. **Product Data:** Where the manuals include manufacturer's standard printed data, include only sheets that are pertinent to the part or product installed. Mark each sheet to identify each part or product included in the installation. Where the Project includes more than one item in a tabular format, identify each item, using appropriate references from the Contract Documents. Identify data that is applicable to the installation, and delete references to information that is not applicable.
5. **Written Text:** Prepare written text to provide necessary information where manufacturer's standard printed data is not available, and the information is necessary for proper operation and maintenance of equipment or systems. Prepare written text where it is necessary to provide additional information or to supplement data included in the manual. Organize text in a consistent format under separate headings for different procedures. Where necessary, provide a logical sequence of instruction for each operation or maintenance procedure.
6. **Drawings:** Provide specially prepared drawings where necessary to supplement manufacturer's printed data to illustrate the relationship of component parts of equipment or systems or to provide control or flow diagrams. Coordinate these drawings with information contained in project record drawings to assure correct illustration of the completed installation.
7. **Warranties, Bonds, and Service Contracts:** Provide a copy of each warranty, bond, or service contract in the appropriate manual for the information of the Owner's operating personnel. Provide written data outlining procedures to follow in the event of product failure. List circumstances and conditions that would affect validity of warranty or bond.

1.8 INSTRUCTIONS FOR THE OWNER'S PERSONNEL

- A. Prior to final inspection, instruct the Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Provide instruction at mutually agreed upon times.
 1. For equipment that requires seasonal operation, provide similar instruction during other seasons.
 2. Use operation and maintenance manuals for each piece of equipment or system as the basis of instruction. Review contents in detail to explain all aspects of operation and maintenance.

VI. WARRANTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for warranties required by the Contract Documents, including manufacturer's standard warranties on products and special warranties.
 - 1. Refer to the General Conditions for terms of the Contractor's period for correction of the Work.
- B. Disclaimers and Limitations: Manufacturer's disclaimers and limitations on product warranties do not relieve the Contractor of the warranty on the Work that incorporates the products. Manufacturer's disclaimers and limitations on product warranties do not relieve suppliers, manufacturers, and subcontractors required to countersign special warranties with the Contractor.

1.3 DEFINITIONS

- A. Standard product warranties are preprinted written warranties published by individual manufacturers for particular products and are specifically endorsed by the manufacturer to the Owner.
- B. Special warranties are written warranties required by or incorporated in the Contract Documents, either to extend time limits provided by standard warranties or to provide greater rights for the Owner.

1.4 WARRANTY REQUIREMENTS

- A. Related Damages and Losses: When correcting failed or damaged warranted construction, remove and replace construction that has been damaged as a result of such failure or must be removed and replaced to provide access for correction of warranted construction.
- B. Reinstatement of Warranty: When Work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.
- C. Replacement Cost: Upon determination that Work covered by a warranty has failed, replace or rebuild the Work to an acceptable condition complying with requirements of the Contract Documents. The Contractor is responsible for the cost of replacing or rebuilding defective Work regardless of whether the Owner has benefited from use of the Work through a portion of its anticipated useful service life.
- D. Owner's Recourse: Expressed warranties made to the Owner are in addition to implied warranties and shall not limit the duties, obligations, rights, and remedies otherwise available under the law. Expressed warranty periods shall not be interpreted as limitations on the time in which the Owner can enforce such other duties, obligations, rights, or remedies.
 - 1. Rejection of Warranties: The Owner reserves the right to reject warranties and to limit selection to products with warranties not in conflict with requirements of the Contract Documents.

- E. Where the Contract Documents require a special warranty, or similar commitment on the Work or part of the Work, the Owner reserves the right to refuse to accept the Work, until the Contractor presents evidence that entities required to countersign such commitments are willing to do so.

1.5 SUBMITTALS

- A. Form of Submittal: At Final Completion compile 2 copies of each required warranty properly executed by the Contractor, or by the Contractor, subcontractor, supplier, or manufacturer. Organize the warranty documents into an orderly sequence based on the table of contents of the Project Manual.
- B. Bind warranties and bonds in heavy-duty, commercial-quality, durable 3-ring, vinyl-covered loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2- by-11-inch (115-by-280-mm) paper.
 - 1. Provide copies of each required warranty, as necessary, for inclusion in each required O&M manual.

END OF SECTION 260010

SECTION 260050 - BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Raceways.
 - 2. Wire and connectors.
 - 3. Supporting devices for electrical components.
 - 4. Electrical identification.
 - 5. Utility company electricity-metering components.
 - 6. Concrete equipment bases.
 - 7. Cutting and patching for electrical construction.

1.2 SUBMITTALS

- A. Product Data: For utility company electricity-metering components.
- B. Shop Drawings: Dimensioned plans and sections or elevation layouts and single-line diagram of electricity-metering component assemblies specific to this Project.

1.3 QUALITY ASSURANCE

- A. 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.
- B. Devices for Utility Company Electricity Metering: Comply with utility company published standards.
- C. Comply with NFPA 70.

1.4 COORDINATION

- A. Coordinate chases, slots, inserts, sleeves, and openings for electrical supports, raceways, and cable with general construction work.
- B. Sequence, coordinate, and integrate installing electrical materials and equipment for efficient flow of the Work. Coordinate installing large equipment that requires positioning before closing in the building.
- C. Coordinate electrical service connections to components furnished by utility companies.
 - 1. Coordinate installation and connection of exterior underground and overhead utilities and services, including provision for service entrances and electricity-metering components.
 - 2. Contractor shall include any and all costs assessed by the electric utility in his/her bid.

- D. Where electrical identification devices are applied to field-finished surfaces, coordinate installation of identification devices with completion of finished surface.

PART 2 - PRODUCTS

2.1 RACEWAYS

- A. IMC: Intermediate metal conduit; ANSI C80.6, zinc-coated steel, with threaded fittings.
- B. LFMC: Liquidtight flexible metal conduit; zinc-coated steel with sunlight-resistant and mineral-oil-resistant plastic jacket.
- C. RNC: Rigid nonmetallic conduit; NEMA TC 2, Schedule 40 PVC, with NEMA TC3 fittings.
- D. Raceway Fittings: Specifically designed for raceway type with which used.

2.2 WIRES, CABLES, AND CONNECTIONS

- A. Conductors, No. 10 AWG and Smaller: Solid or stranded copper.
- B. Conductors, Larger Than No. 10 AWG: Stranded copper.
- C. Insulation: Thermoplastic, rated 600 V, 75 deg C minimum, Type THW, or THHN-THWN.
- D. Cable: Type PVC Coated Type MC, suitable for direct burial with ground wire.
- E. Wire Connectors and Splices: Units of size, ampacity rating, material, type, and class suitable for service indicated.

2.3 SUPPORTING DEVICES

- A. Metal Items for Use Outdoors or in Damp Locations: Stainless steel.
- B. Slotted-Steel Channel: Flange edges turned toward web, and 9/16-inch- (14-mm-) diameter slotted holes at a maximum of 2 inches (50 mm) o.c., in webs. Strength rating to suit structural loading. Stainless Steel.
- C. Slotted Channel Fittings and Accessories: Recommended by the manufacturer for use with the type and size of channel with which used.
 - 1. Materials: Same as channels and angles, stainless steel.
- D. Raceway and Cable Supports: Slotted Channel.
- E. Expansion Anchors: Stainless-steel wedge or sleeve type.
- F. Toggle Bolts: Stainless-steel springhead type.
- G. Powder-Driven Threaded Studs: Stainless, heat-treated steel.

2.4 ELECTRICAL IDENTIFICATION

- A. Identification Device Colors: Use those prescribed by ANSI A13.1, NFPA 70, and these Specifications.
- B. Tape Markers for Conductors: Vinyl or vinyl-cloth, self-adhesive, wraparound type with preprinted numbers and letters.
- C. Underground Warning Tape: Permanent, bright-colored, continuous-printed, vinyl tape compounded for permanent direct-burial service, and with the following features:
 - 1. Not less than 6 inches wide by 4 mils thick (150 mm wide by 0.102 mm thick).
 - 2. Embedded continuous metallic strip or core.
 - 3. Printed legend that indicates type of underground line.
- D. Engraved-Plastic Labels, Signs, and Instruction Plates: Engraving stock, melamine plastic laminate punched or drilled for mechanical fasteners 1/16-inch (1.6-mm) minimum thickness for signs up to 20 sq. in. (129 sq. cm) and 1/8-inch (3.2-mm) minimum thickness for larger sizes. Engraved legend in black letters on white background.
- E. Warning and Caution Signs: Preprinted; comply with 29 CFR 1910.145, Chapter XVII. Colors, legend, and size appropriate to each application.
 - 1. Exterior Units: Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate with 0.0396-inch (1-mm), galvanized-steel backing. 1/4-inch (6-mm) grommets in corners for mounting.
- F. Fasteners for Nameplates and Signs: Self-tapping, stainless-steel screws or No. 10/32 stainless-steel machine screws with nuts and flat and lock washers.

2.5 EQUIPMENT FOR UTILITY COMPANY'S ELECTRICITY METERING

- A. Comply with requirements of electrical power utility company for meter sockets. Xcel Energy requires By-pass type meter.

2.6 CONCRETE BASES

- A. Concrete: 3000-psi (20.7-MPa), 28-day compressive strength.

PART 3 - EXECUTION

3.1 ELECTRICAL EQUIPMENT INSTALLATION

- A. Materials and Components: Install level, plumb, and parallel and perpendicular to other building systems and components, unless otherwise indicated.
- B. Equipment: Install to facilitate service, maintenance, and repair or replacement of components. Connect for ease of disconnecting, with minimum interference with other installations.

3.2 RACEWAY APPLICATION

- A. Outdoor Installations:
 - 1. Exposed: IMC.
 - 2. Underground: RNC.
 - 3. Connection to Vibrating Equipment: LFMC.
 - 4. Boxes and Enclosures: NEMA 250, Type 12, unless otherwise indicated.

3.3 RACEWAY AND CABLE INSTALLATION

- A. Conceal raceways and cables, unless otherwise indicated.
- B. Keep legs of raceway bends in the same plane and keep straight legs of offsets parallel.
- C. Use IMC elbows where RNC turns out of ground.
- D. Install pull wires in empty raceways where noted. Use No. 14 AWG zinc-coated steel or woven polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wires.

3.4 WIRING METHODS FOR POWER, LIGHTING, AND CONTROL CIRCUITS

- A. Application: Use wiring methods specified below to the extent permitted by applicable codes as interpreted by authorities having jurisdiction.
- B. Exposed Feeders and Branch Circuits: Insulated single conductors or Type MC Cable in raceway.
- C. Underground Feeders and Branch Circuits: PVC Coated Type MC Cable, suitable for direct burial.
- D. Remote-Control Signaling and Power-Limited Circuits, Classes 1, 2, and 3: Insulated conductors in raceway unless otherwise indicated.
- E. Provide a dedicated neutral (grounded) conductor for each branch circuit requiring a neutral. No sharing of a neutral conductor on multi-wire branch circuits is allowed.

3.5 WIRING INSTALLATION

- A. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than un-spliced conductors.
- B. Splices must be made utilizing hydraulic compression methods.

3.6 ELECTRICAL SUPPORTING DEVICE APPLICATION

- A. Damp Locations and Outdoors: Stainless steel materials slotted channel system components.
- B. Strength of Supports: Adequate to carry present and future loads, times a safety factor of at least four with, 200-lb (90-kg) minimum design load for each support element.

3.7 SUPPORT INSTALLATION

- A. Secure electrical items and their supports to building structure, using the following methods unless other fastening methods are indicated:
 - 1. Wood: Wood screws or screw-type nails.
 - 2. New Concrete: Concrete inserts with machine screws and bolts.
 - 3. Existing Concrete: Expansion bolts or threaded studs driven by powder charge and provided with lock washers.
 - 4. Structural Steel: Welded threaded studs, Spring-tension clamps, or threaded studs driven by powder charge and provided with lock washers.
 - a. Comply with AWS D1.1 for field welding.
 - 5. Light Steel Framing: Sheet metal screws.
 - 6. Fasteners for Damp, Wet, or Weather-Exposed Locations: Stainless steel.

3.8 IDENTIFICATION MATERIALS AND DEVICES

- A. Install at locations for most convenient viewing without interference with operation and maintenance of equipment.
- B. Coordinate names, abbreviations, colors, and other designations used for electrical identification with corresponding designations indicated in the Contract Documents or required by codes and standards. Use consistent designations throughout Project.
- C. Self-Adhesive Identification Products: Clean surfaces before applying.
- D. Tag and label circuits designated to be extended in the future. Identify source and circuit numbers in each cabinet, pull and junction box, and outlet box. Color-coding may be used for voltage and phase identification.
- E. Install continuous underground plastic markers during trench backfilling, for exterior underground power, control, signal, and communication lines located directly above power and communication lines. Locate 6 to 8 inches (150 to 200 mm) below finished grade. If width of multiple lines installed in a common trench or concrete envelope does not exceed 16 inches (400 mm), overall, use a single line marker.
- F. Install warning, caution, and instruction signs where required to comply with 29 CFR 1910.145, Chapter XVII, and where needed to ensure safe operation and maintenance of electrical systems and of items to which they connect. Indoors install engraved plastic-laminated instruction signs with approved legend where instructions are needed for system or equipment operation. Install metal-backed butyrate signs for outdoor items.
- G. Install engraved-laminated emergency-operating signs with white letters on red background with minimum 3/8-inch- (9-mm-) high lettering for emergency instructions on power transfer, load shedding, and other emergency operations.

3.9 ELECTRICITY-METERING EQUIPMENT

Install utility company metering equipment according to utility company's written requirements. Provide grounding and empty conduits as required by utility company.

3.10 CONCRETE BASES

- A. Construct concrete bases as indicated. Follow supported equipment manufacturer's anchorage recommendations and setting templates for anchor-bolt and tie locations, unless otherwise indicated.

3.11 CUTTING AND PATCHING

- A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces required to permit electrical installations. Perform cutting by skilled mechanics of trades involved.
- B. Repair, refinish and touch up disturbed finish materials and other surfaces to match adjacent undisturbed surfaces.
- C. Restore disturbed earth by planting grass seed.

END OF SECTION 260050

SECTION 260519 - LOW-VOLTAGE CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Copper wire rated 600 V or less.
 - 2. Aluminum wire rated 600 V or less.
 - 3. Metal-clad cable, Type MC, rated 600 V or less.
 - 4. Connectors, splices, and terminations rated 600 V and less.
- B. Related Requirements:
 - 1. Section 260050 "Basic Electrical Materials and Methods".

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 COPPER WIRE

- A. Description: Flexible, insulated and uninsulated, drawn copper current-carrying conductor with an overall insulation layer or jacket, or both, rated 600 V or less.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Alpha Wire Company.
 - 2. General Cable Technologies Corporation.
 - 3. Southwire
- C. Standards:
 - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
 - 2. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."
- D. Conductors: Copper, complying with ASTM B 3 for bare annealed copper and with ASTM for stranded conductors.
- E. Conductor Insulation:

1. Type THW and Type THWN-2: Comply with UL 83.

2.2 ALUMINUM WIRE

- A. Description: Flexible, insulated and uninsulated, drawn aluminum current-carrying conductor with an overall insulation layer or jacket, or both, rated 600 V or less.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Alpha Wire Company.
 2. General Cable Technologies Corporation.
 3. Southwire
- C. Standards:
 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
 2. RoHS compliant.
 3. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."
- D. Conductors: Compact Aluminum, complying with ASTM B 800 and ASTM B 801.
- E. Conductor Insulation:
 1. Type THW and Type THWN-2: Comply with UL 83.

2.3 METAL-CLAD CABLE, TYPE MC

- A. Description: A factory assembly of one or more current-carrying insulated conductors in an overall metallic sheath.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Alpha Wire Company.
 2. General Cable Technologies Corporation.
 3. Southwire
- C. Standards:
 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
 2. Comply with UL 1569.
 3. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."
- D. Circuits:
 1. Single circuit and multi-circuit with color-coded conductors.
- E. Conductors: Aluminum, complying with ASTM B 800 and ASTM B 801.
- F. Ground Conductor: Insulated.

- G. Conductor Insulation:
 - 1. Type TFN/THHN/THWN-2: Comply with UL 83.
 - 2. Type XHHW-2: Comply with UL 44.

H. Armor: Steel, interlocked.

I. Jacket: PVC applied over armor.

2.4 CONNECTORS AND SPLICES

A. Description: Factory-fabricated connectors, splices, and lugs of size, ampacity rating, material, type, and class for application and service indicated; listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- 1. 3M Electrical Products.
- 2. Hubbell Power Systems, Inc.
- 3. Ideal Industries, Inc.
- 4. ILSCO.
- 5. O-Z/Gedney; a brand of Emerson Industrial Automation.

C. Jacketed Cable Connectors: For steel and aluminum jacketed cables, zinc die-cast with set screws, designed to connect conductors specified in this Section.

D. Lugs: One piece, seamless, designed to terminate conductors specified in this Section.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: Copper/Aluminum; solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Service Entrance: Type THHN/THWN-2, single conductors in raceway.

B. Exposed Feeders and Branch Circuits: Type THHN/THWN-2, single conductors or Type MC Cable in raceway, as indicated.

C. Feeders and Branch Circuits Underground: Type THHN/THWN-2, single conductors in raceway where shown, PVC Coated Type MC Cable, where shown.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Complete raceway installation between conductor and cable termination points according to Section 260533 "Raceways and Boxes" prior to pulling conductors and cables.

B. Use manufacturer-approved pulling compound or lubricant where necessary.

- C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

3.4 CONNECTIONS

- A. Tighten electrical 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-486B.
- B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than un-spliced conductors.
 - 1. Use oxide inhibitor in each splice, termination, and tap for aluminum conductors.
 - 2. Splices shall be done utilizing hydraulic compression splices.
- C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches (150 mm) of slack.

3.5 IDENTIFICATION

- A. Identify and color-code conductors and cables.
- B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

END OF SECTION 260519

SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes grounding and bonding systems and equipment.
- B. Section includes grounding and bonding systems and equipment, plus the following special applications:
 - 1. Underground distribution grounding.
 - 2. Ground bonding common with lightning protection system.
 - 3. Foundation steel electrodes.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with UL 467 for grounding and bonding materials and equipment.

2.2 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Advanced Lightning Technology, Ltd.
 - 2. Burndy; Part of Hubbell Electrical Systems.
 - 3. ERICO International Corporation.
 - 4. Galvan Industries, Inc.; Electrical Products Division, LLC.
 - 5. ILSCO.
 - 6. O-Z/Gedney; a brand of Emerson Industrial Automation.

2.3 CONDUCTORS

- A. Insulated Conductors: Copper or tinned-copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
- B. Bare Copper Conductors:
 - 1. Solid Conductors: ASTM B 3.
 - 2. Stranded Conductors: ASTM B 8.
 - 3. Tinned Conductors: ASTM B 33.
 - 4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch (6 mm) in diameter.
 - 5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
 - 6. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.
 - 7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.

2.4 CONNECTORS

- A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.
- B. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.
- C. Cable-to-Cable Connectors: Compression type, copper or copper alloy.
- D. Ground Rod Clamps: Mechanical type, copper or copper alloy, terminal with hex head bolt.

2.5 GROUNDING ELECTRODES

- A. Ground Rods: Copper-clad steel; 5/8 by 96 inches (16 by 2400 mm).

PART 3 - EXECUTION

3.1 APPLICATIONS

- A. Conductor Terminations and Connections:
 - 1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
 - 2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.

3.2 GROUNDING AT THE SERVICE

- A. Equipment grounding conductors and grounding electrode conductors shall be connected to the ground bus. Install a main bonding jumper between the neutral and ground buses.

3.3 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with all feeders and branch circuits.
- B. Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

3.4 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- B. Ground Rods: Drive rods until tops are 2 inches (50 mm) below finished floor or final grade unless otherwise indicated.
 - 1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
 - 2. Use exothermic welds for all below-grade connections.
 - 3. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.
- C. Connections: Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact are galvanically compatible.
 - 1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer in 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.

3.5 FIELD QUALITY CONTROL

- A. Perform tests and inspections as indicated.
- B. Tests and Inspections:
 - 1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
 - 2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.

3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal and at individual ground rods. Make tests at ground rods before any conductors are connected.
 - a. Measure ground resistance no fewer than two full days after last trace of precipitation and without 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.
 - b. Perform tests by fall-of-potential method according to IEEE 81.
- C. Grounding system will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.
- E. Report measured ground resistances that exceed the following values:
 1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10 ohms.
- F. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION 260526

SECTION 260533 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Metal conduits and fittings.
 - 2. Nonmetallic conduits and fittings.
 - 3. Metal wireways and auxiliary gutters.
 - 4. Boxes, enclosures, and cabinets.

1.3 DEFINITIONS

- A. PVC: Schedule 40, Poly Vinyl Chloride.
- B. IMC: Intermediate metal conduit.

1.4 ACTION SUBMITTALS

- A. Product Data: For surface raceways, wireways and fittings, hinged-cover enclosures, and cabinets.

PART 2 - PRODUCTS

2.1 METAL CONDUITS AND FITTINGS

- A. Metal Conduit:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Allied Tube & Conduit; a part of Atkore International.
 - b. Superior Conduit
 - 2. Listing and Labeling: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - 3. IMC: Comply with ANSI C80.6 and UL 1242.
 - 4. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.
- B. Joint Compound for IMC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 NONMETALLIC CONDUITS AND FITTINGS

A. Nonmetallic Conduit:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AFC Cable Systems; a part of Atkore International.
 - b. CANTEX INC.
 - c. CertainTeed Corporation.
 - d. Kraloy.
 - e. RACO; Hubbell.
 - f. Carlton
2. Listing and Labeling: Nonmetallic conduit shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
3. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.

B. Nonmetallic Fittings:

1. Fittings, General: Listed and labeled for type of conduit, location, and use.
2. Fittings for RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.
3. Solvents and Adhesives: As recommended by conduit manufacturer.

2.3 METAL WIREWAYS AND AUXILIARY GUTTERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. B-line, an Eaton business.
2. Hoffman; a brand of Pentair Equipment Protection.
3. Square D

B. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 12 unless otherwise indicated, and sized according to NFPA 70.

1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

D. Wireway Covers: Flanged-and-gasketed type unless otherwise indicated.

E. Finish: Manufacturer's standard enamel finish.

2.4 BOXES, ENCLOSURES, AND CABINETS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Hoffman; a brand of Pentair Equipment Protection.
2. Hubbell Incorporated.

3. O-Z/Gedney; a brand of Emerson Industrial Automation.
- B. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.
 - C. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.
 - D. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
 - E. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 12 with continuous-hinge cover with flush latch unless otherwise indicated.
 1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
 2. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.
 3. Lockable Cover.

2.5 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

- A. General Requirements for Handholes and Boxes:
 1. Boxes and handholes for use in underground systems shall be designed and identified as defined in NFPA 70, for intended location and application.
 2. Boxes installed in wet areas shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel, fiberglass, or a combination of the two.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or equal:
 - a. Armorcast Products Company.
 - b. NewBasis.
 2. Standard: Comply with SCTE 77.
 3. Configuration: Designed for flush burial with open bottom unless otherwise indicated.
 4. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
 5. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
 6. Cover Legend: Molded lettering, "ELECTRIC".
 7. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

- A. Outdoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed Conduit: IMC.
 2. Underground Conduit: RNC, Type EPC-40-PVC.
 3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
 4. Boxes and Enclosures, Aboveground: NEMA 250, Type 12.
- B. Minimum Raceway Size: 3/4-inch (21-mm) trade size.
- C. Raceway Fittings: Compatible with raceways and suitable for use and location.
1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
 2. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.
- D. Install nonferrous conduit or tubing for circuits operating above 60 Hz. Where aluminum raceways are installed for such circuits and pass through concrete, install in nonmetallic sleeve.
- E. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.

3.2 INSTALLATION

- A. Complete raceway installation before starting conductor installation.
- B. Arrange stub-ups so curved portions of bends are not visible above finished slab.
- C. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches (300 mm) of changes in direction.
- D. Make bends in raceway using large-radius preformed ells. Field bending shall be according to NFPA 70 minimum radii requirements. Use only equipment specifically designed for material and size involved.
- E. Support conduit within 12 inches (300 mm) of enclosures to which attached.
- F. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.
- G. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.
- H. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.
- I. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch (35mm) trade size and insulated throat metal bushings on 1-1/2-inch (41-mm) trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.

- J. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.
- K. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.
- L. Cut conduit perpendicular to the length. For conduits 2-inch (53-mm) trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.
- M. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.
- N. Surface Raceways:
 - 1. Install surface raceway with a minimum 2-inch (50-mm) radius control at bend points.
 - 2. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inches (1200 mm) and with no less than two supports per straight raceway section. Support surface raceway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.
- O. Comply with manufacturer's written instructions for solvent welding RNC and fittings.
- P. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 36 inches (915 mm) of flexible conduit for equipment subject to vibration, noise transmission, or movement.
 - 1. Use LFMC in damp or wet locations subject to severe physical damage.
- Q. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.
- R. Fasten junction and pull boxes to or support from building or separate structure. Do not support boxes by conduits.

3.3 INSTALLATION OF UNDERGROUND CONDUIT

- A. Direct-Buried Conduit:
 - 1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom to accept conduit.
 - 2. Install backfill as required to restore surface.
 - 3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches (300 mm) of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Section 312000 "Earth Moving."
 - 4. Install manufactured IMC steel conduit elbows for stub-ups at poles and equipment and at building entrances through floor.
 - a. For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend steel conduit horizontally a minimum of

60 inches (1500 mm) from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.

5. Underground Warning Tape: Comply with requirements in "Identification for Electrical Systems."

3.4 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

- A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.
- B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch (12.5-mm) sieve to No. 4 (4.75-mm) sieve and compacted to same density as adjacent undisturbed earth.
- C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch (25 mm) above finished grade.
- D. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables but short enough to preserve adequate working clearances in enclosure.
- E. Field-cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.5 PROTECTION

- A. Protect coatings, finishes, and cabinets from damage and deterioration.
 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 260533

SECTION 262416 - PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Distribution panelboards.
 - 2. Lighting and appliance branch-circuit panelboards.
 - 3. Load centers.

1.3 DEFINITIONS

- A. GFCI: Ground-fault circuit interrupter.
- B. HID: High-intensity discharge.
- C. MCCB: Molded-case circuit breaker.
- D. SPD: Surge protective device.
- E. VPR: Voltage protection rating.

1.4 ACTION SUBMITTALS

- A. Shop Drawings: For each panelboard and related equipment.
 - 1. Include dimensioned plans, elevations, sections, and details.
 - 2. Show tabulations of installed devices with nameplates, conductor termination sizes, equipment features, and ratings.
 - 3. Detail enclosure types including mounting and anchorage, environmental protection, knockouts, corner treatments, covers and doors, gaskets, hinges, and locks.
 - 4. Detail bus configuration, current, and voltage ratings.
 - 5. Short-circuit current rating of panelboards and overcurrent protective devices.
 - 6. Include evidence of NRTL listing for series rating of installed devices.
 - 7. Include evidence of NRTL listing for SPD as installed in panelboard.
 - 8. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

9. Include wiring diagrams for power, signal, and control wiring.
10. Key interlock scheme drawing and sequence of operations.
11. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards. Submit on translucent log-log graph paper; include selectable ranges for each type of overcurrent protective device. Include an Internet link for electronic access to downloadable PDF of the coordination curves.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: ISO 9001 or 9002 certified.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Remove loose packing and flammable materials from inside panelboards; install temporary electric heating (250 W per panelboard) to prevent condensation.

1.7 FIELD CONDITIONS

- A. Environmental Limitations:
 1. Rate equipment for continuous operation under the following conditions unless otherwise indicated:
 - a. Ambient Temperature: Not exceeding minus 22 deg F (minus 30 deg C) to plus 104 deg F (plus 40 deg C).
 - b. Altitude: Not exceeding 6600 feet (2000 m).
- B. Service Conditions: NEMA PB 1, usual service conditions, as follows:
 1. Ambient temperatures within limits specified.
 2. Altitude not exceeding 6600 feet (2000 m).

1.8 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace panelboards that fail in materials or workmanship within specified warranty period.
 1. Panelboard Warranty Period: 12 months from date of Final project acceptance.
- B. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace SPD that fails in materials or workmanship within specified warranty period.
 1. SPD Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PANELBOARD REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

- B. Comply with NEMA PB 1.
- C. Comply with NFPA 70.
- D. Enclosures: Surface-mounted, dead-front cabinets.
 - 1. Rated for environmental conditions at installed location.
 - a. Outdoor Locations: NEMA 250, Type 3R.
 - 2. Height: 72 inches maximum.
 - 3. Hinged Door: Standard door within hinged trim cover. Trims shall cover all live parts and shall have no exposed hardware. Cover shall be lockable.
- E. Incoming Mains:
 - 1. Location: Bottom.
 - 2. Main Breaker: Main lug interiors up to 400 amperes shall be field convertible to main breaker.
- F. Phase, Neutral, and Ground Buses:
 - 1. Material: Tin-plated aluminum.
 - a. Plating shall run entire length of bus.
 - b. Bus shall be fully rated the entire length.
 - 2. Interiors shall be factory assembled into a unit. Replacing switching and protective devices shall not disturb adjacent units or require removing the main bus connectors.
 - 3. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
 - 4. Full-Sized Neutral: Equipped with full-capacity bonding strap for service entrance applications. Mount electrically isolated from enclosure. Do not mount neutral bus in gutter.
- G. Conductor Connectors: Suitable for use with conductor material and sizes.
 - 1. Terminations shall allow use of 75 deg C rated conductors without derating.
 - 2. Size: Lugs suitable for indicated conductor sizes, with additional gutter space, if required, for larger conductors.
 - 3. Main and Neutral Lugs: Compression for Panel MDP, Mechanical type allowed for remaining panels, with a lug on the neutral bar for each pole in the panelboard.
- H. NRTL Label: Panelboards or load centers shall be labeled by an NRTL acceptable to authority having jurisdiction for use as service equipment with one or more main service disconnecting and overcurrent protective devices. Panelboards or load centers shall have meter enclosures, wiring, connections, and other provisions for utility metering. Coordinate with utility company for exact requirements.
- I. Future Devices: Panelboards or load centers shall have mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.
- J. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals. Assembly listed by an NRTL for 100 percent interrupting capacity.

1. Panelboards and overcurrent protective devices rated 240 V or less shall have short-circuit ratings as shown on Drawings.

2.2 PERFORMANCE REQUIREMENTS

- A. Surge Suppression: Factory installed as an integral part of indicated panelboards, complying with UL 1449 SPD Type 1.

2.3 POWER PANELBOARDS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Eaton.
 2. General Electric Company; GE Energy Management - Electrical Distribution.
 3. Square D
 4. Siemens
- B. Panelboards: NEMA PB 1, distribution type.
- C. Doors: Secured with vault-type latch with tumbler lock; keyed alike.
- D. Mains: Circuit breaker & Lugs only – see drawings. Some Main CB's are required to be 100% rated....see Panel Schedules.
- E. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers.
- F. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers.
- G. Enclosure rating: NEMA 3R.
- H. SPD.
 1. Peak Surge Current Rating: The minimum single-pulse surge current withstand rating per phase shall not be less than 100 kA. The peak surge current rating shall be the arithmetic sum of the ratings of the individual MOVs in a given mode.
 2. Provide surge counter.
 3. Protection modes and UL 1449 VPR for 240/120-V, single-phase, three-wire circuits shall not exceed the following:
 - a. Line to Neutral: 700 V.
 - b. Line to Ground: 700 V.
 - c. Neutral to Ground: 700 V.
 - d. Line to Line: 1200 V.

2.4 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton.
 2. General Electric Company; GE Energy Management - Electrical Distribution.
 3. Square D
 4. Siemens
- B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.
- C. Mains: Circuit breaker, lugs only – see drawings.
- D. Branch Overcurrent Protective Devices: Plug-in circuit breakers, replaceable without disturbing adjacent units.
- E. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.
- F. Enclosure rating: NEMA 3R.
- G. Buses:
1. Plated aluminum or copper phase and neutral buses.

2.5 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

- A. MCCB: Comply with UL 489, with interrupting capacity to meet available fault currents.
1. Thermal-Magnetic Circuit Breakers:
 - a. Inverse time-current element for low-level overloads.
 - b. Instantaneous magnetic trip element for short circuits.
 - c. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
 - d. 100% rated where noted on Panel Schedules.
 2. MCCB Features and Accessories:
 - a. Standard frame sizes, trip ratings, and number of poles.
 - b. Breaker handle indicates tripped status.
 - c. UL listed for reverse connection without restrictive line or load ratings.
 - d. Lugs: Compression – Distribution Panel or Mechanical – Lighting Panel style, suitable for number, size, trip ratings, and conductor materials.
 - e. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and HID lighting circuits.

2.6 IDENTIFICATION

- A. Panelboard Label: Manufacturer's name and trademark, voltage, amperage, number of phases, and number of poles shall be located on the interior of the panelboard door.
- B. Breaker Labels: Faceplate shall list current rating, UL and IEC certification standards, and AIC rating.
- C. Circuit Directory: Computer-generated circuit directory mounted inside panelboard door with transparent plastic protective cover.

1. Circuit directory shall identify specific purpose with detail sufficient to distinguish it from all other circuits.

2.7 ACCESSORY COMPONENTS AND FEATURES

- A. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify actual conditions with field measurements prior to ordering panelboards to verify that equipment fits in allocated space in, and comply with, minimum required clearances specified in NFPA 70.
- B. Examine panelboards before installation. Reject panelboards that are damaged, rusted, or have been subjected to water saturation.
- C. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- B. Comply with NECA 1.
- C. Install panelboards and accessories according to NECA 407.
- D. Equipment Mounting:
- E. Mount panelboard cabinet plumb and rigid without distortion of box.
- F. Mount surface-mounted panelboards to stainless steel slotted supports 1 1/4 inch (32 mm) in depth. Orient steel slotted supports vertically.
- G. Install overcurrent protective devices and controllers not already factory installed.
 1. Set field-adjustable, circuit-breaker trip ranges.
 2. Tighten bolted connections and circuit breaker connections using calibrated torque wrench or torque screwdriver per manufacturer's written instructions.
- H. Make grounding connections and bond neutral for services and separately derived systems to ground. Make connections to grounding electrodes, separate grounds for isolated ground bars, and connections to separate ground bars.
- I. Install filler plates in unused spaces.

- J. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.

3.3 IDENTIFICATION

- A. Create a directory to indicate installed circuit loads after balancing panelboard loads; incorporate Owner's final room designations. Obtain approval before installing. Handwritten directories are not acceptable. Install directory inside panelboard door.
- B. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Electrical Identification.

3.4 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- B. Acceptance Testing Preparation:
 - 1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
 - 2. Test continuity of each circuit.
- C. Panelboards will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports.

3.5 ADJUSTING

- A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.
- B. Set field-adjustable circuit-breaker trip ranges.

END OF SECTION 262416

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SECTION 262726 - WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. GFCI receptacles.

1.3 DEFINITIONS

- A. Abbreviations of Manufacturers' Names:
 - 1. Cooper: Cooper Wiring Devices; Division of Cooper Industries, Inc.
 - 2. Hubbell: Hubbell Incorporated: Wiring Devices-Kellems.
 - 3. Leviton: Leviton Mfg. Company, Inc.
 - 4. Pass & Seymour: Pass& Seymour/Legrand.
- B. GFCI: Ground-fault circuit interrupter.
- C. Pigtail: Short lead used to connect a device to a branch-circuit conductor.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: List of legends and description of materials and process used for pre-marking wall plates.

PART 2 - PRODUCTS

2.1 GENERAL WIRING-DEVICE REQUIREMENTS

- A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NFPA 70.
- C. Devices that are manufactured for use with modular plug-in connectors may be substituted under the following conditions:
 - 1. Connectors shall comply with UL 2459 and shall be made with stranding building wire.
 - 2. Devices shall comply with the requirements in this Section.

- D. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.2 STRAIGHT-BLADE RECEPTACLES

- A. Duplex Convenience Receptacles: 125 V, 20 A; comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Eaton (Arrow Hart).
 - b. Hubbell Incorporated; Wiring Device-Kellems.
 - c. P&S

2.3 GFCI RECEPTACLES

- A. General Description:
 - 1. 125 V, 20 A, straight blade, feed-through type.
 - 2. Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, UL 943 Class A, and FS W-C-596.
 - 3. Include indicator light that shows when the GFCI has malfunctioned and no longer provides proper GFCI protection.

2.4 WALL PLATES

- A. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant, die-cast aluminum with lockable cover.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.
- B. Conductors:
 - 1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
 - 2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
 - 3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
- C. Device Installation:

1. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
2. Connect devices to branch circuits using pigtails that are not less than 6 inches (152 mm) in length.
3. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
4. Use a torque screwdriver when a torque is recommended or required by manufacturer.
5. Tighten unused terminal screws on the device.
6. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.

3.2 IDENTIFICATION

- A. Comply with Identification for Electrical Systems.

3.3 FIELD QUALITY CONTROL

- A. Test Instruments: Use instruments that comply with UL 1436.
- B. Tests for Convenience Receptacles:
 1. Line Voltage: Acceptable range is 105 to 132 V.
 2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
 3. Ground Impedance: Values of up to 2 ohms are acceptable.
 4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
 5. Using the test plug, verify that the device and its outlet box are securely mounted.
 6. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.
- C. Wiring device will be considered defective if it does not pass tests and inspections.

END OF SECTION 262726

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SECTION 262813 - FUSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Cartridge fuses rated 600 V ac and less for use in the following:
 - a. Enclosed switches.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include construction details, material descriptions, dimensions of individual components and profiles.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Bussmann, an Eaton business.
 - 2. Edison; a brand of Bussmann by Eaton.
 - 3. Shawmut
- B. Source Limitations: Obtain fuses, for use within a specific product or circuit, from single source from single manufacturer.

2.2 CARTRIDGE FUSES

- A. Characteristics: NEMA FU 1, current-limiting, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages.
 - 1. Class T: 250-V, zero- to 600-A rating, 200 kAIC.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Comply with NEMA FU 1 for cartridge fuses.
- D. Comply with NFPA 70.

- E. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size and with system short-circuit current levels.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine fuses before installation. Reject fuses that are moisture damaged or physically damaged.
- B. Examine holders to receive fuses for compliance with installation tolerances and other conditions affecting performance, such as rejection features.
- C. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.
- D. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.

3.3 IDENTIFICATION

- A. Install labels complying with requirements for identification for electrical systems and indicating fuse replacement information inside of door of each fused switch and adjacent to each fuse block, socket, and holder.

END OF SECTION 262813

SECTION 262816 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

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. Section Includes:
 - 1. Fusible switches.
 - 2. Enclosures.

1.3 DEFINITIONS

- A. NC: Normally closed.
- B. NO: Normally open.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include nameplate ratings, dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.
 - 1. Enclosure types and details for types other than NEMA 250, Type 1.
 - 2. Current and voltage ratings.
 - 3. Short-circuit current ratings (interrupting and withstand, as appropriate).
 - 4. Include evidence of a nationally recognized testing laboratory (NRTL) listing for series rating of installed devices.
 - 5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.
- B. Shop Drawings: For enclosed switches and circuit breakers.
 - 1. Include plans, elevations, sections, details, and attachments to other work.
 - 2. Include wiring diagrams for power, signal, and control wiring.

1.5 FIELD CONDITIONS

- A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:
 - 1. Ambient Temperature: Not less than minus 22 deg F (minus 30 deg C) and not exceeding 104 deg F (40 deg C).
 - 2. Altitude: Not exceeding 6600 feet (2010 m).

1.6 WARRANTY

- A. **Manufacturer's Warranty:** Manufacturer and Installer agree to repair or replace components that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: One year(s) from date of final project acceptance.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

- A. **Source Limitations:** Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single manufacturer.
- B. **Electrical Components, Devices, and Accessories:** Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
- C. Comply with NFPA 70.

2.2 FUSIBLE SWITCHES

- A. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
 - 1. Eaton.
 - 2. General Electric Company.
 - 3. Square D
 - 4. Siemens
- B. **Standard Duty:**
 - 1. Single throw.
 - 2. Three pole.
 - 3. 240-V ac.
 - 4. 200 A and smaller.
 - 5. UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate indicated fuses.
 - 6. Lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
 - 7. Fusible, accommodates Class T fuses.
- C. **Accessories:**
 - 1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
 - 2. **Class T** Fuse Kit.
 - 3. Lugs: Mechanical type, suitable for number, size, and conductor material.

2.3 ENCLOSURES

- A. **Enclosed Switches and Circuit Breakers:** UL 489, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.

- B. Enclosure Finish: The enclosure shall be gray baked enamel paint, electrodeposited on cleaned, phosphatized steel (NEMA 250 Type 12).
- C. Conduit Entry: NEMA 250 12 enclosures shall contain no knockouts.
- D. Enclosures designated as NEMA 250 Type 12 shall have a dual cover interlock mechanism to prevent unintentional opening of the enclosure cover when the circuit breaker is ON and to prevent turning the circuit breaker ON when the enclosure cover is open.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
 - 1. Commencement of work shall indicate Installer's acceptance of the areas and conditions as satisfactory.

3.2 ENCLOSURE ENVIRONMENTAL RATING APPLICATIONS

- A. Enclosed Switches and Circuit Breakers: Provide enclosures at installed locations with the following environmental ratings.
 - 1. Outdoor Locations: NEMA 250, Type 3R.

3.3 INSTALLATION

- A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- B. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.
- C. Install fuses in fusible devices.
- D. Comply with NFPA 70 and NECA 1.

3.4 IDENTIFICATION

- A. Comply with requirements for Electrical Identification.

3.5 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections for Switches:
 - 1. Visual and Mechanical Inspection:
 - a. Inspect physical and mechanical condition.

- b. Inspect anchorage, alignment, grounding, and clearances.
 - c. Verify that the unit is clean.
 - d. Verify blade alignment, blade penetration, travel stops, and mechanical operation.
 - e. Verify that fuse sizes and types match the Specifications and Drawings.
 - f. Verify that each fuse has adequate mechanical support and contact integrity.
 - g. Inspect bolted electrical connections for high resistance using one of the two following methods:
 - 1) Use a low-resistance ohmmeter.
 - a) Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50 percent of the lowest value.
 - 2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data or NETA ATS Table 100.12.
 - a) Bolt-torque levels shall be in accordance with manufacturer's published data. In the absence of manufacturer's published data, use NETA ATS Table 100.12.
 - h. Verify that operation and sequencing of interlocking systems is as described in the Specifications and shown on the Drawings.
 - i. Verify correct phase barrier installation.
 - j. Verify lubrication of moving current-carrying parts and moving and sliding surfaces.
2. Electrical Tests:
- a. Perform resistance measurements through bolted connections with a low-resistance ohmmeter. Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.
 - b. Measure contact resistance across each switchblade fuseholder. Drop values shall not exceed the high level of the manufacturer's published data. If manufacturer's published data are not available, investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.
 - c. Perform insulation-resistance tests for one minute on each pole, phase-to-phase and phase-to-ground with switch closed, and across each open pole. Apply voltage in accordance with manufacturer's published data. In the absence of manufacturer's published data, use Table 100.1 from the NETA ATS. Investigate values of insulation resistance less than those published in Table 100.1 or as recommended in manufacturer's published data.
 - d. Measure fuse resistance. Investigate fuse-resistance values that deviate from each other by more than 15 percent.
- C. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.

END OF SECTION 262816

SECTION 26 56 68 – EXTERIOR ATHLETIC LIGHTING

Lighting System with LED Light Source

PART 1 – GENERAL

1.1 SUMMARY

- A. Work covered by this section of the specifications shall conform to the contract documents, engineering plans as well as state and local codes.
- B. The purpose of these specifications is to define the lighting system performance and design standards for Columbia Park using an LED Lighting source. The manufacturer / contractor shall supply lighting equipment to meet or exceed the standards set forth in these specifications.
- C. The sports lighting will be for the following venues:
 - 1. Softball
- D. The primary goals of this sports lighting project are:
 - 1. **Guaranteed Light Levels:** Selection of appropriate light levels impact the safety of the players and the enjoyment of spectators. Therefore light levels are guaranteed to not drop below specified target values for a period of 5 years.
 - 2. **Environmental Light Control:** It is the primary goal of this project to minimize spill light to adjoining properties and glare to the players, spectators and neighbors.
 - 3. **Cost of Ownership:** In order to reduce the operating budget, the preferred lighting system shall be energy efficient and cost effective to operate. All maintenance costs shall be eliminated for the duration of the warranty.

1.2 LIGHTING PERFORMANCE

- A. **Illumination Levels and Design Factors:** Playing surfaces shall be lit to an average target illumination level and uniformity as specified in the chart below. Lighting calculations shall be developed, and field measurements taken on the grid spacing with the minimum number of grid points specified below. Appropriate light loss factors shall be applied and submitted for the basis of design. Average illumination level shall be measured in accordance with the IESNA LM-5-04 (IESNA Guide for Photometric Measurements of Area and Sports Lighting Installations). Illumination levels shall not to drop below desired target values in accordance to IES RP-6-15, Page 2, Maintained Average Illuminance and shall be guaranteed for the full warranty period.

Area of Lighting	Average Target Illumination Levels	Maximum to Minimum Uniformity Ratio	Grid Points	Grid Spacing
Softball	50fc infield / 30fc outfield	2:1 infield / 2.5:1 outfield	140	20' x 20'

- B. **Color:** The lighting system shall have a minimum color temperature of no higher than 5700K and a CRI of no less than 75.

- C. **Mounting Heights:** To ensure proper aiming angles for reduced glare and to provide better playability, minimum mounting heights shall be as described below. Higher mounting heights may be required based on photometric report and ability to ensure the top of the field angle is a minimum of 10 degrees below horizontal.

# of Poles	Pole Designation	Pole Height
6	A1-A2, B1,B2,C1,C2	60'

1.3 ENVIRONMENTAL LIGHT CONTROL

- A. **Light Control Luminaires:** All luminaires shall utilize spill light and glare control devices including, but not limited to, internal shields, louvers and external shields. No symmetrical beam patterns are accepted.
- B. **Spill Light and Glare Control:** To minimize impact on adjacent properties, spill light and candela values must not exceed the following levels taken at 3 feet above grade.
- C. **Spill Scans:** Spill scans must be submitted indicating the amount of horizontal and vertical footcandles along the specified lines. Light levels shall be taken at 30-foot intervals along the boundary line. Readings shall be taken with the meter orientation at both horizontal and aimed towards the most intense bank of lights. Illumination level shall be measured in accordance with the IESNA LM-5-04 after 1 hour warm up.
- D. The first page of a photometric report for all luminaire types proposed showing horizontal and vertical axial candle power shall be provided to demonstrate the capability of achieving the specified performance. A summary of the horizontal and vertical aiming angles for each luminaire shall be included with the photometric report.

PART 2 – PRODUCT

2.1 SPORTS LIGHTING SYSTEM CONSTRUCTION

- A. **Manufacturing Requirements:** All components shall be designed and manufactured as a system. All luminaires, wire harnesses, drivers and other enclosures shall be factory assembled, aimed, wired and tested.
- B. **Durability:** All exposed components shall be constructed of corrosion resistant material and/or coated to help prevent corrosion. All exposed carbon steel shall be hot dip galvanized per ASTM A123. All exposed aluminum shall be powder coated with high performance polyester or anodized. All exterior reflective inserts shall be anodized, coated, and protected from direct environmental exposure to prevent reflective degradation or corrosion. All exposed hardware and fasteners shall be stainless steel, passivated and coated with aluminum-based thermosetting epoxy resin for protection against corrosion and stress corrosion cracking. Structural fasteners may be carbon steel and galvanized meeting ASTM A153 and ISO/EN 1461 (for hot dipped galvanizing), or ASTM B695 (for mechanical galvanizing). All wiring shall be enclosed within the cross-arms, pole, or electrical components enclosure.
- C. **System Description:** Lighting system shall consist of the following:
 1. Galvanized steel poles and cross-arm assembly.
 2. Non-approved pole technology:

- a. Square static cast concrete poles will not be accepted.
 - b. Direct bury steel poles which utilize the extended portion of the steel shaft for their foundation will not be accepted due to potential for internal and external corrosive reaction to the soils and long-term performance concerns.
3. Lighting systems shall use concrete foundations.
- a. For a foundation using a pre-stressed concrete base embedded in concrete backfill the concrete shall be air-entrained and have a minimum compressive design strength at 28 days of 3,000 PSI. 3,000 PSI concrete specified for early pole erection; actual required minimum allowable concrete strength is 1,000 PSI. All piers and concrete backfill must bear on and against firm undisturbed soil.
 - b. For anchor bolt foundations or foundations using a pre-stressed concrete base in a suspended pier or re-enforced pier design pole erection may occur after 7 days if fully cured.
4. Manufacturer will supply all drivers and supporting electrical equipment
- a. Remote drivers and supporting electrical equipment shall be mounted approximately 10 feet above grade in aluminum enclosures. The enclosures shall be touch-safe and include drivers and fusing with indicator lights on fuses to notify when a fuse is to be replaced for each luminaire. Disconnect per circuit for each pole structure will be located in the enclosure. Integral drivers are not allowed.
 - b. Manufacturer shall provide surge protection at the pole equal to or greater than 40 kA for each line to ground (Common Mode) as recommended by IEEE C62.41.2_2002.
5. Wire harness complete with an abrasion protection sleeve, strain relief and plug-in connections for fast, trouble-free installation.
6. All luminaires, visors, and cross-arm assemblies shall withstand 150 mi/h winds and maintain luminaire aiming alignment.
7. Control cabinet to provide remote on-off control and monitoring features of the lighting system.
8. Manufacturer shall provide lightning grounding as defined by NFPA 780 and be UL Listed per UL 96 and UL 96A.
- a. Integrated grounding via concrete encased electrode grounding system.
 - b. If grounding is not integrated into the structure, the manufacturer shall supply grounding electrodes, copper down conductors, and exothermic weld kits. Electrodes and conductors shall be sized as required by NFPA 780. The grounding electrode shall be minimum size of 5/8 inch diameter and 8 feet long, with a minimum of 10 feet embedment. Grounding electrode shall be connected to the structure by a grounding electrode conductor with a minimum size of 2 AWG for poles with 75 feet mounting height or less, and 2/0 AWG for poles with more than 75 feet mounting height.
- D. Safety: All system components shall be UL listed for the appropriate application.

2.2 ELECTRICAL

- A. Electric Power Requirements for the Sports Lighting Equipment:
 - 1. Electric power: SEE ELECTRICAL PLAN

2. Maximum total voltage drop: Voltage drop to the disconnect switch located on the poles shall not exceed three (3) percent of the rated voltage.

B. Energy Consumption: The kW consumption for the field lighting system shall be approximately 30kw.

2.3 CONTROL

A. Instant On/Off Capabilities: System shall provide for instant on/off of luminaires.

B. Lighting contactor cabinet(s) constructed of NEMA Type 4 aluminum, designed for easy installation with contactors, labeled to match field diagrams and electrical design. Manual off-on-auto selector switches shall be provided.

C. Dimming: System shall provide for 3-stage dimming (high-medium-low). Dimming will be set via scheduling options (Website, app, phone, fax, email)

2.4 STRUCTURAL PARAMETERS

A. Wind Loads: Wind loads shall be based on the current version of the International Building Code. Wind loads to be calculated using ASCE 7-16, an ultimate design wind speed of 115 mph and exposure category C.

B. Pole Structural Design: The stress analysis and safety factor of the poles shall conform to 2013 AASHTO Standard Specification for Structural Supports for Highway Signs, Luminaires, and Traffic Signals (LTS-6).

C. Foundation Design: The foundation design shall be based on soil parameters as outlined in the geotechnical report. If no geotechnical report is available, the foundation design shall be based on soils that meet or exceed those of a Class 5 material as defined by 2018 IBC Table 1806.2.

D. Foundation Drawings: Project specific foundation drawings stamped by a registered engineer in the state where the project is located are required. The foundation drawings must list the moment, shear (horizontal) force, and axial (vertical) force at ground level for each pole. These drawings must be submitted at time of bid to allow for accurate pricing.

PART 3 – EXECUTION

3.1 SOIL QUALITY CONTROL

It shall be the Contractor's responsibility to:

1. Notify the Owner and Engineer if soil conditions exist other than those on which the foundation design is based, or if the soil cannot be readily excavated.
2. Provide engineered foundation embedment design by a registered engineer in the State of SD for soils other than specified soil conditions;
3. Provide additional materials required to achieve alternate foundation;
4. Provide excavation and removal of materials other than normal soils, such as rock, caliche, etc.

3.2 FIELD QUALITY CONTROL

- A. Illumination Measurements: Upon substantial completion of the project and in the presence of the Contractor, Project Engineer, Owner's Representative, and Manufacturer's Representative, illumination measurements shall be taken and verified. The illumination measurements shall be conducted in accordance with IESNA LM-5-04.
- B. Field Light Level Accountability
 - 1. Light levels are guaranteed not to fall below the target maintained light levels for the entire warranty period.
- C. Correcting Non-Conformance: If, in the opinion of the Project Engineer, Owner or owner's appointed Representative, the actual performance levels including footcandles and uniformity ratios are not in conformance with the requirements of the performance specifications and submitted information, the Manufacturer shall be required to make adjustments to meet specifications and satisfy the Project Engineer and Owner.

3.4 WARRANTY AND GUARANTEE

- A. 5-Year Warranty: Each manufacturer shall supply a signed warranty covering the entire system for 5 years from the date of substantial completion. Warranty does not cover weather conditions events such as lightning or hail damage, vandalism or abuse, unauthorized repairs or alterations, or product made by other manufacturers.

PART 4 – DESIGN APPROVAL

4.0 PRE-BID SUBMITTAL REQUIREMENTS (Non-Musco)

- A. Design Approval: The Project Engineer will review pre-bid submittals by alternate manufacturers for approval to bid their product. Approvals will be issued by Project Engineer via Addendum.
- B. Approved Product: Musco's Light-Structure System™ with TLC for LED™ is the approved product.

END OF SECTION 265668

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SECTION 31 11 00 CLEARING AND GRUBBING

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.

1.02 DESCRIPTION

- A. Each Contractor shall accept the sites in their present condition. All grubbing shall be limited to those areas where new construction is shown.
- B. Clearing and grubbing will consist of the removal and disposal of trees, stumps, brush, roots, vegetation, logs, rubbish, and other objectionable natural or manmade material on and near the site of the work.
- C. All existing fences interfering with the construction operations shall be removed, salvaged, and reconstructed as shown on standard drawings after completion of the work. The reconstructed fences shall, in every way, be equal to or superior to the fence removed.
- D. All wastes generated from this project will be disposed of according to Part 3.05 of this specification.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Construction or protection fencing shall be wire fabric or of snow fence construction fastened to metal or wood posts solidly set in the ground in such a manner that will prevent the collapse of the protective material.

PART 3 EXECUTION

3.01 GENERAL

- A. The Contractor will be responsible to find a suitable site to stockpile any materials generated from the work prior to proper disposal.
- B. Prior to certification of project completion, the Contractor shall obtain and furnish to the Owner a lien waiver or a letter of satisfaction written by the stockpile area property owner and addressed to the Contractor.

3.02 PROTECTION

- A. Trees, shrubs and brush designated for preservation by the Owner's representative, shall be carefully trimmed as directed. Trees, shrubs, etc., so designated shall be protected from scarring, barking, or other injuries during construction operations by fencing or other approved barricades.

- B. Paint required for cut or scarred surfaces of trees or shrubs selected for preservation shall be an approved asphalt base paint prepared especially for tree surgery or orange shellac.

3.03 CLEARING

- A. The entire project site shall be cleared of all trees, stumps, brush, logs, and rubbish only as required to complete construction except such trees and brush as may be designated by the Owner to be left in place.

3.04 GRUBBING

- A. On areas required for construction of embankments, all stumps, roots, etc., shall be removed to a depth of at least one foot below the existing ground surface.
- B. On areas required for borrow sites and material sources, stumps, roots, etc., shall be removed to the complete extent necessary to prevent such objectionable matter becoming mixed with the material to be used on construction.
- C. Stump holes and other holes from which obstructions have been removed shall be backfilled and compacted in accordance with the requirements of the applicable sections of those specifications dealing with the excavation, backfill, embankment and compaction in the areas affected.

3.05 CLEANING OF THE WORK SITE

- A. All materials cleared and grubbed shall be disposed of as outlined in these specifications or as directed by the Engineer or Owner.
- B. All trees, shrubs, brush, and other vegetation shall be removed and disposed of on a daily basis.
- C. Before the work will be considered complete, the Contractor must remove all surplus materials, tools, equipment, or plant, leaving the site of the work and all portions of the finished work clean, unobstructed, free from all weeds, brush, rubbish, stumps, or other objectionable materials and ready for use.

3.06 WASTE DISPOSAL

- A. All material generated by this project must be disposed of at a permitted site. Depending on what material is generated and whether it is contaminated or uncontaminated will determine which permitted facility can accept it. Permitted facilities include construction and demolition debris sites, restricted use sites, and regional landfills. Contact the SD DENR Waste Management Program at 605-773-3153 to identify locally permitted disposal sites for various categories of contaminated and uncontaminated materials.
- B. All timber from which saw logs, posts, poles, ties, or cord wood can be made shall be considered as merchantable timber and shall be the property of the Contractor.
- C. All perishable material shall be removed from the site.

* * * 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
 - 2. Aggregate Base Course - Section 32 11 23

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 construction of the softball complex, parking lots, roadway, sidewalks, buildings, etc., 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 01051. 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 METHOD OF MEASUREMENT

- A. The quantity of "Unclassified Excavation" shall be measured as the difference in volume between the original position of the soil and the final position of the excavated soil as shown on the cross sections or as modified in the field by a change in final position as directed by the Engineer.

1.05 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 and base at an approximate rate of 1 test per 10,000 SqFt, or as deemed necessary by the Engineer.
- C. The Contractor may 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 0.1 feet of the final elevations as staked by the Owner's authorized representative.

PART 2 PRODUCTS

2.01 CONTRACTOR FURNISHED CLAY BORROW

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 and meet the requirements of the Soils Report.

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 softball complex, 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. The entire area shall be rolled and compacted.
- B. After removal 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".
- C. A thin layer (approximately 6 inches) of the fill material shall then be uniformly

spread over the entire area and whole area compacted to 95% of maximum density as determined by standard proctor ASTM Test Designation D698 at a moisture content between 1% and 4% under and optimum moisture (per soils report).

- D. 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. Compaction and watering shall be continued on all areas below the proposed softball complex until it has been compacted to 95% of maximum density in accordance with ASTM D698 (standard proctor) at a moisture content between 1% under and 4% under optimum.
- H. 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, as shown on plans.
- B. All topsoil removed from the excavation areas shall be salvaged and replaced over the disturbed areas.
- C. The stockpiling of topsoil shall be in accordance with the requirements of paragraph 3.04.

3.10 SUBGRADE 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 TOPSOIL TOLERANCES

- A. The topsoiling of the outfield playing surfaces of the ballfield shall be of such smoothness that it will not vary more than 0.05 of a foot from true grade as established by grade hubs. The ENGINEER and OWNER must both APPROVE the topsoiling prior to any grass seeding. Any deviation in excess of this amount shall be corrected by loosening, adding, or removing materials, reshaping, and compacting.

- B. The topsoiling of all other areas outside that of the outfield playing surfaces of the ballfield 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.

3.12 WATERING FOR EMBANKMENTS

- A. Refer to Section 31 23 11 - Watering for Embankments.

3.13 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.

3.14 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.

* * * 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. Structural Excavating, Filling and Grading - Section 31 23 16
 - 2. Trenching, Backfilling and Compacting - Section 31 23 33
 - 3. Manholes and Castings – Section 33 39 13
 - 4. Water Utility Piping and Fittings – Section 33 11 00
 - 5. 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.

PART 4 MEASUREMENT AND PAYMENT

4.01 METHOD OF MEASUREMENT

- A. Sheeting, shoring, and bracing left in place to protect footings, structures, or piping shall be measured as part of the base bid prices if detailed on the plans.

4.02 BASIS OF PAYMENT

- A. Payment for sheeting, shoring, and bracing will be allowed, if not detailed on the plans, only if ordered to be left in place by the Engineer in writing during construction.

* * * END OF SECTION * * *

SECTION 31 23 16

STRUCTURAL EXCAVATING, FILLING, AND GRADING

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. Clearing, Grubbing and Waste Disposal - Section 31 11 00.
 - 2. Sheeting, Shoring and Bracing - Section 31 23 14
 - 3. Trenching, Backfilling and Compacting - Section 31 23 33
 - 4. Seeding and Fertilizing – Section 32 92 19
 - 5. Existing Underground Utilities - Section 33 01 00
 - 6. Manholes and Castings – Section 33 39 13

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, filling, backfilling, and grading for all structures complete in accordance with the specifications, applicable drawings, and subject to the terms and conditions of the contract.
- B. Structures shall include, but not be limited to; manholes, pond structures, and ground vaults.
- C. Structural foundations for buildings, water storage structures, and other architectural structures are not included with this specification. See project specific specifications for those items.
- D. Such excavation and backfilling as is required for the installation of piping, electrical, and mechanical work is not covered in this section but is covered in those sections related to each item.
- E. The extent and performance of the excavations, filling, backfilling, and grading shall be as shown on the plans and shall comply with the requirements, codes, and guidelines of the various governing bodies and regulatory agencies.

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. After the excavation has been completed and before any engineered fill or structures

are placed, the subgrade shall be inspected and tested by the Engineer before it is used as a foundation.

- C. 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.
- D. The Contractor may conduct additional soil testing and quality control testing as desired for his own information and use.

1.04 SUBMITTALS

- A. Three copies of the following reports shall be submitted directly to the Engineer from the testing and inspection services employed by the Contractor as per 1.03 above with copies to the Owner.
 - 1. Material Certifications
 - 2. Field density reports
 - 3. Results of quality control tests
 - 4. Inspection and observation reports
 - 5. Verification of footing conditions and elevations

1.05 JOB CONDITIONS

- A. The Contractor shall locate existing underground utilities in the areas of work. If existing utilities are to remain in place, provide adequate means of protection during earthwork operations.
- B. Should uncharted or incorrectly charted piping or other utilities be encountered during excavation, consult the Engineer immediately for directions as to procedure. Cooperate with Owner and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of utility owner.
- C. Do not interrupt existing utilities serving facilities occupied and used by Owner or others except when permitted in writing by the Owner, and then only after acceptable temporary utility services have been provided.
- D. The use of explosives on any portion of the work without prior written permission from authorities having jurisdiction is prohibited. Contractor is solely responsible for handling, storage, and use of explosive materials when their use is permitted.
- E. Barricade open excavations occurring as part of this work and post with warning lights. Operate warning lights during hours from dusk to dawn each day and as otherwise required.
- F. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

1.06 CLASSIFICATION OF EXCAVATED MATERIALS

A. No classification of excavated materials will be made. Excavation and trenching work shall include the removal and subsequent handling of all materials excavated or otherwise removed in performance of the contract work, regardless of the type, character, composition, or condition thereof.

*** Exception: A bid item may be provided on the bid form for the removal of unsuitable material.

PART 2 PRODUCTS

2.01 ENGINEERED FILL MATERIAL

A. The Contractor shall provide acceptable soil material where required for structural engineered fill which meets the following gradation:

MECHANICAL ANALYSIS:

SIEVE SIZE	% PASSING
3/8"	100%
#4	95-100
#8	80-100
#30	25-60
#200	0-10

B. The engineered fill material shall be non-plastic when tested in accordance with ASTM D4318.

2.02 NON-ENGINEERED FILL AND BACKFILL MATERIALS

A. The Contractor shall provide acceptable soil materials for backfill and fill which shall be non-expansive material and shall be free of clay, rock, or gravel larger than two (2) inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.

B. Acceptable soil materials are defined as those materials that, in the judgment of the independent testing and inspection service, will perform as required for the intended use.

PART 3 EXECUTION

3.01 STRIPPING

A. All vegetation such as brush, heavy sod, decayed matter, rubbish and any other unsuitable material within a fill area shall be stripped or otherwise removed before

the excavation or backfill is started. In no case shall such objectionable material be allowed in or under fill.

- B. All dark loam shall be stripped and stockpiled to be replaced on top of the final embankments and all disturbed areas not covered by walks or pavements.

3.02 EXCAVATION

- A. The sloped sides of all excavations are to comply with all local, state, and federal codes and ordinances having jurisdiction. The sides and slopes of excavations should be maintained in a safe condition until completion of backfilling. Bottom of excavation shall slope as shown on the plans.
- B. Sheeting, shoring, and bracing are to be furnished and used where minimum sloping is not possible because of space restriction and stability of material.
- C. Excavation shall be completed to an extent to conform to elevations and dimensions shown within a tolerance of plus or minus 0.10 feet and extending a sufficient distance from footings and foundations to permit placing and removal of concrete formwork, installation of services, other construction required and for inspection. Undercutting of banks will not be permitted. In excavating for footings and foundations, care shall be taken not to disturb the bottom of the excavation or over excavate. Excavate by hand, if necessary, to final grade just before concrete is placed. Trim bottoms to required lines and grades to leave solid base to receive concrete or engineered fill. If excavations under footings are carried below the elevations shown or directed, the over excavation shall be restored to proper elevation by and at the expense of the Contractor, using approved, compacted engineered fill.
- D. Where unsuitable material underlies the footing or foundation, the unsatisfactory material is to be excavated to a depth where suitable materials are found or as directed by the independent testing and inspection service, or the Engineer. All over excavation required for removal of unstable material shall be backfilled with engineered fill material. The backfill material shall be compacted equal to the density and moisture content as specified herein. Footings shall be placed at the elevations shown on the plans.
- E. Prevent surface water and subsurface or groundwater from flowing into excavations and from flooding project site and surrounding area. Do not allow water to accumulate in excavations. Remove water to prevent softening of foundation bottoms, undercutting footings, and soil changes detrimental to stability of subgrades and foundations. Provide and maintain pumps, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations. Convey water removed from excavations and rainwater to collecting or runoff areas. Provide and maintain temporary drainage ditches and other diversions outside excavation limits for each structure. Do not use trench excavations as temporary drainage ditches.
- F. Stockpile suitable excavated materials until required for backfill or fill. Place, grade, and shape stockpiles for proper drainage. Locate and retain soil materials away from edge of excavations. Dispose of excess soil material and waste materials as

specified.

- G. Protect excavation bottoms against freezing when atmospheric temperature is less than 35 degrees F.

3.03 COMPACTION

- A. Soil compaction processes shall be controlled during construction providing for the percentage of density specified.
- B. Testing methods and Density Requirements:
 - 1. When depth of Engineered fill is greater than eight (8) inches, the Engineered Fill shall tested and compacted to not less than 95% Proctor density (ASTM D698). If depth of Engineered Fill is less than eight (8) inches, testing will not be required unless visual observation by the Engineer warrants testing.
 - 2. All non-engineered fill and all subgrades shall be compacted to 95% of Standard Proctor (ASTM D698). Testing will be performed under each structure to assure density requirements are attained.
- C. Where subgrade or a layer of soil material must be moisture conditioned before compaction, uniformly apply water to the surface of subgrade or layer of soil material in such a manner as to prevent free water appearing on the surface during or subsequent to compaction operations. Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to specified density. Soil material that has been removed because it is too wet to permit compaction may be stockpiled or spread and allowed to dry. Assist drying by disking, harrowing, or pulverizing, until moisture content is reduced to a satisfactory value as determined by moisture-density relation tests.

3.04 COMPACTION AND FILL

- A. Backfill excavations as promptly as work permits but not until completion of the following:
 - 1. Inspection and acceptance by Engineer of all construction below finish grade, including the independent inspection service, and, where applicable, damp proofing, waterproofing, and perimeter insulation.
 - 2. Inspection, testing, approval, and recording locations of underground utilities.
 - 3. Removal of all concrete formwork.
 - 4. Removal of shoring and bracing, and backfilling of voids with satisfactory materials. Cut off temporary sheet piling driven below bottom of structures and remove in manner to prevent settlement of the structure or utilities, or leave in place if required.
 - 5. Removal of trash and debris.
 - 6. Permanent or temporary horizontal bracing is in place on horizontally supported walls.
- B. Remove vegetation, debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface prior to placement of fills. Plow, strip, or

break up sloped surfaces steeper than one (1) vertical to four (4) horizontal so that fill material will bond with existing surface. When existing ground surface has a density less than that specified herein, break up the ground surface, pulverize, moisture-condition to the optimum moisture content, and compact to required depth and percentage of maximum density.

- C. Place backfill and fill materials in layers not exceeding 8 inches in loose depth. Before compaction moisten or aerate each layer as necessary to provide the optimum moisture content. Mechanically compact each layer to the required percentage of maximum density for each area classification. Compaction of structure backfill by inundation with water will not be permitted. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.
- D. Place all backfill and fill materials evenly adjacent to structures, to the required elevations. Take care to prevent wedging action of backfill against structures by carrying the material uniformly around structure to approximately same elevation in each lift.

3.05 GRADING

- A. Uniformly grade areas within the limits of grading under this section, including adjacent transition areas. Smooth all finished surfaces within specified tolerances, compact with uniform levels or slopes between points where elevations are shown, or between such points and existing grades.
- B. Grade areas adjacent to building lines to drain away from structures and to prevent ponding. Finish surfaces free from irregular surface changes and as follows:
 - 1. Grassed Areas: Finished areas are to receive topsoil to within not more than 0.10 feet above or below the required subgrade elevations.
 - 2. Walks: Shape surface of areas under walks to line, grade, and cross section with finished surface not more than 0.10 feet above or below the required subgrade elevation.
 - 3. Roads and Parking within Building Excavation Limits: Shape surface of areas under pavement to line, grade, and cross section with finished surface not more than 1/2 inch above or below the required subgrade elevation.
- C. Grade all surfaces of fill under slabs smooth and even, free of voids, compacted as specified, and to required elevation. Provide final grades within a tolerance of 1/4-inch when tested with a 10-foot straightedge.

3.06 TOPSOIL

- A. The Contractor shall remove and stockpile sufficient topsoil to surface to a minimum depth of six (6) inches, or depth as shown on the plans, all fills, embankments, and any other areas on the site of the work where the original topsoil will be covered or damaged. Topsoil shall be free from trash, debris, and surface vegetation more than two (2) inches in height.
- B. Prior to the topsoiling and finish grading operations, all rough grades shall be corrected, adjusted, and repaired if required. All subgrade surfaces shall be brought

to the prescribed elevations.

- C. The subgrade surface shall be prepared prior to topsoil placement by being made loose and friable by cross-disking or other approved method, 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 shall be placed and evenly spread to such thickness that the finished compacted depth of four (4) inches, unless otherwise shown on the plans, is obtained.
- F. Topsoil material shall not be placed when the topsoil or subgrade is frozen or wet enough to cause clodding.
- G. Topsoiling operations shall be considered complete when the finished surface of the compacted topsoil is:
 - 1. Free of sticks, stones, and other material of one (1) inch or more in any direction.
 - 2. Smooth and true to required grades with a maximum allowable deviation of 0.1 foot.

3.07 MAINTENANCE

- A. Protect newly graded areas from traffic and erosion and keep free of trash and debris.
- B. Repair and re-establish grades in settled, eroded, and rutted areas to specified tolerances.
- C. Where completed compacted areas are disturbed by subsequent construction operations or adverse weather the Contractor will scarify surface, reshape, and compact to required density prior to further construction.

3.08 DISPOSAL OF EXCESS AND WASTE MATERIALS

- A. Transport acceptable excess excavated material to designated areas on the Owner's property. Stockpile soil or spread as directed by Owner.
- B. Remove all trash, debris, and waste materials from the Owner's property and dispose of at an approved landfill.

3.09 SETTLEMENT

- A. The Contractor shall be responsible for all settlement of backfill, fills, and embankments that may occur within the correction period stipulated in the General Conditions.
- B. The Contractor shall make, or cause to be made, all repairs, or replacements made necessary by settlement within thirty (30) days after notice from the Engineer or Owner.

PART 4 MEASUREMENT AND PAYMENT

4.01 METHOD OF MEASUREMENT

- A. Structural excavation, filling, and grading will not be measured for direct payment and will be considered incidental work pertaining to the contract. No direct compensation will be made for this work.
- B. When over excavation is required to remove and replace unsuitable material, such excavation shall be measured at the Contract Units as shown in the Bid Form, and in accordance with the provisions for Unsuitable Materials outlined in Part 3 of this specifications, provided such excavation is not due to the fault or neglect of the Contractor.

4.02 BASIS OF PAYMENT

- A. Structural excavation, filling, and grading will be considered incidental work pertaining to the contract. No direct compensation will be made for this work.
- B. When over excavation is required to remove and replace unsuitable material, such excavation shall be paid at the contract unit price as shown in the Bid Form.

* * * 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. Structural Excavating, Filling and Grading - Section 31 23 16
 - 3. Curbs, Gutters, Sidewalks and Driveways - Section 32 16 00
 - 4. Existing Underground Utilities - Section 33 01 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 95% 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, boulevards, and cropland areas shall be left smooth with a minimum of 6" of compacted black dirt (4" minimum on pasture and grasslands) throughout the entire area disturbed by the trench.
- B. Pasture or native grasslands or other areas designated on the plans shall be reseeded to the full width and length of areas disturbed during construction.
- C. Prior to topsoiling and finish grading, all rough grades shall be corrected, adjusted, and brought to the required elevations.

- D. 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.
- E. 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.
- F. Topsoil material shall not be placed when the topsoil or subgrade is frozen or wet enough to cause clodding.
- G. 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.
- H. 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.

PART 4 MEASUREMENT AND PAYMENT

4.01 METHOD OF MEASUREMENT

- A. Trenching, backfilling, and compacting are considered incidental work with no separate measurement and payment to be made.
- B. Should rock (solid material not removable without blasting or power hammer) be encountered, one of the following procedures will be followed upon agreement between the Owner, Contractor, and Engineer:
 - 1. The line will be relocated; or
 - 2. Excavation will continue at a negotiated price, or the unit price, as shown on the Bid Form. Measurement will be on the basis of actual length, depth, and width. The maximum width allowed for payment shall be nominal pipe diameter plus 16 inches at the trench bottom and six (6) feet at ground level.
 - 3. Shale, regardless of the nature of deposit, will not be considered as rock excavation unless so designated on the plans. The responsibility and cost of satisfactorily demonstrating to the Engineer that the material being considered for rock excavation cannot be removed by means other than drilling and/or blasting shall be the obligation of the Contractor.
- C. When over excavation is required to remove and replace unsuitable material, such excavation shall be measured at the Contract Units as shown in the Bid Form, and in accordance with the provisions for Unsuitable Materials outlined in Part 3 of this specifications, provided such excavation is not due to the fault or neglect of the Contractor.
- D. Dewatering will not be directly measured directly and will be considered as

subsidiary work pertaining to the Contract unless dewatering is specifically called for in the bid schedule. When called for in the bid schedule, the quantity given in the bid schedule is an estimate only, given to aid the Contractor in the preparation of his bid. Dewatering shall be measured in lineal feet of trench actually requiring dewatering as preapproved by the Engineer.

4.02 BASIS OF PAYMENT

- A. Trenching, backfilling, and compacting are considered incidental work with no separate payment to be made.
- B. Should rock (solid material not removable without blasting or power hammer) be encountered, one of the following procedures will be followed upon agreement between the Owner, Contractor, and Engineer:
 - 1. The line will be relocated; or
 - 2. Excavation will continue at a negotiated price, or the unit price, as shown on the Bid Form.
- C. When over excavation is required to remove and replace unsuitable material, such excavation shall be paid at the contract unit price as shown in the Bid Form.
- D. Dewatering will not be directly measured for direct payment unless dewatering is specifically called for in the bid schedule. Payment for dewatering that is preapproved by the Engineer shall be paid for at the unit contract price shown on the Bid Form.

* * * END OF SECTION * * *

SECTION 31 34 19

GEOTEXTILE FABRICS

PART 1 GENERAL

1.01 SUMMARY

- A. This section includes the requirements for furnishing and installing geotextile fabric as shown on the plans.

1.02 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. Excavation and Fill - Section 31 23 00
 - 2. Aggregate Base Course - Section 32 11 23

1.03 QUALITY ASSURANCE

- A. When geotextile meeting or exceeding the required property values have been submitted and approved, the properties used for quality control shall be properties established by geotextile manufacturer for this type of product and not the values specified herein.

1.04 DELIVERY, HANDLING, AND STORAGE

- A. Geotextile shall be provided in rolls wrapped in relatively impermeable and opaque protective covers with the following clearly marked on each roll.
 - 1. Manufacturer's name.
 - 2. Product identification.
 - 3. Lot and roll number.
 - 4. Roll dimensions.
- B. Geotextile shall be stored in a dry location above the ground surface. Geotextile shall not be stored directly on the ground.
- C. Geotextile shall be handled in accordance with the manufacturer's recommendations to prevent damage to material during unloading, handling, and installation operations.

PART 2 PRODUCTS

2.01 GENERAL

- A. The Contractor shall furnish materials whose minimum roll values meet or exceed project requirements.
- B. The geotextile fabric shall have polymeric yarns or fibers oriented into a stable

network to retain relative structure during handling, placement, and service.

2.02 GEOTEXTILE FABRIC PROPERTIES

- A. The Contractor shall provide a Certificate of Compliance verifying that the material meets the following specifications or documentation that the material is listed on the approved products list. If the type of fabric to be used is not specified, Geotextile Separator Fabric -shall be used. All values listed are Minimum Average Roll Values (MARV) unless otherwise specified.
- B. **The geotextile shall conform to the minimum physical property requirements for a Geotextile Separator fabric listed in Table 1.**
- C. The geotextile shall be furnished and stored at the site in a protective wrapping which shall protect the fabric from ultraviolet radiation and from abrasion due to shipping and handling. If the geotextile is to be exposed directly to sunlight in excess of two weeks, the fabric shall be ultraviolet stabilized.

TABLE 1 - GEOTEXTILE AND IMPERMEABLE PLASTIC MEMBRANE

Fabric and Membrane Property	Test Method	Drainage Fabric		Silt Fence	Geotextile Separator		MSE Geotextile Fabric	Impermeable Plastic Membrane
		Type A	Type B		Woven	Non-Woven		
PERFORMANCE CRITERIA DURING SERVICE LIFE								
Equivalent or Apparent Opening Size, US Standard Sieve	ASTM D4751	40-100	40-100	20-70	* 40-100	40-100	40-100	---
Thickness, Mils	ASTM D1777	---	---	---	---	---	---	12
Permittivity, Sec-1	ASTM D4491	0.2 Min	0.3 Min	0.4 Min	0.05 Min	0.1 Min	0.005 Min	<0.000010 cm/sec ⁽⁶⁾
STRENGTH REQUIREMENTS								
Wide Width Strip Tensile Strength, lbs/inch Machine & X-Machine Direction	ASTM D4595 ⁽²⁾	40	90	---	130	65	200	80
Grab Strength, lbs Machine & X-Machine Direction	ASTM D4632	---	---	90 Min	---	---	---	---
Elongation at Failure, % Machine & X-Machine Direction	ASTM D4595 ⁽²⁾	40 Min	50 Min	---	20 Min	20 Min	35 Max	20 Min
Burst Strength, psi	ASTM D3786 Diaphragm Method	130	290	---	290	210	430	---
Trapezoid Tear Strength, lbs	ASTM D4533 Any Direction	25	75	---	50	40	75	50
Puncture Strength, lbs	ASTM D4833 ⁽³⁾	25	90	---	75	50	110	60
ENVIRONMENTAL REQUIREMENTS								
Mildew/Rot Resistance, %	AATCC 30 1988 ⁽⁵⁾	100	100	---	100	100	100	100
Insect/Rodent Resistance, %	AATCC 24 1985 ⁽⁵⁾	100	100	---	100	100	100	100

TABLE 1 - GEOTEXTILE AND IMPERMEABLE PLASTIC MEMBRANE

Fabric and Membrane Property	Test Method	Drainage Fabric		Silt Fence	Geotextile Separator		MSE Geotextile Fabric		Impermeable Plastic Membrane
		Type A	Type B		Woven	Non-Woven			
Ultraviolet Resistance, % Strength Retention	ASTM D4355	(4)	(4)	70	(4)	(4)	(4)	(4)	(4)
TYPICAL USES									
		a	b	c	d	d	e		f

*Note: The actual AOS of the silt fence should only have one value for AOS on the certification. To be approved the value shall be within the allowable range specified above.

(2) 8" wide x 4" length (200 x 100 mm) specimen tested at a strain rate of 10% (0.4 inch) (10 mm) per minute.

(3) Using 5/16" (8 mm) diameter flat tipped steel cylinder centered with ring clamp.

(4) Non-stabilized or low susceptible geotextiles should not be exposed to ultraviolet radiation for more than 5 days.

(5) American Association of Textile Chemists and Colorists test procedures.

(6) Permeability Coefficient (ASTM D 4491).

(a) Joints for concrete pipe culverts & RC boxes, edge drains, drainage tubing, etc. Used as a general filtration fabric.

(b) Riprap, gabions, inslopes retention on MSE backfill, etc. Use-same as (a) except has a higher construction loading.

(c) Medians, ditches, slopes, etc. Used to filter sediment-laden water.

(d) Subgrades, embankments, etc. Used to separate granular material from subgrade.

(e) Bridge End Backfill and reinforced slopes. Used to create a reinforced fill and/or used as the wall facing material.

(f) Under pavements. Used to restrict the flow of fluids to underlying materials.

2.03 STAPLES

A. Staples for the filter fabric, if used, shall be made of 11-gauge or heavier steel wire. The staples shall be "U" shaped with a 1-inch crown, and legs with a minimum of 8-inches in length.

B. Installation shall be in accordance with the manufacturer's recommendations.

PART 3 EXECUTION

3.01 GEOTEXTILE INSTALLATION

A. The Contractor shall install all geotextile fabrics according to manufacturer's recommendations and as specified herein.

B. On side slopes, the geotextile shall be rolled down slope in such a manner as to continually keep geotextile in tension.

C. In presence of wind, Contractor shall weight geotextile during placement with sufficient sand bags, or equivalent, to keep geotextile in place during placement of granular materials.

D. During placement of geotextile, care shall be taken not to entrap in or under geotextile, stones, excessive dust, or moisture that could damage clay liner or hamper subsequent seaming operations.

E. Do not expose geotextile to precipitation prior to or during installation, and do not expose geotextile to direct sunlight for more than 15 days, unless otherwise specified.

- F. All overlaps of geotextile fabrics shall be oriented in direction of earth filling.
- G. The Contractor shall repair all tears in geotextile prior to installation of granular materials. The repair procedures shall be as recommended by manufacturer and as outlined below.
 - 1. On slopes, a fabric patch shall be sewn in place over the tear with a minimum overlap of 24 inches in each direction. The patch shall be continually sewn using a double sewn lock stitch, seams 1/4 to 3/4 inches apart and no closer than 1 inch from any edge.
 - 2. Should any tear exceed 10% of the roll width, the roll shall be removed from the slope and replaced.
 - 3. On non-slopes, the fabric patch may be spot sewn with a minimum overlap of 24 inches in each direction.
 - 4. All soil or granular material, which may have penetrated torn geotextile shall be removed and the area grade smooth.
- H. Geotextile shall be installed around all appurtenances protruding through geotextile as recommended by manufacturer and as specified below.
 - 1. Holes for pipes and appurtenances shall be the minimum size necessary for installation.
 - 2. The Contractor shall patch, seam, sew, or overlap the geotextile material around the pipe or appurtenances to provide a barrier against particle migration into or out of the geotextile fabric.

* * * END OF SECTION * * *

SECTION 32 11 23 AGGREGATE MATERIALS

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. Subbase Course - Section 32 11 26
 - 2. 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 aggregates 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 AND GRAVEL CUSHION

- A. The aggregate for base course/gravel cushion 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

REQUIREMENT	Aggregate Base Course	Gravel
		Cushion
SIEVE	PERCENT PASSING	
Liquid Limit Max	25	25
Plasticity Index	0-6	0-6
L.A. Abra. Loss, max.	40	40
Foot Notes	1,2	
Processing Required	crushed	crushed

- 1 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.
 2. 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 SUBGRADE PREPARATION

- A. Imported borrow material shall be spread over the entire width of the section and manipulated in such a way that the subgrade below is proof rolled to locate and repair unstable subgrade. Contractor shall then alternately blade and roll the loosened materials, adding water where necessary, until the material is compacted to 95% of maximum density between 1% below and 4% below optimum moisture. Contractor shall then cut the subgrade to within 0.1 feet of the grade stakes provided by the Owner's representative.

3.02 BASE COURSE

- A. Following the completion of the subgrade preparation, 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 to 97% of maximum density between 3% below and 3% above optimum moisture.

3.03 GRAVEL CUSHION

- A. Following the completion of the subgrade preparation, 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 reinforced concrete sidewalk.

3.04 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 11 24 AGRILIME

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: N/A

1.02 DESCRIPTION OF WORK

- A. Agri-lime course 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 agri-lime shall be within 0.05 feet at any point, as staked and checked by the Owner's Representative.

PART 2 PRODUCTS

2.01 AGRILIME

- A. The aggregate for agri-lime material shall consist of sound durable particles made of 100% crushed red dolomite limestone. The physical characteristics and quality of the materials shall conform to the specifications for the particular material required by the contract as follows:

Sieve Size	% Passing
3/8"	100
#4	95-100
#40	35-50
#80	25-35
#200	15-25

% ATSM: C127	Absorption	Not Greater than 4.0
ATSM: C131	Abrasion Loss (LAR)	Not Greater than 40
ATSM: C88	Soundness Loss (5 Cycle MG-SO ₄)	Max Allowed 15
ATSM: D4318	Atterberg Limits:	
	Liquid Limits	Max Allowed 40
	Plasticity Index	Max Allowed 6
ATSM: D3042	% Insoluble Residue Passing #200	Not Greater than 10

PART 3 EXECUTION

3.01 SUBGRADE PREPARATION

- A. Areas to receive agri-lime are all in fill sections. Following site removals, Borrow shall be hauled and placed. This fill material shall then be spread over the entire width of the section and manipulated in such a way that the subgrade below is proof rolled to locate and repair unstable subgrade. Contractor shall then alternately blade and roll the loosened materials, adding water where necessary, until the material is compacted to 95% of maximum density between 1% below and 4% below optimum moisture. Contractor shall bring in the borrow fill then shall grade the subgrade to within 0.1 feet of the grade stakes provided by the Owner's representative.

3.02 AGRILIME

- A. Following the completion of the subgrade filling/preparation, the agri-lime material, meeting the requirements as set forth in Part 2 above, shall be furnished and installed to obtain the desired grades (within 0.05 feet), as shown on the plans.

3.03 STORAGE

- A. **If the agri-lime material is to be stored/stockpiled prior to use on the infields, IT MUST be kept on hard surfacing (asphalt or concrete), which is to be free of rocks, dust and other contaminants.**

* * * 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: N/A

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, 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 SDDOT 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 320.3, 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 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. Tack coat shall be incidental to the asphalt patching.

PART 3 EXECUTION

3.01 GENERAL

- A. The construction requirements and material handling shall conform to the requirements of Section 320.3, 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 replace 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 an a compacted thickness of 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 maximum 45 tonne (50 ton) gross weight 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. Clearing, Grubbing and Waste Disposal - Section 31 11 00
 - 2. Structural Excavating, Filling, and Grading - Section 31 23 16
 - 3. Trenching, Backfilling and Compaction - Section 31 23 33
 - 4. 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 03 00 00.

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. Placement of concrete or asphalt on frozen surfaces will not be permitted.
- D. 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 on the Construction plans.
- B. 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.
- C. 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 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.
- 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.

3.04 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 321816.13
PLAYGROUND PROTECTIVE SURFACING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Protective surfacing for playground area.

1.02 RELATED REQUIREMENTS

1.03 REFERENCE STANDARDS

- A. ASTM F1292 - Standard Specification for Impact Attenuation of Surfacing Materials Within the Use Zone of Playground Equipment 2018, with Editorial Revision (2020).
- B. ASTM F1487 - Standard Consumer Safety Performance Specification for Playground Equipment for Public Use 2021.
- C. CPSC Pub. No. 325 - Public Playground Safety Handbook 2015.

1.04 DEFINITIONS

- A. Use Zone: The area beneath and immediately adjacent to a play structure or equipment (play event) that is designated for unrestricted circulation around equipment, and on whose surface it is predicted that a user would land when falling from or exiting the equipment.
- B. Critical Fall Height: The maximum fall height at which the protective surfacing meets the requirements of ASTM F1292.
- C. Fall Height: The vertical distance between the finished elevation of the designated play surface and the finished elevation of the protective surfacing beneath it as defined by ASTM F1487.
- D. Protective Surfacing: Resilient ground surfacing. The characteristics of the protective surfacing are based on the fall height of the playground equipment. Changes in either the surfacing or the fall height, particularly reducing the resilience of the protective surfacing or increasing the fall height, will reduce safety-related performance.
- E. Subbase: A layer under the resilient layer of the protective surfacing but over the subgrade; may be rigid, as in concrete or bituminous, or aggregate.

1.05 SUBMITTALS

- A. Product Data: For all manufactured surfacing products, provide manufacturer's product data showing materials of construction, compliance with specified standards, installation procedures, and safety limitations.
 - 1. Include IPEMA certifications where required.
- B. Shop Drawings: Detailed scale drawings showing locations of proposed playground equipment and exposed footings, bases, and anchorage points.
 - 1. Clearly identify footing and base elevations in relation to a fixed survey point on site and to subgrade elevation and depth of protective surfacing.
 - 2. Show locations of underground utilities.
 - 3. Show measured fall height for each playground equipment item, determined in accordance with ASTM F1487.
 - 4. Show Use Zone perimeters, determined in accordance with ASTM F1487.
- C. Samples: For each product for which color must be selected provide color chart showing full range of colors.
- D. Maintenance Data:
 - 1. For manufactured surfacing products, provide manufacturer's recommended maintenance instructions and list of repair products, with address and phone number of source of supply.

1.06 QUALITY ASSURANCE

- A. Maintain one copy of the latest edition of ASTM F1487 and CPSC Pub. No. 325 at project site.

- B. Manufacturer Qualifications: Company regularly engaged in manufacturing products specified in this section, with not less than three years of documented experience.
 - 1. Surfacing installed in minimum 10 sites and been in successful service minimum 5 years.
- C. Installer Qualifications: Company certified by manufacturer for training and experience installing the protective surfacing; provide installer's company name and address, and training and experience certificate.

1.07 PRE-INSTALLATION MEETING

- A. Convene a meeting one week before installation to discuss coordination between various installers.
 - 1. Require attendance by personnel responsible for grading and installers of playground equipment, protective surfacing, footings, and adjacent work.
 - 2. Include representatives of Contractor.
 - 3. Notify Owner at least 2 weeks prior to meeting.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, handle, and store protective surfacing to project site in accordance with manufacturer's recommendations.
- B. Store materials in a dry, covered area, elevated above grade.

1.09 WARRANTY

- A. Provide minimum 7 year warranty for playground surfacing.

PART 2 PRODUCTS

2.01 PERFORMANCE CRITERIA

- A. Because the safety of the playground depends on strict compliance with the performance criteria, this information is provided for Contractor's information.
 - 1. The protective surfacing constitutes a resilient layer installed over a non-resilient layer, which is installed over the subgrade, with the top of playground equipment footings and anchorage devices covered by full depth of the resilient portion of the protective surfacing.
 - 2. The top elevation of the protective surfacing is intended to be flush with adjacent grades.
 - 3. Use Zone: The protective surfacing has been designed to provide acceptable impact attenuation as defined in ASTM F1292 for Critical Height of 10 feet.

2.02 MATERIALS

- A. Poured-In-Place Permeable Surfacing: Shredded rubber bonded with polyurethane adhesive, allowing water penetration, over subgrade.
 - 1. Rubber: 100 percent recycled shredded styrene butadiene rubber (SBR) shreds or granules.
 - 2. Color: Determined by Owner based on manufacturer color selections. Each color selection to consist of 50% black and 50% color granules.
 - 3. Resilient Depth: 4-1/2 inches, maximum.
 - 4. Certification: Provide IPEMA certification of ASTM F1292 Critical Fall Height at thickness specified.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Playground equipment installer will perform playground layout prior to installation of footings; verify correctness of layout before starting this work.
- B. Verify that playground equipment installation is complete.
- C. Verify location of underground utilities and facilities in the playground area. Damage to underground utilities and facilities will be repaired at Contractor's expense.
- D. Verify that subgrades are at proper elevations and that smooth grading is complete.
- E. Verify that proper depth of surfacing is marked on base supports of playground equipment.

3.02 PREPARATION

- A. Correct subgrade irregularities to ensure that required depth of protective surfacing can be installed, and subgrade elevation is in accordance with manufacturer's requirements.
- B. Inside Use Zones remove all obstructions that would extend into the resilient protective surfacing.
- C. Remove rocks, debris, and other similar items.

3.03 SUBBASE

- A. Concrete subbase provided by Owner under separate contract.

3.04 RESILIENT SURFACING LAYER

- A. Install in accordance with CPSC Pub. No. 325, ASTM F1487, manufacturer's instructions, and requirements of authorities having jurisdiction (AHJ).
- B. Install proper thickness throughout Use Zone(s).
- C. Clean and dry surface of subbase.
- D. Poured In Place Surfacing:
 - 1. Mix components mechanically on-site in accordance with manufacturer's directions; do not mix by hand.
 - 2. Install seamlessly; ensure complete bond to subbase.
 - 3. Cover footings and foundations and adhere tightly around penetrating elements.
 - 4. Maintain full thickness of resilient layers within Use Zone; cover or abut containment curbs as indicated on drawings; completely cover tapered transition edges.
 - 5. Hand trowel exposed surface to smooth, even finish.
 - 6. Impact Attenuation Layer: Install entire layer in one continuous pour on the same day.
 - 7. Wear Surface: Bond wear surface to substrate with adhesive. Apply adhesive in small quantities so that wear surface can be applied before adhesive dries.
 - a. Install surfacing seamlessly. When wear surface is composed of different color patterns, pour surface continuously and seamlessly.
 - b. When seams are required due to color change or field conditions, place adjacent wear surface as soon as possible, before initial pour has cured. Coat edge of initial pour with adhesive and apply wear surface mixture immediately.
 - c. Add a minimum of 1/16 inch depth to specified surfacing depth to ensure required impact attenuation performance is met.
 - d. Install wear surface to cover foundations and adhere tightly around elements penetrating the surface.

3.05 FIELD QUALITY CONTROL

- A. Owner or Owner's representative will inspect playground surfacing after installation to verify that surfacing is of proper type and depth and that playground meets specified design safety and accessibility requirements.
- B. Repair or replace rejected work until compliance is achieved.

3.06 CLEANING AND PROTECTION

- A. Restore adjacent existing areas that have been damaged from the construction.
- B. Clean playground equipment of construction materials, dirt, stains, filings, and blemishes due to shipment or installation. Clean in accordance with manufacturer's instructions, using cleaning agents as recommended by manufacturer.
- C. Clean playground area of excess construction materials, debris, and waste.
- D. Remove excess and waste material and dispose of off-site in accordance with requirements of authorities having jurisdiction.
- E. Protect installed products until Date of Substantial Completion.
- F. Replace damaged products before Date of Substantial Completion.

END OF SECTION

SECTION 32 31 13 CHAIN LINK FENCING AND GATES

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 work consists of furnishing and erecting chain link wire mesh fence, gates, and related hardware.

PART 2 MATERIALS

2.01 TYPE I OR II STEEL PIPE

- A. Type I framework shall consist of schedule 40 steel pipe with 1.8 ounces of zinc coating per square foot of surface area. The zinc coating shall be in conformance with ASTM F-1083.
- B. Type II framework shall consist of pipe manufactured from steel conforming to ASTM A-569, which is cold-formed, high frequency, or induction welded and having minimum yield strength of 50,000 psi. The external surface shall be triple coated as per ASTM F-1234, Type B & Type D with 1.0 ounce \pm 0.1 ounce of zinc per square foot, 30 \pm 15 micrograms of chromate per square inch and high performance polymer. The coating shall demonstrate the ability to resist 1,000 hours of exposure to salt spray with a minimum of 5% red rust in a test conducted in accordance with ASTM B-117. Internal surface coatings shall consist of a zinc-rich based organic coating having a 915 zinc powder loading capable of providing the ability to withstand 650 hours of exposure to salt fog with a maximum of 5% red rust, when conducted in accordance to ASTM B-117.
- C. All coatings shall be applied inside and out after welding of seams.
- D. Pipe shall be straight, true to section and conform to the following weights:

Pipe Size O.D.	Type I Weight (lbs/ft)	Type II Weight (lbs/ft)
1 5/8"	2.27	1.84
2"	2.72	2.28
2 1/2"	3.65	3.12
3"	5.79	4.64
3 1/2"	7.58	5.71

4"	9.11	6.56
6 5/8"	18.97	-----

E. Fence Posts shall be of the sizes specified below:

Fabric Height	Type I or II	
	Line Posts O.D.	Terminal Posts O.D.
Under 6'	2"	2 1/2"
6' to 9'	2 1/2"	3"
9' to 12'	3"	4"

F. Gate posts shall be of the sizes specified below:

Single Gate Width	Double Gate Width	Post O.D. Type II
Up to 6'	Up to 12'	3"
7' to 12'	13' to 25'	4"
<12'	<25'	6-5/8"

G. Rails and braces shall be minimum diameter of 1-5/8" O.D. Top rail may be SS-40, 1.46 pounds/LF, with swaged ends due to curvature of fence.

2.02 CHAIN LINK FABRIC

- A. Zinc coated fabric shall be galvanized after weaving with a minimum of 1.2 ounces of zinc per square foot of surface area and conform to ASTM A-392, Class I. Fabric shall be 9-gauge wire woven in a 2" diamond mesh. The top selvage shall be twisted and barbed and the bottom selvage shall be knuckled.
- B. Aluminum coated fabric shall be manufacture in accordance with ASTM A-491 and coated before weaving with a minimum of 0.4 ounces of aluminum per square foot of surface area. The steel wire and coating shall conform to ASTM A-817. Fabric shall be 9-gauge wire woven in a 2" diamond mesh. The top selvage shall be twisted and barbed and the bottom selvage shall be knuckled.

2.03 PVC COATED CHAIN LINK FABRIC

- A. PVC coated fabric shall be manufacture in accordance with ASTM F668 - 11 Class 2
 - b. The steel wire shall conform to ASTM A-817. Fabric shall be 9-gauge wire woven in a 2" diamond mesh. The PVC coated fabric shall be black (for the dugouts.)

2.04 TENSION WIRE

- A. Tension wire shall be marcelled 7 gauge steel wire with a minimum coating of 0.80 ounces of zinc or 0.40 ounces of aluminum per square foot of wire surface and

conforming to ASTM A-824.

2.05 WIRE TIES

A. Wire Ties shall be aluminum, 9 gauge wire, alloy 1100-H4 or equivalent.

2.06 MISCELLANEOUS FITTINGS AND HARDWARE

- A. Post Caps shall be pressed steel, cast iron, or cast aluminum alloy designed to fit snugly over posts to exclude moisture. Cone style caps shall be used for terminal posts and loop style caps for line posts.
- B. Rail and brace ends shall be pressed steel, cast iron, or cast aluminum alloy and shall be cup-shaped to receive rail and brace ends.
- C. Top rail sleeves shall be expansion type tubular steel with a minimum thickness of 0.051 inches and 7 inches in length.
- D. Tension bars shall be steel strips a minimum of 5/8 inches wide and 3/16 inches thick.
- E. Tension bands shall be pressed steel with a minimum of 14-gauge thickness and 3/4 inch width.
- F. Brace bands shall be pressed steel with a minimum of 12-gauge thickness and 3/4 inch width.
- G. Truss rods shall be a minimum of 3/8-inch diameter steel rod of merchant quality with a turnbuckle.

2.07 GATES

A. Chain link gates shall have a frame assembly with a minimum 2" O.D. pipe with fabric to match fence. All materials shall be of the same grade materials as the items specified for posts and fabric mesh. See plans for gate and lock details. All locks for this project shall be keyed alike.

2.08 HOG RINGS

A. Hog rings shall be steel wire of 11-gauge thickness with a minimum zinc coating of 0.80 ounce per square foot of wire surface.

PART 3 EXECUTION

3.01 CONSTRUCTION REQUIREMENTS

- A. The Contractor shall remove all debris and perform necessary excavation and backfilling prior to erecting the fence. All installation procedures shall conform to ASTM F-567.
- B. Posts shall be set in concrete footings of the dimensions shown on the plans to eliminate danger of frost heaving the post, concrete in the crown-top shall not be larger than the concrete in the lower part of the footing. The top of the footing shall be 2 inches above grade and sloped to direct water away from posts.

- C. Posts shall be spaced at not more than ten (10) foot intervals. In determining post spacing, measurements will be made parallel to the slope of the natural ground. Posts shall be set vertically, except at locations where it would be more satisfactory to place the posts perpendicular to the slope of the ground, as directed by the Engineer.
- D. Brace gate and terminal posts back to adjacent line posts with horizontal brace rails and diagonal truss rods.
- E. Pull posts and adjacent panels shall be constructed at sharp breaks in the vertical grades and at intervals of not more than five hundred (500) feet on straight runs of fence.
- F. The fence fabric shall be placed on the faces of the posts, which are on the outsides of curves. On straight alignments, the fence fabric shall be placed on the faces of the posts designated by the Engineer. The bottom of the fabric shall be placed a normal distance of two (2) inches above the ground line. Over irregular ground a minimum clearance of one (1) inch and maximum clearance of six (6) inches will be permitted for a distance not to exceed eight (8) feet. Fabric shall be tied to line posts and top rails with tie wires spaced at maximum intervals of 12 inches for posts and 24 inches for rails. The fabric shall be attached to the bottom tension wire at maximum intervals of 24 inches. The fence fabric shall be cut and each span attached independently to all corner and pull posts. Rolls of wire fabric shall be joined by weaving a single strand into each of the rolls to form a continuous mesh.
- G. Tension wires shall be placed, stretched tight and secured to all posts in a satisfactory manner before fence fabric is placed. Sufficient tension shall be applied to the tension wires to allow maximum sag of one-fourth (1/4) inch between posts after the fence fabric has been attached. Temporary bracing on posts shall be provided to prevent undue stresses in the posts when tension is applied to one (1) tension wire at a time.
- H. Gates shall be installed plumb, level and secure for the full opening without interference. The center stops and keepers shall be set in concrete.

* * * END SECTION * * *

**SECTION 323119
DECORATIVE METAL FENCES AND GATES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Decorative steel fences.

1.02 RELATED REQUIREMENTS

- A. Section 033000 - Cast-in-Place Concrete.

1.03 REFERENCE STANDARDS

- A. ASTM A276/A276M - Standard Specification for Stainless Steel Bars and Shapes 2017.
- B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2020.
- C. ASTM B117 - Standard Practice for Operating Salt Spray (Fog) Apparatus 2019.
- D. ASTM D523 - Standard Test Method for Specular Gloss 2014 (Reapproved 2018).
- E. ASTM D714 - Standard Test Method for Evaluating Degree of Blistering of Paints 2002 (Reapproved 2017).
- F. ASTM D822/D822M - Standard Practice for Filtered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings 2013 (Reapproved 2018).
- G. ASTM D1654 - Standard Test Method for Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments 2008, with Editorial Revision (2017).
- H. ASTM D2244 - Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates 2021.
- I. ASTM D2794 - Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact) 1993 (Reapproved 2019).
- J. ASTM D3359 - Standard Test Method for Rating Adhesion by Tape Test 2017.
- K. ASTM F2408 - Standard Specification for Ornamental Fences Employing Galvanized Steel Tubular Pickets 2016.

1.04 SUBMITTALS

- A. Product Data: Submit manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.
- B. Shop Drawings:
 - 1. Indicate plan layout, spacing of components, post foundation dimensions, hardware anchorage, gates, and schedule of components.
- C. Manufacturer's Qualification Statement.
- D. Installer's Qualification Statement.
- E. Manufacturer's Warranty.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum five years documented experience.
- B. Installer Qualifications: Experienced with type of construction involved and materials and techniques specified and approved by fence manufacturer.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Store materials in a manner to ensure proper ventilation and drainage. Protect against damage, weather, vandalism and theft.

1.07 WARRANTY

- A. Correct defective Work within a five year period after Date of Substantial Completion.
- B. Provide five year manufacturer warranty for coating and defects in workmanship or materials.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Decorative Metal Fences and Gates:
 - 1. Ameristar Perimeter Security, USA: www.ameristarfence.com/#sle.
 - a. Montage Plus, Majestic, Three-Rail.
 - 2. Substitutions: or approved equal.

2.02 FENCES

- A. Fences: Complete factory-fabricated system of posts and panels, accessories, fittings, and fasteners; finished with electrodeposition coating, and having the following performance characteristics:
 - 1. Capable of resisting vertical load, horizontal load and infill performance requirements for fence categories defined in ASTM F2408.
- B. Electro-Deposition Coating: Multi-stage pretreatment/wash with zinc phosphate, followed by epoxy primer and acrylic topcoat.
 - 1. Total Coating Thickness: 2 mils, minimum.
 - 2. Color: Black.
 - 3. Coating Performance: Comply with general requirements of ASTM F2408.
 - a. Adhesion: ASTM D3359 (Method B); Class 3B with 90 percent or more of coating remaining in tested area.
 - b. Corrosion Resistance: ASTM B117, ASTM D714 and ASTM D1654; 1/8 inch coating loss or medium No.8 blisters after 1,500 hours.
 - c. Impact Resistance: ASTM D2794; 60 inch pounds.
 - d. Weathering Resistance: ASTM D523, ASTM D822/D822M and ASTM D2244; less than 60 percent loss of gloss.
- C. Steel: ASTM A653/A653M; tensile strength 45,000 psi, minimum.
 - 1. Hot-dip galvanized; ASTM A653/A653M, G60.
 - 2. 62 percent recycled steel, minimum.
- D. Fasteners: ASTM A276/A276M, Type 302 stainless steel; finished to match fence components.

2.03 WELDED STEEL FENCE

- A. Provide fence meeting requirements for Industrial class as defined by ASTM F2408.
- B. Fence Panels: Fusion welded; height as indicated on plans by 8 feet long.
 - 1. Panel Style: Three rail.
 - 2. Attach panels to posts with manufacturer's standard panel brackets.
- C. Posts: Steel tube.
 - 1. Size: 2-1/2 inches square by 16 gage, with manufacturer's standard cap.
- D. Rails: Manufacturer's standard, double-wall steel channel 1.4375" w x 1.5" h by 14 gage with pre-punched picket holes.
- E. Pickets: Steel tube.
 - 1. Spacing: 3-3/4 inch clear.
 - 2. Size: 0.75 inch square by 18 gage, 0.0478 inch.
 - 3. Style: Flush top rail.
- F. Flexibility: Capable of following variable slope of up to 1:2.

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.

3.03 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Set fence posts in accordance with the manufacturer recommended spacing.
- C. When cutting rails immediately seal the exposed surfaces by:
 1. Removing metal shavings from cut area.
 2. Apply zinc-rich primer to thoroughly cover cut edge and drilled hole; allow to dry.
 3. Apply two coats of custom finish spray paint matching fence color.
 4. Failure to seal exposed surfaces in accordance with manufacturer's instructions will negate manufacturer's warranty.
- D. Space gate posts according to the manufacturers' drawings, dependent on standard out-to-out gate leaf dimensions and gate hardware selected.
 1. Base type and quantity of gate hinges on the application; weight, height, and number of gate cycles.
 2. Identify the necessary hardware required for the application on the manufacturer's gate drawings.
 3. Provide gate hardware by the manufacturer of the gate and install in compliance with manufacturer's recommendations.

3.04 TOLERANCES

- A. Maximum Variation From Plumb: 1/4 inch.
- B. Maximum Offset From Indicated Position: 1 inch.
- C. Minimum Distance from Property Line: 6 inches.

3.05 FIELD QUALITY CONTROL

- A. Layout: Verify that fence installation markings are accurate to design, paying attention to gate locations, underground utilities, and property lines.
- B. Workmanship: Verify neat installation free of defects.

3.06 CLEANING

- A. Clean jobsite of excess materials; scatter excess material from post hole excavations uniformly away from posts. Remove excess material if required.
- B. Clean fence with mild household detergent and clean water rinse well.
- C. Remove mortar from exposed posts and other fencing material using a 10 percent solution of muriatic acid followed immediately by several rinses with clean water.
- D. Touch up scratched surfaces using materials recommended by manufacturer. Match touched-up paint color to factory-applied finish.

3.07 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 323300
SITE FURNISHINGS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Benches.
- B. Picnic Tables.
- C. Waste receptacles.

1.02 REFERENCE STANDARDS

- A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2019.
- B. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes 2021a.
- C. ASTM A536 - Standard Specification for Ductile Iron Castings 1984, with Editorial Revision (2019).
- D. ASTM B211/B211M - Standard Specification for Aluminum and Aluminum-Alloy Rolled or Cold Finished Bar, Rod, and Wire 2019.

1.03 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's specifications and descriptive literature, installation instructions, and maintenance information.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with at least three years of documented experience.

1.05 WARRANTY

- A. See General Conditions of the Contract for Construction AIA A201-2017 for warranty requirements.

PART 2 PRODUCTS

2.01 METAL FURNISHINGS

- A. Metal Furnishings, General:
 - 1. Cast iron components: Ductile iron castings complying with ASTM A536; cleaned, treated, and powder-coated.
 - a. Color: As selected by Architect from manufacturer's standard range.
 - 2. Steel components: Plates, bars, and shapes complying with ASTM A36/A36M and tubing complying with ASTM A500/A500M; cleaned, treated, and powder-coated.
 - a. Color: As selected by Architect from manufacturer's standard range.
 - 3. Aluminum Components: ASTM B211/B211M.
 - 4. Hardware: Stainless steel.
- B. Benches: as indicated in furnishings schedule.
- C. Picnic Tables: as indicated in furnishings schedule
- D. Waste Receptacles: as indicated in furnishings schedule.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify proper installation of mounting surfaces, preinstalled anchor bolts, and other mounting devices; and ready to receive site furnishing items.
- B. Do not begin installation until unacceptable conditions are corrected.

3.02 INSTALLATION

- A. Install site furnishings in accordance with approved shop drawings, and manufacturer's installation instructions.

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 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 3408 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.
 - 3. PVC Gasket Joints: ASTM D-3139, ASTM D 1784 Pipe.
- 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. Gate Valves: Cast iron 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 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: 24 inches. Maximum Cover Over Installed Mainline Piping: 36 inches (915 mm).
 - 2. Minimum Cover Over Installed Lateral Piping: 18 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. Preparation of turf areas.
- B. Seeding, mulching and fertilizer.
- C. Turf establishment.

1.02 REFERENCE STANDARDS

- A. SD DOT Standard Specifications for Roads and Bridges, most current addition and all addenda.

1.03 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.

1.04 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.
 - 2. Microbial Inoculant
- B. Certification of grass seed: From seed vendor for each grass-seed monostand or mixture stating the botanical and hybrid 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 Engineer.
 - 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. 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.

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 - Irrigated Turf (Ballfield):
 - 1. Elite Hybrid Kentucky Bluegrass: 80 percent; 20 percent perennial ryegrass. Substitutions are acceptable but require Owner PRE-APPROVAL by addendum.
 - a. Millborn Seed 'GK Elite'
- B. Seed Mixture - Irrigated Turf (Park) and Non-Irrigated Turf
 - 1. Improved Kentucky Bluegrass: 60 percent; 25 percent fine-leaf perennial ryegrass; 15 percent creeping red fescue. Substitutions are acceptable but require Owner PRE-APPROVAL by addendum.
 - a. Millborn Seed 'Quality Sun & Shade'
30% Top Gun Perennial Rye
- C. Microbial Inoculant
 - 1. Inoculate seed prior to planting at rate recommended by manufacturer for seed type specified.
 - a. Myco-Apply Super Concentrate, or approved equal

2.02 ACCESSORIES

- A. 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.
- B. Nonasphaltic Tackifier: Colloidal tackifier recommended by fiber-mulch manufacturer for slurry application; nontoxic and free of plant-growth or germination inhibitors.
- C. 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: 9-23-15.
 - 2. Application rate: 6.0 lb/1000 SF
- D. Water: Clean, fresh and free of substances or matter that could inhibit vigorous growth of grass.
- E. 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.
- F. Erosion Control Blanket: Curled wood excelsior or straw
 - 1. Curlex II CL
American Excelsior Company
www.curlex.com
 - 2. Excel SS-2
Western Excelsior Corporation
www.westernexcelsior.com
 - 3. SB150
North American Green
www.nagreen.com
 - 4. Equal as approved by SD DOT for Type 2 Erosion Control Blanket

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 Engineer and replace with new planting soil.

3.02 PREPARATION

- A. 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.
 - a. Apply at rate recommended by manufacturer's written instructions.
 2. Loosen soil to a depth of approximately 3 inches with tillage equipment on one pass.
 3. Remove stones larger than 1 inch 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.
- 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.
- C. Before planting, obtain Engineer'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. Do not apply fertilizer at same time or with same machine as will be used to apply seed.
- C. Mix thoroughly into upper 2 inches of topsoil during tillage.

3.04 SEEDING

- A. The specified seed mixture shall be uniformly drilled at a rate of [6] lbs per 1000 sq ft evenly in two intersecting directions using a press drill equipped with individually mounted, adjustable, spring loaded, double disk furrow openers fitted with depth control bands or drums. Hydroseeding is not permitted.
- B. Do not seed areas in excess of that which can be mulched on same day.
- 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 – June 15
 2. Fall: August 15 –September 15
 3. Dormant: November 1 – Freeze Up
- D. Do not sow immediately following rain, when ground is too dry, or during windy periods.
- E. 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 EROSION CONTROL BLANKET

- A. Lay fabric smoothly on surface. Install erosion control blankets as indicated and in accordance with manufacturer's recommendations. The extent of erosion control blankets shall be as shown on drawings.
- B. Orient erosion control blankets in vertical strips and anchored with staples, at spacing as indicated by manufacturer's written instruction for project application.
 - 1. Provide 12 inch overlap of adjacent rolls, anchor with a common row of staples.
 - 2. Overlap horizontal joints between erosion control blankets sufficiently to accommodate a common row of staples with the uphill end on top of the blanket below.
- C. Where exposed to overland sheet flow, bury top end of each section in 6 inch deep excavated topsoil trench. Staple the erosion control blanket to the bottom of the trench. Backfill and compact the trench as required.
- D. Secure outside edges and overlaps at 36 inch intervals with stakes.

3.07 TEMPORARY EROSION CONTROL

- A. Contractor shall be required to place temporary erosion control as per requirements of Section 01 57 00.
- B. When permanent seeding cannot be completed within 14 days of final grading, or between the dates allowed for seeding, temporary seeding will be required to be installed in disturbed areas. Temporary seeding will be completed utilizing the Temporary Seed Mixture specified.
- C. If seeding cannot be completed prior to November 1, the disturbed areas will be required to be mulched at the rate specified to stabilize the areas until seeding can be completed as specified.

3.08 MAINTENANCE

- A. Upon acceptance of seeded turf areas the Owner will assume maintenance operations.
- B. Immediately reseed areas that show bare spots.

3.09 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 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. 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.
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 05 23.16 UTILITY PIPE JACKING

PART 1

PART 2 GENERAL

2.01 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. Existing Underground Utilities - Section 33 01 00
 - 2. Sheeting, Shoring and Bracing - Section 31 23 14
 - 3. Trenching, Backfilling and Compacting - Section 31 23 33
 - 4. Curbs, Gutters, Sidewalks and Driveways - Section 32 16 00
 - 5. Sanitary Sewer Piping and Fittings – Section 33 31 00
 - 6. Standard Drawing 01 33 23.16-1 Type I Crossing
 - 7. Standard Drawing 01 33 23.16-2 Type II Crossing

2.02 DESCRIPTION OF WORK

- A. The work covered by this section of the specifications includes all labor, material, equipment, and services necessary to furnish and install the types of road crossings as shown on the plans and as specified herein.

2.03 SUBMITTALS

- A. The Contractor shall submit, for review, copies of Shop Drawings for materials specified herein.
- B. Certificates from the manufacturer that the materials furnished meet or exceed the specified requirements.

2.04 QUALITY ASSURANCE

- A. All pipelines, conduit, and casing pipe installed on railroad property and/or within federal, state, or county highway right-of-way shall conform to the most recently adopted codes for the system involved, the State Accommodation of Utilities Policy, and all permits as issued to the Owner by the permit issuing authority having jurisdiction over the area affected.

2.05 DEFINITIONS

- A. Type 1 Crossing: A crossing utilizing a casing installed by boring or jacking as hereinafter described.

PART 3 MATERIALS

3.01 STEEL CASING

- A. Steel casing pipe shall conform to ANSI Specification B36.10, and shall have a minimum yield strength of 35,000 psi. Minimum wall thickness shall be in accordance with the following:

PIPE MINIMUM WALL	
DIAMETER (INCHES)	THICKNESS (INCHES)
12 or less	0.188
14 to 16	0.282
18	0.313
20	0.344
22	0.375
24	0.407
26	0.438
28 to 30	0.469
32	0.501
34 to 36	0.532
38 to 42	0.563

- B. All casing pipe joints shall be welded.

3.02 CASING SPACERS

- A. Use manufactured casing spacers to position carrier pipe in casing. Wood skids will not be allowed.
- B. Use the following material requirements for casing spacers:
1. HDPE Band/Panel and Riser: ASTM D 638.
 2. Stainless Steel or Carbon Steel Band/Panel and Riser: Type 304 stainless steel per ASTM A 240 or carbon steel per ASTM 36.
 3. Liner: Elastomeric PVC per ASTM D 149.
 4. Spacer Skid/Runner: Abrasion resistant polymer with a low coefficient of friction.
 5. Fasteners: Type 304 (18-8) stainless steel per ASTM A193.
- C. Watermain piping will be centered and restrained within the casing pipe. Spacers shall be sized such that the height of the risers and runners are to center the carrier pipe in the casing pipe with a top clearance of three-fourths inch minimum.
- D. Sanitary sewer piping will be in a restrained position such that the carrier rests near the bottom of the casing pipe and the height of the risers and runners are to provide a bottom clearance not less than one-half inch between the casing pipe and the extreme outside diameter of the joint (bell, seam weld, joint clamp, ...) of the carrier pipe and a top clearance of three-fourths inch minimum.

3.03 END SEALS

- A. Casing pipe end seals will be a "Pull-On" or "Wrap Around" type seal manufactured

from a minimum 1/8" thick neoprene rubber. End seals will be sealed to the carrier pipe and casing pipe by 1/2" wide T304 stainless steel bandings with 100% non-magnetic worm gear mechanism.

- B. Casing end seals shall specifically designed to conform to eccentric or concentric carrier/casing configuration.

PART 4 EXECUTION

4.01 GENERAL

- A. All work shall be planned and coordinated so as to not unduly interfere with the movement of traffic.
- B. The Contractor shall comply with the regulations of the permitting authority. The Contractor shall notify the permitting authority prior to construction. Copies of the permits are included in Section 01 11 00. Prior to construction of the crossing, the Contractor shall notify the permit-issuing agency.
- C. Road crossings shall be located so as to cross tracks or highways approximately at right angles. The location shall be such so as to not restrict drainage, endanger existing structures, or interfere with maintenance or reconstruction procedures.
- D. All topsoil shall be saved and replaced upon completion of the crossing.

4.02 TYPE 1 STREET/HIGHWAY/RAILROAD BORING

- A. Casing pipe shall be installed by boring, jacking, or directional bore with distance to the headers conforming to permit and/or code requirements.
- B. When pipes are installed by the boring method, the pipe must be jacked through the soil as the soil is removed by the auger. Installing pipe through pre-bored holes is not permitted. Removal of material from the bored hole by washing or sluicing is not permitted.
- C. The casing pipe shall be uniform in alignment and grade as shown on the plans.
- D. The casing pipe under highways and roads shall extend from jacking pit to receiving pit. The jacking and receiving pits for highway and road crossings shall be no closer than the toe of the inside slope.
- E. The casing pipe under railroads shall extend a minimum of 30 ft from either side of the centerline of the track. The jacking and receiving pits for shall not be closer to the roadway than the toe of slope.
- F. Casing spacers for watermain piping will be placed within two (2) feet on either side of the bell joint and equally spaced at approximate 5 to 6 feet intervals thereafter for a total of four casing spacers per 20-foot pipe length. Casing spacers for sanitary sewer piping will be placed within two (2) feet on either side of the bell joint and equally spaced at approximate 4 to 5 feet intervals thereafter for a total of three casing spacers per 13-foot pipe length.
- G. The Contractor will install the end seals prior to making connection on either side of the boring. End seals will be installed to provide a water tight seal on each end of

the casing pipe.

H. Directional boring shall be completed as per 3.04 below.

4.03 TESTING PIPE

- A. Cleaning and flushing are to be done by the CONTRACTOR in accordance with the requirements of Section 33 13 00.
- B. Directional drilling pipe shall be tested by CONTRACTOR after pullback. Testing shall be in accordance with Section 33 13 01.

4.04 SITE RESTORATION

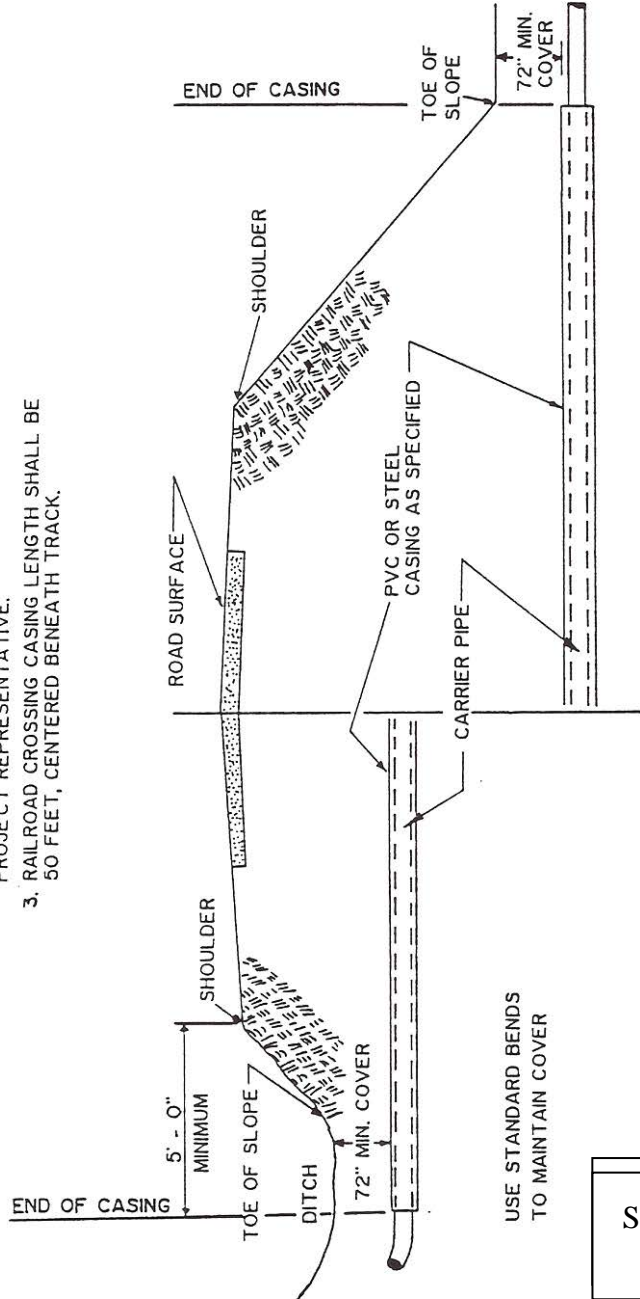
- A. Following drilling operations, CONTRACTOR will de-mobilize equipment and restore the work site to the original conditions or better. All excavations will be backfilled and compacted according to the specifications.
- B. Surface restoration shall be completed in accordance with the requirements of the contract, to a condition as good as or better than existed prior construction.

4.05 BACKFILL AND COMPACTION

- A. The backfill and compaction shall be completed in accordance with the requirements of Section 31 23 33 - Trenching, Backfilling and Compacting.

NOTES:

1. LENGTH OF BORE SHALL BE A MINIMUM OF 5 FEET BEYOND OUTSIDE SHOULDER WITH A MINIMUM COVER OF 72 INCHES.
2. ALL BORES SHALL BE MADE PERPENDICULAR TO ROADWAY UNLESS APPROVED BY RESIDENT PROJECT REPRESENTATIVE.
3. RAILROAD CROSSING CASING LENGTH SHALL BE 50 FEET, CENTERED BENEATH TRACK.



FILL SECTION

CUT SECTION

TYPE I CROSSING
NO SCALE

Standard Drawing
33 05 23.16-2



HELMS and ASSOCIATES

CONSULTING ENGINEERS • LAND SURVEYORS
BOX 111 ABERDEEN, S. D. 57401 PHONE (605) 225-1212

SHEET

PROJECT NO.

DATE

DRAWN BY

*** 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. Pressure Piping Tied Joint Restraint System - Section 33 05 19
 - 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 5 copies of 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 GRAVITY PVC PIPE - 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 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.

2.02 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.

2.03 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. +5.....65
 - e. Tensile Strength, Min. psi1000
 - 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.

2.04 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.

2.05 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 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.

2.07 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.

2.08 TRACER WIRE (FORCEMAIN)

- 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. All tracer wires are to be connected to a cast iron or 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 "Sewer" 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.

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 95% 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 95% 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

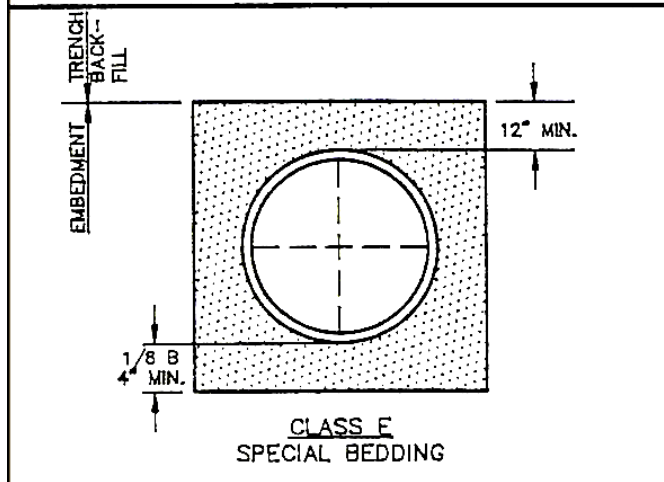
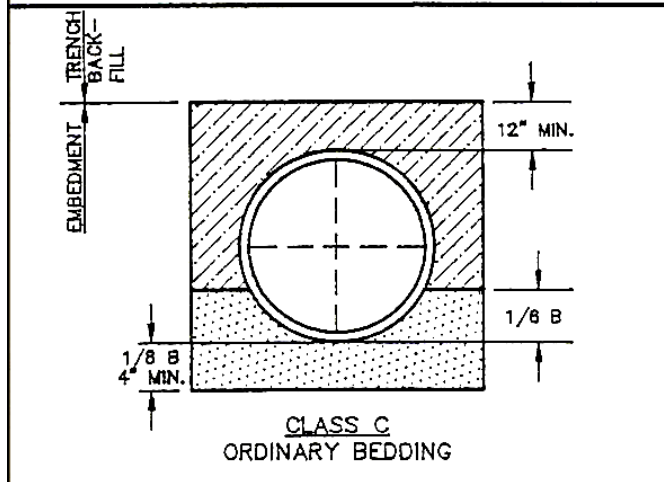
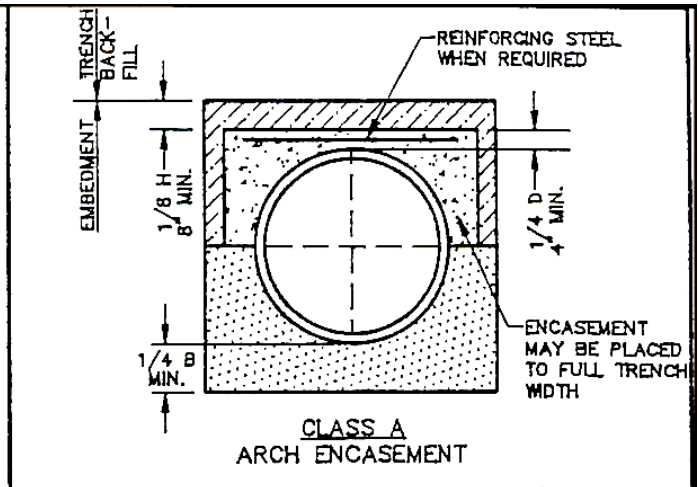
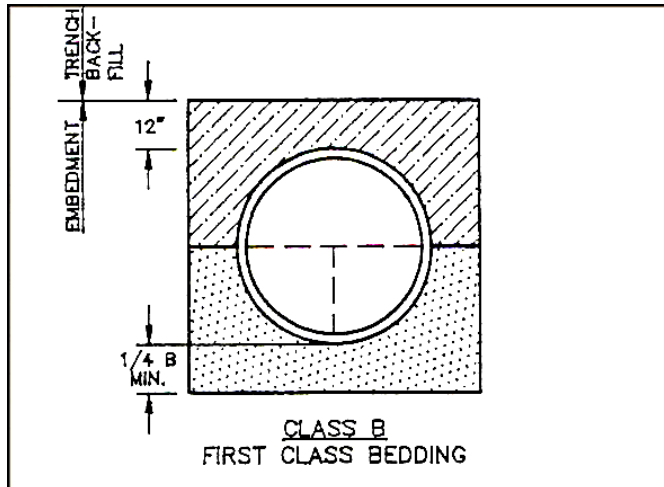
- A. Mechanical joints shall be carefully assembled in accordance with the manufacturer's recommendations. If effective sealing is not obtained, the joint shall be disassembled, thoroughly cleaned, and reassembled or replaced. Over tightening bolts to compensate for poor installation practice will not 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 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. Bring the wire to the ground surface at each manhole connection and loop the wire in a tracer wire terminal box. These boxes shall be located perpendicular to the manhole on the north side 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.



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 Detail
33 31 00-01

*** 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. Structural Excavating, Filling and Grading - Section 31 23 16
 - 3. Curbs, Gutters, Sidewalks and Driveways - Section 32 16 00
 - 4. Existing Underground Utilities - Section 33 01 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 herein in accordance with the requirements of Section 01 33 23.

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 ½ inch ASTM A615 Grade 60 Steel reinforcement. All steel will be powder coated as per ASTM A934.

2.04 MANHOLE WALL JOINT SEALANT

- A. Flexible gasket material for sealing manhole wall joints shall be RAM-NEK as manufactured by Henry Company, Houston Texas; ConSeal CS-202 as manufactured by Concrete Sealants, Inc., New Carlisle, Ohio; Polylok’s Butyl Joint Sealant, Polylok, Incorporated, Wallingford, CT; or approved equivalent.

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 EXCAVATION

- A. The requirements of Section 31 23 16 shall apply to the excavation, backfilling, and compaction for manholes.

3.03 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.

3.04 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.

3.05 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.
- C. The backfill material shall conform to the requirements of Section 31 23 16.

3.06 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.

3.07 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. Manholes and Castings – Section 33 05 13
 - 3. 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 in accordance with the requirements of Section 01 33 23 and the requirements 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, 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 MATERIALS

- A. Polyethylene (PE) piping shall conform to the requirements set forth in Part 2.02.
- B. PVC storm sewer piping shall conform to the requirements set forth in Part 2.03.

2.02 PE STORM SEWER PIPE

- A. Storm sewer pipe will conform to the requirements of ASTM D1248 Standard Specification for Polyethylene (P/E) Plastics Molding and Extrusion Materials and 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 2.0-psi internal pressure for a minimum of 10 minutes.
- D. Fittings for PE pipe will have gasket style joints, be from the same manufacturer as the PVC pipe, and conform to the requirements of ASTM D3350.
- E. Tapping saddle tees or wyes may be used for lateral connections.

2.03 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.

2.04 UNDERDRAIN/DRAIN TILE PIPING

- A. 4" perforated underdrain piping shall conform to: AASHTO M252 Standard Specification for Corrugated Polyethylene Drainage Pipe.
- B. Porous backfill and pipe bedding for perforated underdrain piping shall be free of clay, humus, or other objectionable matter, & shall conform to the gradation in Table 1 when tested in accordance with ASTM C136.

Table 1. Gradation of Porous Backfill

Sieve Designation (square openings)	Percentage by Weight Passing Sieves	
	Porous Material No. 1	Porous Material No. 2
1-1/2 inch (38 mm)		100
1 inch (25 mm)		90 - 100
3/8 inch (9 mm)	100	25 - 60
No. 4 (4.75 mm)	95 - 100	5 - 40
No. 8 (2.36 mm)		0 - 20
No. 16 (1.18 mm)	45 - 80	
No. 50 (0.30 mm)	10 - 30	
No. 100 (0.15 mm)	0 - 10	

- C. The filter fabric (sock) shall conform to the requirements of AASHTO M288 Class 2.

Table 2

Fabric Property	Test Method	Test Requirement
Grab Tensile Strength, lbs	ASTM D4632	125 min
Grab Tensile Elongation %	ASTM D4632	50 min
Burst Strength, psi	ASTM D3785	125 min
Trapezoid Tear Strength, lbs	ASTM D4533	55 min
Puncture Strength, lbs	ASTM D4833	40 min
Abrasion, lbs	ASTM D4886	15 max loss
Equivalent Opening Size	ASTM D4751	70-100
Permittivity sec⁻¹	ASTM D4491	0.80
Accelerated Weathering (UV Stability) (Strength Retained - %)	ASTM D4355 *(500 hrs exposure)	70

- D. Polyethylene drain pipe shall be installed in accordance with the requirements of ASTM D2321 or AASHTO Standard Specification for Highway Bridges Section 30. Perforations shall meet the requirements of AASHTO M252 or AASHTO M294 Class 2, unless otherwise indicated on the plans. The pipe shall be laid accurately to line and grade.

2.05 GRAVITY PVC PIPE FITTINGS

- A. Fittings for Polyvinyl Chloride (PVC) gravity pipefittings 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.
- D. Sewer "Wyes" shall be in-line sewer wyes.

2.06 BEDDING MATERIAL

- A. Bedding material for solid wall storm piping 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.

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.
- D. Lift holes shall be covered or plugged to prevent backfill from entering the pipe.

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. Removal of unstable material or rock below bedding grade shall be performed as set forth in Section 31 23 33.

3.03 BEDDING

- A. Bedding shall be used with all storm drainage piping.
 - 1. Class B bedding, as shown on the attached standard drawing 33 41 00-01, will be used with all P/E and PVC storm drainage piping.

3.04 BACKFILL ABOVE BEDDING GRADE

- A. Pipe shall be backfilled to the elevation shown on the plans or as directed by the Engineer. Backfilling shall conform to the requirements as specified hereinafter.
- B. The Contractor shall place backfill material in lifts not exceeding 1-foot and compact to 95% Standard Proctor Density (ASTM D698) at a moisture content between 5% below optimum and 3% over optimum or as directed by the Engineer. Stones equal to or larger than 3-inches in diameter shall not be placed within 2-feet of the pipe.
- C. Final 12-inches of backfill material, below flexible surfacing, will be compacted to 98% of maximum density as determined by standard proctor ASTM Test Designation D 698 at moisture content between 5% below optimum and 4% over optimum.
- D. Selected embankment material shall be placed along the pipe in layers not exceeding six (6) inches loose depth and thoroughly compacted by mechanical compactors to the required density before successive layers are placed. The width of the berms on each side of the pipe shall be twice as wide as the external diameter of the pipe or twelve (12) feet, whichever is least. This method of backfilling shall be continued until the embankment is at least two (2) feet over the top of the pipe. In trench installations, backfill width shall be equal to trench width. The backfill shall be brought up evenly on both sides of the pipe for its full length. This method of backfilling shall be continued until the embankment is at least two (2) feet over the top of the pipe.
- E. Topsoil shall be replaced to a minimum 6-inch depth upon completion of the

embedment operations in grassed areas.

3.05 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.

3.06 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. Electronic deflectometer.
4. Rigid "Go - No Go" device of the size, dimensions, and construction as recommended by the pipe manufacturer for the pipe size being tested.
5. The Engineer may require the Contractor to conduct random deflection tests between successive manholes 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.

C. GRAVITY SEWER LINE INFILTRATION TEST

1. The gravity sewer line, its connections, and manholes shall be subjected to an infiltration test when the ground water levels are two (2) feet or more above the top of sewer pipe and the appurtenance being tested.
2. The maximum allowable rate of infiltration shall be 50 U.S. gallons per mile of sewer per inch of diameter for twenty-four (24) hours as measured by a flow-measuring device acceptable to the Engineer.

D. GRAVITY SEWER LINE EXFILTRATION TEST

1. An exfiltration test of the gravity sewer line will be accepted when the ground water table is less than two feet below the top of the pipe or appurtenance being tested.

2. The maximum allowable rate of exfiltration shall be 50 U.S. gallons per mile of sewer per inch of diameter for twenty-four (24) hours.
3. During the exfiltration testing, the internal water head must be two (2) feet higher than the top of the pipe, or ground water level, whichever is higher at the highest point of the test section. At no time may the internal-external pressure differential exceed 25 feet (10.8 psi) at the lowest point on the system being tested.
4. The exfiltration test process shall be conducted for a period of not less than 2 hours on each section being tested.

E. GRAVITY SEWER LINE AIR TEST

1. In lieu of an infiltration/exfiltration test, a low-pressure air test may be used to evaluate the water tightness of the gravity sewer line. The low pressure air test shall conform to the requirements of the recommended practice for low pressure air testing of installed sewer pipe, Uni-Bell Plastic Pipe Association specification UNI-B-6-98.
2. Maximum allowable air loss shall be $Q = 0.0015$ cubic feet per minute per square foot of internal surface area.
3. The minimum allowable time (T), in seconds, for the air pressure to drop 1.0 psig shall be based on the following:

$$T = [0.085 \times D \times K] \div Q$$

Where: $K = 0.000419 D \times L$, but not less than 1.0

$Q = 0.0015$ CuFt/min/SqFt of internal surface

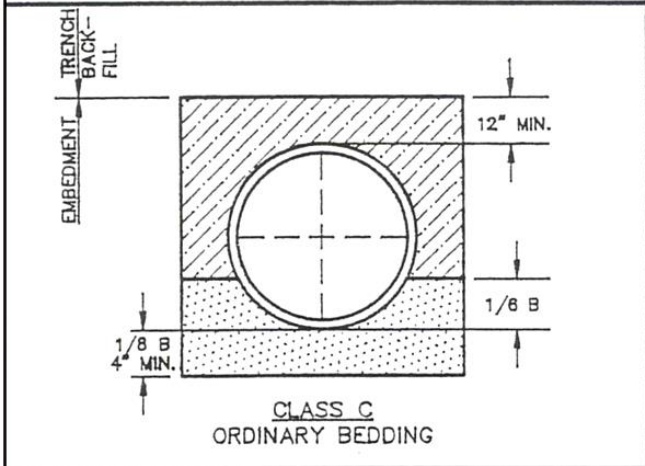
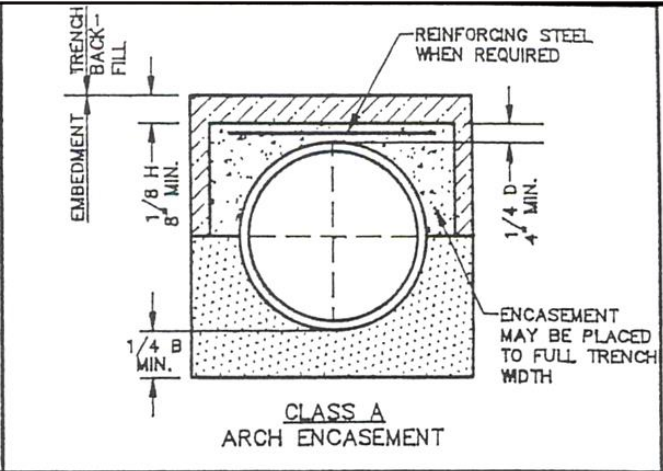
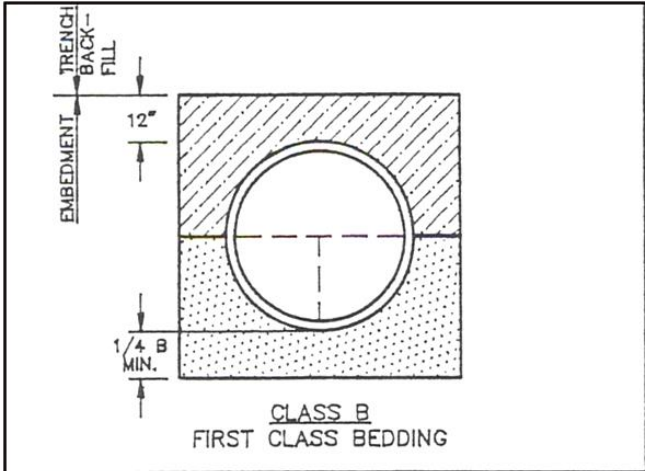
$D =$ Nominal pipe diameter in inches

$L =$ Length of pipe being tested in feet

NOTE: If a 0.5 psig pressure drop is used, the appropriate required test times shall be exactly half as long as those using the above equation.

3.07 CLEANING OF GRAVITY SEWER LINES

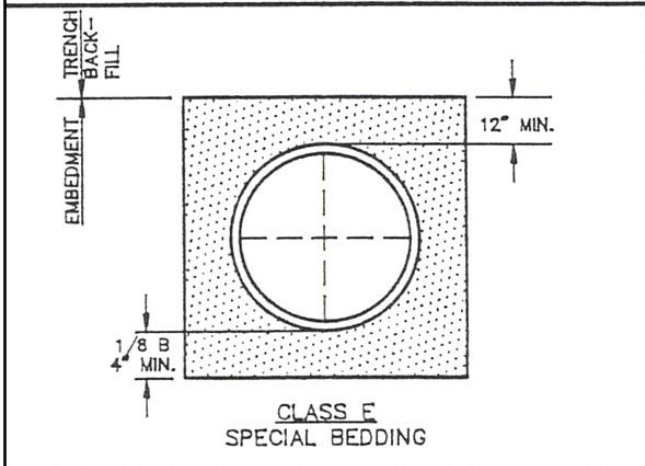
- A. All lines shall be thoroughly flushed and cleaned before acceptance until all traces of construction materials, soil or other foreign matter have been removed.
- B. The Contractor shall take all necessary measures to protect adjacent facilities and property. Damages caused by flushing water or water 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 3.06.



NOTES:

GRANULAR EMBEDMENT SHALL BE SIZE 67 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 Detail
33 41 00-01

*** END OF SECTION ***

Soil Technologies, Inc.

28822 124th Street – Mobridge, SD 57601 – (605) 762-3406

www.soil-technologies.com

“Building Your Success On A Solid Foundation”

April 15, 2022

Columbia Park LLC
Attn: Terry Birck
1 Tower Lane Ste. 2242
Oakbrook Terrace, IL 60181


Subj: Soil Exploration Program
Proposed Park and Ballfield
Columbia, SD
STI #22-1725


This report presents the findings of the Soil Exploration Program for the above referenced project. The exploration program was performed in accordance with your authorization of our proposal to you dated January 10, 2022. 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



The seal is circular with a dotted border. The text inside the seal reads: 'PROFESSIONAL ENGINEER' at the top, 'REG. NO. 6394' in the center, 'KIM E. STOECKER' below that, and 'SOUTH DAKOTA' at the bottom. A small star is at the very bottom center.

**COLUMBIA PARK LLC
COLUMBIA, SD**

**SOIL EXPLORATION PROGRAM
PROPOSED PARK AND BALLFIELD
COLUMBIA, SD**

STI #22-1725

April 15, 2022

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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 PROGRAM

PROPOSED PARK AND BALLFIELD

COLUMBIA, SD

STI #22-1725

1.0 INTRODUCTION

1.1 Project Information

We understand the proposed project will consist of the construction of a park and ballfield in Columbia, SD. The project will include the overall park and ballfield along with a parking lot, two restroom buildings, at least one small shelter, a large shelter/event pavilion, and a septic drain field. The proposed buildings will consist of a single-story, slab-on-grade structure (no below grade floors or crawl space). The building dimensions were not available. The structures will be supported on shallow spread footing foundations.

NOTE: Due to saturated site conditions, we were only able to access boring locations #3, #4, and #8. We performed those 3 borings. No other borings were accessible, and therefore were not performed. Thus, the recommendations of the report apply only to those 3 borings.

• Conditions:

- The finished floor elevations of the proposed buildings will be within 2 feet above the existing grades and be at elevations between 1303.0 and 1305.0 feet.*
- The perimeter frost footings of the buildings will rest 5 to 6 feet below the finished floor slabs and be at elevations between 1297.0 to 1300.0 feet.*
- The new perimeter finished grades immediately surrounding the buildings will be below the finished floor elevations.
- Column loads will be a maximum of 75 kips (total dead and live loads) with continuous footing loads less than 4 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 and Assoc – Aberdeen, SD.*

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.

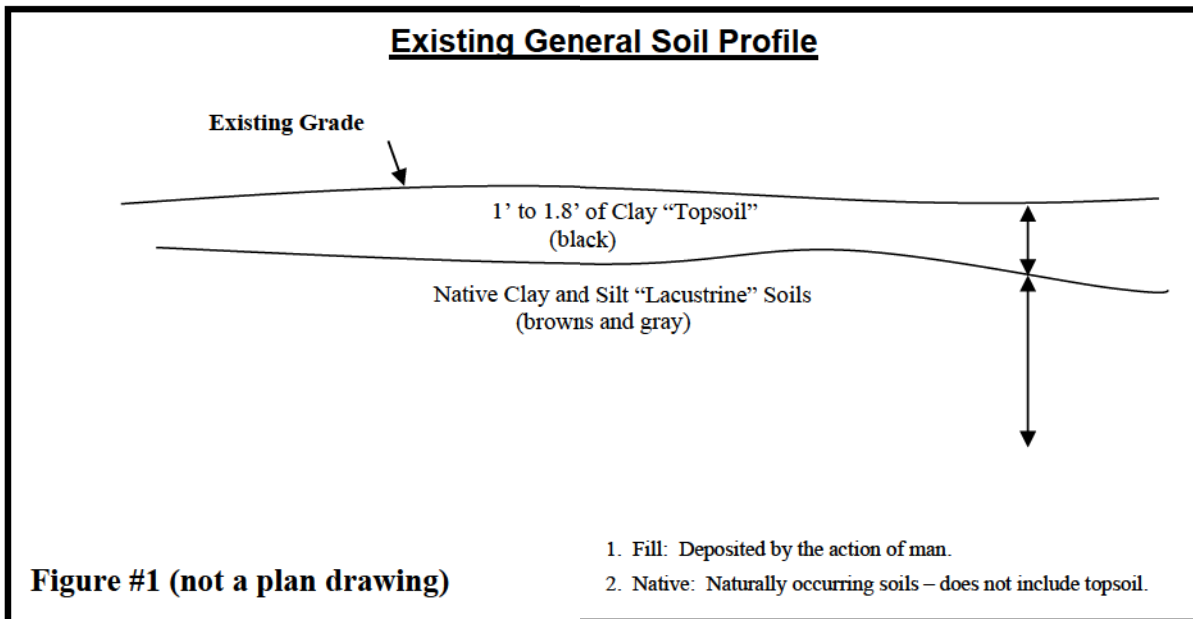
Our design assumptions include a minimum theoretical safety factor of 3 with respect to shearing or base failure of the foundations. We assume an allowable total settlement of 1 inch and a differential settlement of up to ½ inch over a length of 30 feet.

The recommendations in this report assume the locations of the proposed buildings are within 50 feet of the boring locations as shown on the attached sketch. If the locations of the proposed buildings are changed so as not to be within this distance for each of the respective borings, 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 areas of the proposed structures consists of about 1 to 1.8 feet of clay “topsoil” overlying native clay and silt “lacustrine deposits” (lake deposited soils). The lacustrine soils extend to the termination depths of the borings at 16 feet below the existing grades. Please see Figure #1 below and the attached boring logs.



- **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 structures at boring locations #3, #4, and #8 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:** Topsoil” exist at the site and extends from the surface to depths of about 1 to 1.8 feet below the existing grades. In our opinion, the topsoil is not suitable for support of the footings. Also, somewhat weak native clay “lacustrine” soils exist immediately below the “topsoil” to a depth of 3 feet and should not be used for support of the footings.
- **FLOOR AREA:** Similar to the footing areas, the 1 to 1.8 feet of “topsoil” at the surface is not suitable for support of the floor slabs, and should be replaced with engineered fill. However, the native clay “lacustrine” soils below the “topsoil” can be used for support of the floor slabs.
- **SOIL DISTURBANCE:** The clay and silt soils encountered at the site are sensitive to disturbance and care must be taken to not disturb them. If they become disturbed, they must be replaced with engineered fill or recompacted in-place and density tested.

2.2 Site Preparations

FOOTINGS (Interior, Exterior, & Thickened Edged): In our opinion, the existing “topsoil” should not be used for support of the footings. In addition, the upper portion of the native clay and silt “lacustrine” soils are somewhat weak and should not be used for support of the footings. Therefore, we recommend that the footing excavations extend through the existing “topsoil” and native clay or silt “lacustrine” soils to a depth of at least 3 feet below the existing grades.

The approximate minimum recommended footing area excavation depths and corresponding elevations at each boring location are shown on each of the attached boring logs. Please note that the required footing excavation depths may be significantly different at other locations at the site.

During the footing area excavations, the exposed soils at the bottom of the excavations should be observed by STI’s on-site Geotechnical Engineer. Soft, loose, or otherwise weak soils should be excavated as directed by the Geotechnical Engineer. Upon the Geotechnical Engineer’s approval of the exposed soils, the footings can then be constructed to rest on the competent native clay or

silt “lacustrine” soils, or they can rest on engineered fill soils (soils that have been compacted and tested to a specified density) placed above the native clay and silt “lacustrine soils. Refer to engineered fill recommendations on page 8.

FLOOR SLAB: Similar to the footings, it is our opinion that the existing “topsoil” should not be used for support of the floor slabs. Therefore, we recommend that site preparations for the floor slab areas also consist of excavating the existing “topsoil” to expose the underlying native clay or silt “lacustrine” soils. The floor excavation depths are noted on each of the attached boring logs. Please note that the required floor excavation depths may be significantly different at other locations at the site.

During the floor area excavations, the exposed soils at the bottom of the excavations should be observed by STI’s on-site Geotechnical Engineer. Soft, or otherwise weak soils should be excavated and replaced with engineered fill as directed by the Geotechnical Engineer. Upon the Geotechnical Engineer’s approval of the exposed soils, engineered fill should be placed above the exposed native soils to meet the design floor grade elevations. Refer to the engineered fill recommendations listed on page 8.

- **Frost Movement Below Slabs**

The existing native clay and silt “lacustrine” soils likely have high susceptibility of frost related movement. This frost related movement can cause distress to unprotected structural units or slabs. Generally, we anticipate that the frost depth inside unheated but enclosed buildings will extend to a depth of about 36 to 42 inches. Thus, if limited frost movement is desired below movement sensitive surfaces such as unheated interior slabs, significant depths (at least 36”) of free-draining granular fill having less than 12% passing the #200 sieve should be placed for their support. Please refer to “Exterior Movement” and “Movement of Building Components” on pages 15-16 for additional information.

- **Polyethylene Vapor Membrane (Slab-on-grade)**

We recommend that consideration be given to placing a polyethylene vapor membrane (retarder) beneath the floor slabs, 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 floors 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 floors. 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.

We wish to note that floor moisture problems have occurred in other structures with similar soils conditions and have resulted in significant challenges with floor coverings, especially water tight coverings such as linoleum. Therefore, we recommend the following:

- The flooring contractor(s) should be informed of the potential floor moisture problems prior to placement of the concrete floor.
- Low slump concrete may significantly retard moisture migration through concrete floors and therefore, should be considered when preparing the concrete specifications. Strict compliance of the slump specification should be monitored by a qualified testing firm during placement of the concrete floors.
- Sufficient time should be allowed for the concrete floor to cure prior to placement of the flooring. Typically, flooring manufacturers require 3 to 4 weeks of curing time at room temperature (60° F. or more) prior to placement of flooring, but more may be required.
- Appropriate tests such as Calcium Chloride Vapor Emission tests and Concrete Relative Humidity tests (using in-situ probes) should be performed prior to installing the floor covering. The tests should be conducted by personnel qualified to conduct the tests in accordance with ASTM Standards. Only floor covering that meets the acceptable levels as per the Calcium Chloride, Relative Humidity, and other tests should be placed. We suggest that no flooring installation proceed without the approval of those responsible for its useful life.
- Plumbing or other cuts made in the vapor membrane should be completely sealed prior to placement of the concrete floor.

- **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 1. The subgrade modulus values are assumed to be at the surface of the described soil type compacted to at least 95% 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.

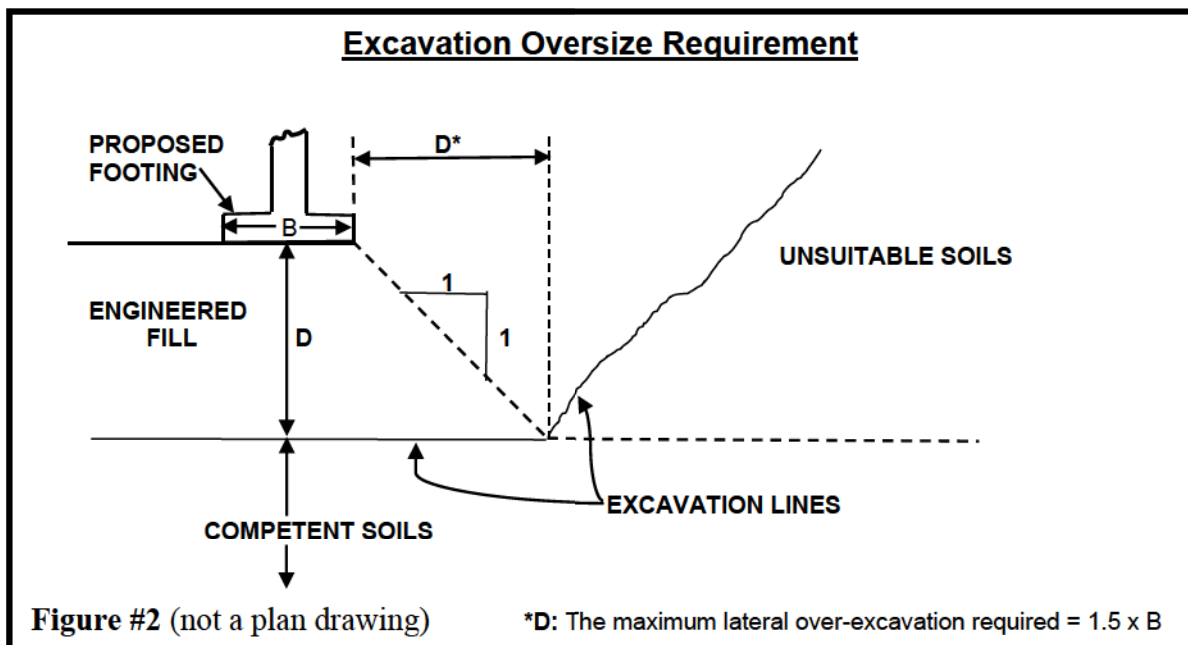
TABLE 1

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

*Values should be reduced (up to 40%) for exterior pavements used for traffic during frost melting periods.

- **Excavation Oversize Requirements**

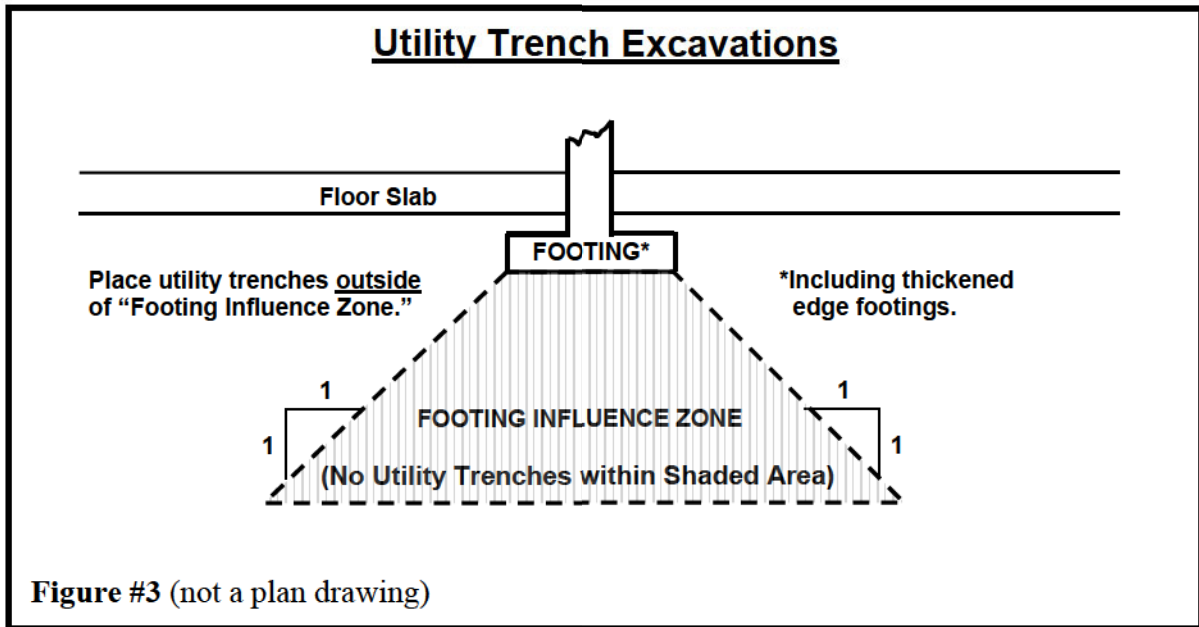
Engineered fill placed below the footings should be oversized one foot laterally for each foot of fill placed below the footings (extend the excavation outwards from the outer edges of the footings a distance of 1 foot for every 1 foot of fill placed below the footings). The maximum lateral over-excavation required is 1.5 times the width of the footing. Please see Figure #2 below illustrating the 1:1 excavation oversize requirement.



- **Utility Trenches**

Utility trenches within the building footprints (and in structural areas outside the building footprints) should be refilled with engineered fill. The engineered fill should be compacted and tested to the specified density listed on page 8. In addition, utility trenches should not be

placed within the influence zone of the footings, including the influence zone of thickened edge footings. Please see Figure #3 below. If it is necessary to install a utility by crossing beneath a footing, that portion of the utility trench below the footing should be refilled with a lean concrete mix (flowable fill).



- **Soil Disturbance**

The soils encountered at the site can be sensitive to disturbance, especially when their moisture conditions are high. Care should be taken not to disturb the soils underlying the footings, floor slab(s), or other structural units. If disturbed, they should be completely excavated from these areas and replaced with engineered fill, or if the disturbance is shallow, recompact in-place and density tested. 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) into the soils underlying the footings or floor slab(s), should be backfilled with engineered fill and compacted to the specified density listed on page 8.

- **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 on the #200 sieve.

<p>Above and below the footings and from 6 inches to at least 36 inches below the bottom of the floor slab (including utility trenches):</p>	<p><u>In moist to dry soil conditions exist in the excavation,</u> use a relatively clean granular engineered fill such as a pit run or processed sand or sand with gravel (SP, SW). The pit run and processed sand should have a maximum gravel/cobble size of 3 inches with less than 12% passing the #200 sieve by weight.</p> <p><u>If wet or saturated soil conditions exist in the excavation,</u> 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, a maximum 40% passing the #40 sieve, and less than 5% passing the #200 sieve. A 6 to 12-inch layer of a ½” or less rock can be placed at the bottom of the excavation for stabilization purposes.</p> <p><u>NOTE the following:</u></p> <ul style="list-style-type: none"> - The on-site, non-organic lean clay soils (brown) are acceptable as CL engineered fill. - Organic soils (topsoil) should not be used for engineered fill. 	
<p>6-inch or more sand cushion below floor slab (capillary break):</p>	<p>The final 6” or more of engineered 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 5% 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>Compaction of engineered fill: (Less than 5 feet total thickness)</p>	<ul style="list-style-type: none"> - Below Footings <u>and in the footing influence zone (pg. 7):</u> - Below Floor Slabs: - Utility Trenches (inside & within 10’ outside of the buildings): 	<p><u>Minimum % Compaction</u></p> <ul style="list-style-type: none"> ➤ 95% of the ASTM: D698* ➤ 95% of the ASTM: D698* ➤ Same as “Below Floor Slabs” <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. 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 (sand) 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.”

- **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 buildings 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 responsibility of the work performed during that phase of the project and its effect on related components.

2.3 Foundations

- **Allowable Soil Bearing Pressure**

In our opinion, the proposed structures can be supported on a shallow spread footing foundation system (column pads and/or strip footings). We recommend that the footings be designed using **an allowable soil bearing pressure of up to 2000 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.**

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 foundations. Long term total settlements of the building footings 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. **(Column loads will be a maximum of 75 kips (total dead and live loads) with continuous footing loads less than 4 kips/ft (total dead and live loads).**

Please note that, the total and differential settlement of the footings (and floor slabs) 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 floors to be saturated or freeze prior to or after their placement, inadequate compaction of engineered fill soils, supporting the footings or floor slabs on expansive soils such as fat clay (CH) or on soils that were inadvertently loosened during construction, etc.

- **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 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.

- **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.

2.4 Exterior Backfill

- **Soil Type**

Assuming the absence of retaining or below grade basement walls, the on-site or imported non-organic lean clay (CL), silt (ML) or sand (SP, SW, SM, or SC) soils should be used for exterior backfill soils (fill soils placed outside the exterior foundation walls and adjacent areas). 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 clay, silt or sand soils. However, if sand or silt backfill is used, 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 #4 on page 13. NOTE: The moisture content of the on-site clay and silt soils may be high and thus, they may require drying to achieve compaction.

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.

- **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 2 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 8.

TABLE 2

Compaction of Exterior Backfill	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.

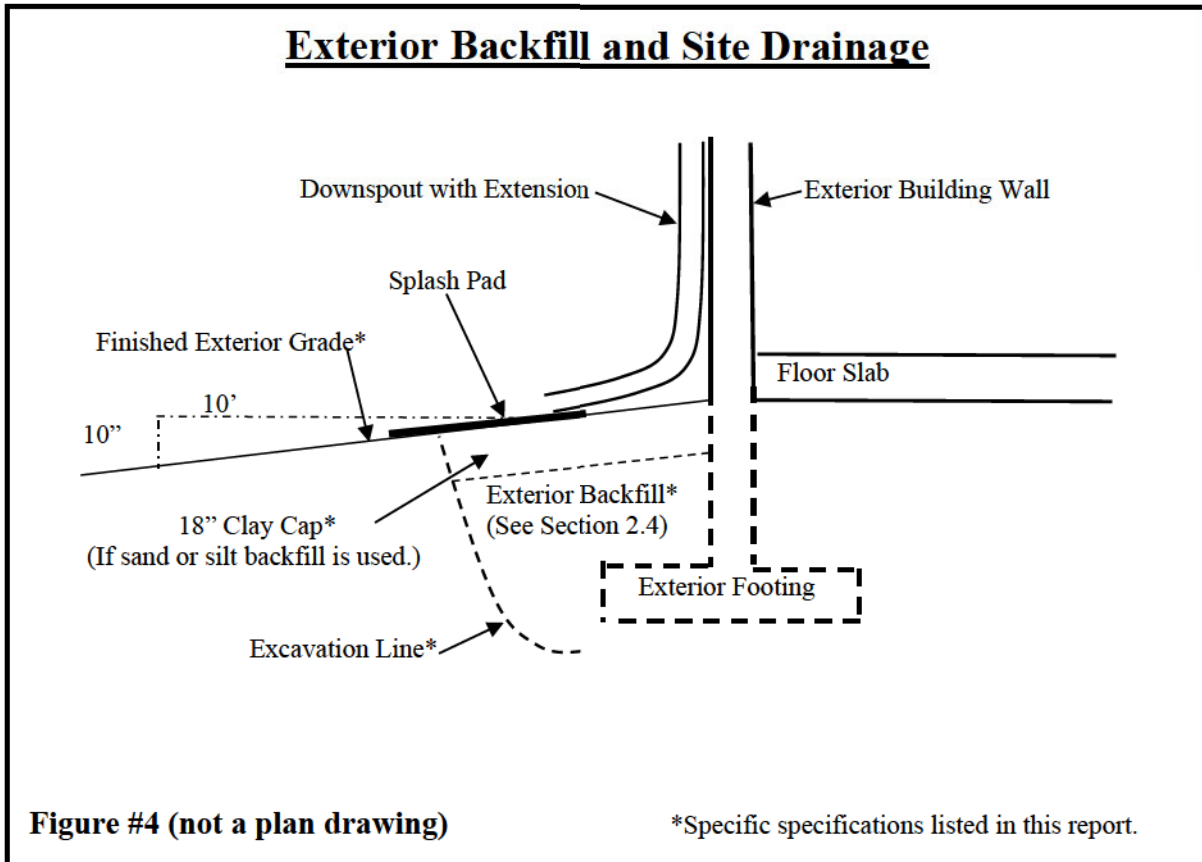
2.5 Site Drainage

• **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 structures should be sloped away from the structures with a minimum slope of 1 inch per foot for at least 10 feet beyond the excavation lines. (Please refer to Figure #4 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 structures.

• **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 structures. The gutters and downspouts, as well as splash pads and extensions, should be maintained so that leakage does not occur adjacent to the structures. (Please refer to Figure #4 below.)



2.6 Parking Lot Recommendations

Due to saturated soil conditions, we were not able to access and perform the soil borings in the proposed parking lot area. The 3 borings we did perform in the building areas have topsoil depths of 1 to 1.8 feet. In general, it is likely the proposed parking lot areas have about the same topsoil depths. NOTE: Since no soil/boring information is available in the parking lot area, the following are suggested site preparations and may need to be modified during construction.

We assume the parking lot and driveway traffic will consist of mostly cars and pickups. Also, we assume that the parking lot area will be raised about 6 to 10 inches above the existing grades to promote drainage. Based on these assumptions, we suggest that the top 8 inches of the organic topsoil be excavated. Following the 8" excavation, the exposed topsoil should be scarified to a depth of at least 8 inches and recompact to at least 95% of the Standard Proctor Density (ASTM: D698). The exposed soils should then be proof-rolled using a loaded truck and under the observation of the geotechnical or civil engineer. Deflections or rutting of the subgrade soils by 1 inch or more should be reworked and moisture adjusted so that a deflection of less than 1 inch is achieved. If soft areas develop during scarifying/recompaction or proof-rolling and cannot be

remedied, they should be removed and replaced with a granular fill (sand/gravel) or, alternatively, a non-organic lean clay fill having a liquid limit of 45 or less and a plasticity index between 14 and 28. Subgrade fill soils should then be placed as needed followed by a minimum of 8 inches of SD DOT aggregate base course.

A geotextile fabric should also be considered. If used, it should be placed between the subgrade soil and the aggregate base course. If there are heavy wheel traffic areas (garbage trucks, etc.), we suggest that the aggregate base course be at least 12 inches thick. Also, extra care be taken in the design and construction process to help ensure that adequate surface and subgrade drainage is maintained throughout the parking lot and driveway areas. (We assume Helms and Assoc will make the final pavement design based on final design grade elevations, etc.).

NOTE: The clay and silt soils encountered at the site likely have a moderate to high susceptibility of frost related movement and therefore, some frost related distress (cracking) of the asphalt and concrete should be expected. The potential of distress can be minimized by adding a significant depth of relatively clean granular subbase material below the aggregate base course.

3.0 CONSTRUCTION AND DESIGN CONSIDERATIONS

3.1 Site Excavation

- **Soil Disturbance & Moisture Changes**

The soils encountered at the site can be sensitive to disturbance and will experience strength loss under the influence of construction traffic and/or additional moisture. Construction traffic in areas where these soils are used for structural 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 support becomes frozen, desiccated, saturated, or is disturbed, the affected soil should be removed, or should be scarified, moisture conditioned, and recompacted in-place prior to placement of additional fill or structural units. Also, the excavations should be done with an excavation bucket having a smooth cutting edge.

The excavations should be left open a minimal amount of time to prevent strength loss of these soils by ponding of water or changes in their in-situ moisture content. In addition, surface drainage away from the excavations should be provided during construction.

- **Dewatering**

We do not anticipate that the footing and floor excavations will extend below the groundwater level, and thus, dewatering techniques for proper placement of engineered fill and/or the footings/floor slab systems are not anticipated, but should not be ruled out. Please refer to the groundwater measurements listed at the bottom of the attached boring logs.

If dewatering is required, it 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. Dewatering will also help limit the potential softening or loosening of the native clay and silt soils prior to placement of the engineered fill and footings.

In general, if de-watering is needed, it is our opinion that it should be able to be accomplished using typical sump-pump methods. However, placement of a 6 to 10-inch layer of ½" or less rock, or an initial lift of free draining sand, may be required. (See "**If wet or saturated soil conditions**" on page 8.)

- **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 E should be used to determine site coefficients and seismic design category.

- **Existing Structure**

Although not anticipated, if the foundations for the proposed building / structures 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.

- **Exterior Movement**

Exterior architectural features, slabs, and utilities can experience moisture or frost related movement which can result in distress. 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 granular fill material beneath slabs-on-grade.
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.

- **Movement of Building Components**

As mentioned, we understand that the proposed buildings will not be heated. Due to the potential frost related movement of the native clay and silt soils, we recommend that the floor slabs be isolated from other building components. The isolation should include installation of an expansion joint between the floor and other building components. A sealant should be applied to the expansion joint to minimize moisture penetration through it. Also, bond breakers should be installed to reduce binding between the building components.

- **OSHA**

Excavations must comply with the requirements of local, state, federal and other prescribed safety regulations, e.g., OSHA 29 CFR Part 1926, Subpart P, "Excavations." Reference to these requirements should be included in the project specifications.

- **Chemical Considerations of Soil**

Based on our past experience, the clay and silt soils found in this area have a potential for relatively high sulfate and chloride concentrations. These high chemical concentrations can result in chemical attack on the subgrade concrete and metal. Unless specific tests are performed with respect to the chemical attack of the on-site soils, we recommend that appropriate cement and water/cement ratio be used to resist the degree of chemical attack. Suitable wrappings and coatings should be provided for subgrade metals to resist corrosion.

3.2 Excavation Observation 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, reinforcing steel, and/or concrete of floor slab to verify that the floor areas 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.

3.3 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 near fully cured. Typically, flooring manufacturers require 3 to 4 weeks or more of curing time at room temperature (60° F or more) prior to placement of flooring.

4.0 GENERAL EXPLORATION INFORMATION

4.1 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.

Three standard penetration test borings were performed at the site on April 11th, 2022. 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.

4.2 Site Surface Conditions

The site of the proposed construction is located along the east and west sides of S. Broadway Street and along the south side of Baldwin Ave. SW in Columbia, SD. The site is bordered on the west by S. James 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. The elevations are listed at the top of the attached boring logs.

4.3 Site Subsurface Conditions

The subsurface conditions encountered at each boring location are illustrated on logs attached to this report. The logs also indicate the possible geologic origin of the materials encountered. 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.

4.4 Water Levels

Observations for subsurface groundwater were made at the boring locations during our field operations. Groundwater was not 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.

Please note that in order to accurately determine the static groundwater level, observations over a long 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.

4.5 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.

5.0 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 design and construction of the proposed project described herein and 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 project 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 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.

6.0 STANDARD OF CARE

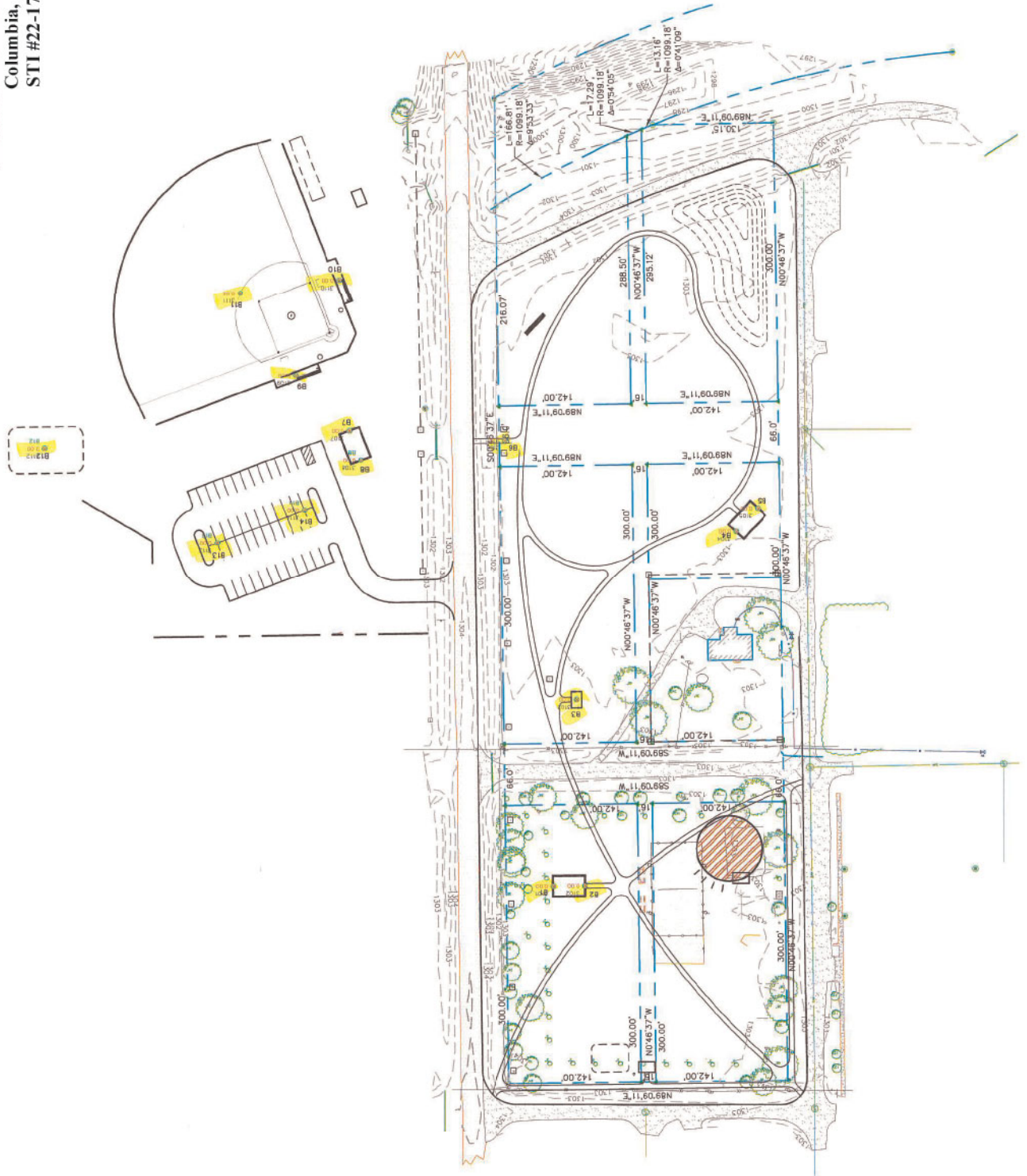
The recommendations contained in this report represent our professional opinions. These opinions were arrived at in accordance with currently accepted engineering procedures at this time and location. Other than this, no other representation, guarantee, or warranty, either expressed or implied, is made.

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 Park and Ball-field
Columbia, SD
ST11 #22-1725



BORING LOG

STI JOB #: 21-1725		Project: Proposed Park and Ballfield		BORING #: 3												
Location: Columbia SD				Sheet 1 of 1												
Latitude (North)=		Longitude (West)=		SURFACE ELEVATION = 1303.2												
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 (pcf)	Liquid Limit	Plastic Limit	200 Sieve (%)		
1.8	1301.4	Organic Lean Clay, black, moist (CL-OL)	TOPSOIL		4	1	SPT									
2.5	1300.7	Lean Clay, dark brown, frozen (CL)	LACUSTRINE DEPOSIT													
		Sandy Silt, light brown, dry, stiff to firm (ML)				9	2	SPT								
6.5	1296.7	Silt, light brown, moist, stiff (ML/CL)			6		SPT	8								61
10	1293.2	Lean Clay, brown mottled, moist, stiff (CL/ML)			10	4	SPT	17								
11.5	1291.7	Elastic Silt, brown mottled and gray, moist, stiff (MH)														
14	1289.2	Silt, fine grained, brown mottled and gray, wet, firm (ML/CL)			12	5	SPT									
16	1287.2	END OF BORING			9	6	SPT									
					8	7	SPT									
WATER LEVEL MEASUREMENTS				▼	Boring Started: 4/11/2022 at 10:15											
					Boring Completed: 4/11/2022 at 10:49											
DATE:	TIME:	SAMPLED TO:	CAVE IN:	CASING:	DEPTH:	Drilling Method:		to								
4/11/2022	10:53		14'	none	none	Drilling Method:		3 1/4" HSA 0' to 14.5'								
4/11/2022	11:45		14'	none	none	Jet with Drilling Mud:		to								
						Hammer Type:		Auto Hammer (140 lb)								
						Crew Chief:		BO		Logged By: BO						
						Backfill Method:										
SOIL TECHNOLOGIES, INC				28822 124TH ST., MOBRIDGE, SD TELEPHONE: (605) 762-3406												

Floor Areas: Excavate the existing "Topsoil" to expose the underlying native Clay "Lacustrine" soils at a depth of at least 1.8 feet below the existing grade. Final excavation depth to be approved by STI's on-site Geotechnical Engineer. Place engineered fill to meet the design floor grade elevation.

For Footings: Excavate the existing "Topsoil" and native Silt "Lacustrine" soils to a depth of at least 3 feet below existing grade. Final excavation depth to be approved by STI's on-site Geotechnical Engineer. Construct footings to rest on the native silt or clay soils or on engineered fill placed to meet the design footing grade elevation.

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BORING LOG

STI JOB #: 21-1725		Project: Proposed Park and Ballfield		BORING #: 4												
		Location: Columbia SD		Sheet 1 of 1												
Latitude (North)=		Longitude (West)=		SURFACE ELEVATION = 1302.6												
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 (%)		
1.5	1301.1	Organic Lean Clay, black, moist (CL-OL)	TOPSOIL		4	1	SPT									
2	1300.6	Lean Clay, dark brown, moist (CL)	LACUSTRINE DEPOSIT					Floor Areas: Excavate the existing "Topsoil" to expose the underlying native Clay "Lacustrine" soils at a depth of at least 1.5 feet below the existing grade. Final excavation depth to be approved by STI's on-site Geotechnical Engineer. Place engineered fill to meet the design floor grade elevation.								
3	1299.6	Lean Clay, brown, moist, firm (CL)														
		Lean Clay, light brown, moist, stiff (CL/ML)			5	2	SPT									
6.5	1296.1	Elastic Silt, light brown, moist, firm to stiff (MH)			9	3	SPT									
					7	4	SPT	41	82	2.1						
					7	5	SPT									
13	1289.6	Silt, brown mottled and gray, moist to 14' then wet, stiff (CL/ML)			14	6	SPT									
16	1286.6	END OF BORING			11	7	SPT									
WATER LEVEL MEASUREMENTS				▼	Boring Started: 4/11/2022 at 11:01											
					Boring Completed: 4/11/2022 at 11:24											
DATE:	TIME:	SAMPLED TO:	CAVE IN:	CASING:	DEPTH:	Drilling Method: to										
4/11/2022	11:30		16'	none	none	Drilling Method: 3 1/4" HSA 0' to 14.5'										
						Jet with Drilling Mud: to										
						Hammer Type: Auto Hammer (140 lb)										
						Crew Chief: BO Logged By: BO										
						Backfill Method:										
SOIL TECHNOLOGIES, INC				28822 124TH ST., MOBRIDGE, SD TELEPHONE: (605) 762-3406												

For Footings: Excavate the existing "Topsoil" and native Clay "Lacustrine" soils to a depth of at least 3 feet below existing grade. Final excavation depth to be approved by STI's on-site Geotechnical Engineer. Construct footings to rest on the native clay or silt soils or on engineered fill placed to meet the design footing grade elevation.

BORING LOG

STI JOB #: 21-1725 **Project:** Proposed Park and Ballfield **BORING #:** 8
Location: Columbia SD **Sheet 1 of 1**

Latitude (North)= Longitude (West)= **SURFACE ELEVATION =** 1303.1

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)	Cu (psf)	Liquid Limit	Plastic Limit	200 Sieve (%)			
1	1302.1	Organic Lean Clay, black, moist (CL-OL)	TOPSOIL		6	1	SPT										
3	1300.1	Lean Clay, light brown, frozen (CL)	LUCUSTRINE DEPOSIT		13	2	SPT										
		Lean Clay, light brown, frozen to 3.5' then moist, stiff (CL/ML)			10		SPT	26		4.5+							
6.5	1296.6	Silt, light brown mottled, moist, laminations of Sand, stiff (ML/CL)			10	4	SPT										
9	1294.1	Lean Clay, light brown, moist, firm (CL)			8	5	SPT	38	92	1.8							
11.5	1291.6	Lean Clay, light brown mottled and gray, moist, laminations of Sand, firm (CL)			7	6	SPT										
15	1288.1	Silt, brown, moist, stiff (ML/CL)			12	7	SPT										
16	1287.1	END OF BORING															

Floor Areas: Excavate the existing "Topsoil" to expose the underlying native Clay "Lacustrine" soils at a depth of at least 1.5 feet below the existing grade. Final excavation depth to be approved by STI's on-site Geotechnical Engineer. Place engineered fill to meet the design floor grade elevation.

For Footings: Excavate the existing "Topsoil" and native Clay "Lacustrine" soils to a depth of at least 3 feet below existing grade. Final excavation depth to be approved by STI's on-site Geotechnical Engineer. Construct footings to rest on the native clay or silt soils or on engineered fill placed to meet the design footing grade elevation.

WATER LEVEL MEASUREMENTS						Boring Started: 4/11/2022 at 9:18	
						Boring Completed: 4/11/2022 at 9:57	
DATE:	TIME:	SAMPLED TO:	CAVE IN:	CASING:	DEPTH:	Drilling Method: 6" Flight Auger 0' to 14.5'	
						Drilling Method: 3 1/4" HSA to	
4/11/2022	10:06		14.5'	none	none	Jet with Drilling Mud: to	
4/11/2022	11:57		14'	none	none	Hammer Type: Auto Hammer (140 lb)	
						Crew Chief: BO Logged By: BO	
						Backfill Method:	

SOIL TECHNOLOGIES, INC 28822 124TH ST., MOBRIDGE, SD
 TELEPHONE: (605) 762-3406

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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 to 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>SYMBOL</u>	<u>DEFINITION</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>SYMBOL</u>	<u>DEFINITION</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>RELATIVE DENSITY</u>	<u>"N" VALUE</u>	<u>CONSISTENCY</u>	<u>"N" VALUE</u>		
very loose	0-4	very soft	0-1	Lamination	Up to ½" thick stratum
loose	5-10	soft	2-4	Layer	½" to 6"
medium dense	11-24	firm	5-8	Lens	½" to 6" discontinuous stratum, pocket
dense	25-50	stiff	9-15	Varved	Alternating laminations of clay, silt and/or fine grained sand, or colors thereof
very dense	>50	very stiff	16-30	Dry	Powdery, no noticeable water
		hard	31-60	Moist	Below saturation
		very hard	>60	Wet	Saturated, above liquid limit
				Waterbearing	Pervious - soil is below water

"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.

RELATIVE GRAVEL PROPORTIONS

<u>TERM</u>	<u>RANGE</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. 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 spaced so that there is a minimum of one test performed for every 2000 square feet of engineered fill placed.
- 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

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