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## **SECTION 01 10 00 - SUMMARY**

### **PART 1 GENERAL**

#### **1.1 SUMMARY**

A. Section Includes:

1. Project information.
2. Work covered by Contract Documents.
3. Work under Owner's separate contracts.
4. Contractor's use of site and premises.
5. Coordination with occupants.
6. Work restrictions.
7. Specification and Drawing conventions.

B. Related Requirements:

1. Section 01 50 00 - Temporary Facilities and Controls

#### **1.2 PROJECT INFORMATION**

A. Project Identification: Kenai Municipal Airport Sand Storage Building

1. Project Location: 515 North Willow Street  
Kenai, AK 99611

B. Owner: City of Kenai  
210 Fidalgo Ave.  
Kenai, AK 99611

1. Owner's Representative: Scott Curtin, Public Works Director, (907) 283-8240
2. Project Representative: TBD

C. Engineer: HDL Engineering Consultants, LLC  
3335 Arctic Boulevard  
Anchorage, AK 99503

D. Engineer's Consultants: Engineer has retained the following design professionals, who have prepared designated portions of the Contract Documents:

1. Architect: Klauder & Company Architects, Inc.
2. Electrical and Mechanical Engineering (Building): RSA Engineering, Inc.
3. Structural Engineering: Nelson Engineering



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4. Electrical Engineering (Gate): MBA Consulting Engineers, Inc.

### **1.3 WORK COVERED BY CONTRACT DOCUMENTS**

- A. The Work of Project is defined by the Contract Documents and generally consists of the following:
  1. Construct 5,600 SF Sand Storage Building, including site preparation, pre-manufactured metal building, water service, site paving, and related work.
  2. Replace access gate with 30-foot wide, power-operated, sliding cantilever gate and other related work.
  3. All other work indicated on the Drawings and in these Specifications.
- B. Type of Contract:
  1. Project will be constructed under a single prime contract.
- C. Work is separated into different Phases and Schedules. Phase 1 shall be Schedule A and Phase 2 shall be Schedule B and Schedule C (if Additive Alternate 1 is awarded), as shown on the Bid Schedule and the Drawings. Schedule A will be awarded first; Schedule B and Schedule C (if awarded) shall be awarded and added to the agreement by change order once funding becomes available, but no later than March 1, 2021.

### **1.4 CONTRACTOR'S USE OF SITE AND PREMISES**

- A. Unrestricted Use of Site: Contractor shall have full use of Project site for construction operations during construction period. Contractor's use of Project site is limited by Owner's right to perform work or to retain other contractors on portions of Project and compliance with the Construction Safety and Phasing Plan.
- B. Condition of Existing Grounds: Maintain portions of existing grounds, landscaping, and hard-scaping affected by construction operations throughout construction period. Repair damage caused by construction operations.

### **1.5 WORK RESTRICTIONS**

- A. Comply with restrictions on construction operations.
  1. Comply with limitations on use of public streets, work on public streets, rights of way, and other requirements of authorities having jurisdiction.
  2. Comply with Construction Safety and Phasing Plan.
- B. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after providing temporary utility services according to requirements indicated:
  1. Notify Project Representative not less than two days in advance of proposed utility interruptions.
  2. Obtain Project Representative's written permission before proceeding with utility interruptions.

3. Maintain uninterrupted utilities to adjacent Lease Lots at all times.

## **1.6 ENVIRONMENTAL PERMITS AND LIMITATIONS**

- A. The Contractor shall provide all permits and comply with all permits and environmental conditions, limitations, and mitigation measures as required by local, state and federal agencies for this project. The Owner has not applied for any permits. The approved FAA Categorical Exclusion for the project is available upon request. The Contractor shall carefully read the contract documents and comply with requirements for other permits or environmental limitations required for constructing this project, including but not limited to:
  1. If cultural, archaeological, or historical sites are discovered during construction, then all work that may impact the sites shall stop and the contractor shall notify the City. The City will consult with the State Historic Preservation Office to determine the appropriate corrective action.
  2. If contamination or hazardous materials are encountered during construction, all work in the vicinity of the contamination shall stop and the Engineer will consult with ADEC to determine the appropriate action.
  3. If active bald or golden eagle nests are found within the project area, a primary zone of a minimum of 330 feet shall be maintained as an undisturbed habitat buffer around nesting eagles. If topography or vegetation does not provide an adequate screen or separation, the buffer shall be extended to 0.25 mile, or a sufficient distance to screen the nest from human activities. Within the secondary zone (between 330 and 660 feet), no obtrusive facilities or major habitat modifications shall occur. If nesting occurs in sparse stands of trees, treeless areas, or where activities occur within line-of-sight of the nest, this buffer shall extend up to 0.5 mile. If active Bald or Golden Eagle nests are found within 660 feet of the project area (primary and secondary protection zones), the Contractor shall notify the City and USFWS will be consulted to determine the appropriate action.
  4. To minimize the risk of introducing invasive species and to comply with Executive Order 13112, ground disturbing activities shall be kept to a minimum. Disturbed areas shall be revegetated with native Alaskan seed in accordance with the Alaska Department of Natural Resources Re-vegetation Manual.
  5. The Contractor is responsible for obtaining all necessary permits and clearances for material and disposal sites and borrow or equipment storage areas, including compliance with the APDES CGP for storm water discharge, unless the City of Kenai has obtained the necessary permits.
  6. Vegetation clearing will follow the USFWS Recommended Time Periods for Avoiding Vegetation Clearing in Alaska, unless the USFWS has been consulted to determine the most appropriate clearing methods to avoid impacts to nesting migratory species. The project area is located within Southcentral Alaska, in which the USFWS recommends avoiding vegetation clearing from May 1 through July 15th in forested/woodland and shrub/open areas.

## **1.7 SPECIFICATION AND DRAWING CONVENTIONS**

- A. Specification Content: The 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:

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1. Imperative mood and streamlined language are generally used in the Specifications. 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.
  2. Text Color: Text used in the Specifications, including units of measure, manufacturer and product names, and other text may appear in multiple colors or underlined as part of a hyperlink; no emphasis is implied by text with these characteristics.
  3. Hypertext: Text used in the Specifications may contain hyperlinks. Hyperlinks may allow for access to linked information that is not residing in the Specifications. Unless otherwise indicated, linked information is not part of the Contract Documents.
  4. Specification requirements are to be performed by Contractor unless specifically stated otherwise.
- B. Division 00 Contracting Requirements: General provisions of the Contract, including General and Supplementary Conditions, apply to all Sections of the Specifications.
- C. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.

### **PART 2 PRODUCTS (NOT USED)**

### **PART 3 EXECUTION (NOT USED)**

**END OF SECTION 01 10 00**

## **SECTION 01 25 00 - SUBSTITUTION PROCEDURES**

### **PART 1 GENERAL**

#### **1.1 SUMMARY**

- A. Section includes administrative and procedural requirements for substitutions.
- B. Related Requirements:
  - 1. Section 01 60 00 - Product Requirements

#### **1.2 DEFINITIONS**

- A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.
- B. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
- C. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required in order to meet other Project requirements but may offer advantage to Contractor or Owner.

#### **1.3 ACTION SUBMITTALS**

- A. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
  - 1. Substitution Request Form: Use form acceptable to Project Representative.
  - 2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
    - a. Statement indicating why specified product or fabrication or installation method cannot be provided, if applicable.
    - b. Coordination of information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.
    - c. Detailed comparison of significant qualities of proposed substitutions with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes, such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.

- d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
  - e. Samples, where applicable or requested.
  - f. Certificates and qualification data, where applicable or requested.
  - g. List of similar installations for completed projects, with project names and addresses as well as names and addresses of architects/engineers and owners.
  - h. Material test reports from a qualified testing agency, indicating and interpreting test results for compliance with requirements indicated.
  - i. Detailed comparison of Contractor's construction schedule using proposed substitutions with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
  - j. Cost information, including a proposal of change, if any, in the Contract Sum.
  - k. Contractor's certification that proposed substitution complies with requirements in the Contract Documents, except as indicated in substitution request, is compatible with related materials and is appropriate for applications indicated.
  - l. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.
3. Project Representative's Action: If necessary, Project Representative will request additional information or documentation for evaluation within seven days of receipt of a request for substitution. Project Representative will notify Contractor of acceptance or rejection of proposed substitution within fifteen days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.
- a. Forms of Acceptance: Change Order, Construction Change Directive, or Engineer's Supplemental Instructions for minor changes in the Work.
  - b. Use product specified if Project Representative does not issue a decision on use of a proposed substitution within time allocated.

#### **1.4 QUALITY ASSURANCE**

- A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.

## **1.5 PROCEDURES**

Coordination: Revise or adjust affected work as necessary to integrate work of the approved substitutions.

## **1.6 SUBSTITUTIONS**

- A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than fifteen days prior to time required for preparation and review of related submittals.
  - 1. Conditions: Project Representative will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Project Representative will return requests without action, except to record non-compliance with these requirements:
    - a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
    - b. Substitution request is fully documented and properly submitted.
    - c. Requested substitution will not adversely affect Contractor's construction schedule.
    - d. Requested substitution has received necessary approvals of authorities having jurisdiction.
    - e. Requested substitution is compatible with other portions of the Work.
    - f. Requested substitution has been coordinated with other portions of the Work.
    - g. Requested substitution provides specified warranty.
    - h. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.
- B. Substitutions for Convenience: Project Representative will consider requests for substitution if received within sixty days after the Notice of Award. Requests received after that time may be considered or rejected at discretion of Project Representative.
  - 1. Conditions: Project Representative will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Project Representative will return requests without action, except to record non-compliance with these requirements:

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- a. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Project Representative for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
- b. Requested substitution does not require extensive revisions to the Contract Documents.
- c. Requested substitution is consistent with the Contract Documents and will produce indicated results.
- d. Substitution request is fully documented and properly submitted.
- e. Requested substitution will not adversely affect Contractor's construction schedule.
- f. Requested substitution has received necessary approvals of authorities having jurisdiction.
- g. Requested substitution is compatible with other portions of the Work.
- h. Requested substitution has been coordinated with other portions of the Work.
- i. Requested substitution provides specified warranty.
- j. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

**PART 2 PRODUCTS (NOT USED)**

**PART 3 EXECUTION (NOT USED)**

**END OF SECTION 01 25 00**

## **SECTION 01 26 00 - CONTRACT MODIFICATION PROCEDURES**

### **PART 1 GENERAL**

#### **1.1 SUMMARY**

- A. Section includes administrative and procedural requirements for handling and processing Contract modifications.

#### **1.2 MINOR CHANGES IN THE WORK**

- A. Project Representative will issue a Field Order authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time.
  - 1. Work Change Proposal Requests issued by the Project Representative are not instructions either to stop work in progress or to execute the proposed change.

#### **1.3 PROPOSAL REQUESTS**

- A. Owner-Initiated Proposal Requests: Project Representative will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
  - 1. Work Change Proposal Requests issued by Project Representative are not instructions either to stop work in progress or to execute the proposed change.
  - 2. Within 7 days, unless otherwise stated, after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
    - a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
    - b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
    - c. Include costs of labor and supervision directly attributable to the change.
    - d. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
- B. Contractor-Initiated Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to Project Representative.



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1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
  2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
  3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
  4. Include costs of labor and supervision directly attributable to the change.
  5. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
  6. Comply with requirements in Section 012500 "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.
- C. Proposal Request Form: Use AIA Document G709 or similar form, approved by Owner and Project Representative, for Proposal Requests.

### **1.4 CHANGE ORDER PROCEDURES**

- A. Change Orders shall be prepared, negotiated, and processed in accordance with Article 9 of the General Conditions. On Owner's approval of a Work Change Proposal Request, Project Representative will issue a Change Order for signatures of Owner and Contractor.

### **1.5 WORK CHANGE DIRECTIVE**

- A. Work Change Directive: Project Representative may issue a Work Change Directive which instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
1. Work Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.
- B. Documentation: For time and material basis work, maintain detailed records on a time and material basis of work required by the Work Change Directive. Daily time records are to be submitted to the Project Representative by 9:00 am on the following workday.
1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

### **PART 2 PRODUCTS (NOT USED)**

### **PART 3 EXECUTION (NOT USED)**

**END OF SECTION 01 26 00**

## **SECTION 01 29 00 - PAYMENT PROCEDURES**

### **PART 1 GENERAL**

#### **1.1 SUMMARY**

- A. Section includes administrative and procedural requirements necessary to prepare and process Applications for Payment.
- B. Payment procedures shall be in accordance with Article 8 of the General Conditions.

#### **1.2 SCHEDULE OF VALUES**

- A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule.
  - 1. Correlate line items in the Schedule of Values with other required administrative forms and schedules, including Application for Payment forms, Submittals Schedule and Contractor's Construction Schedule.
  - 2. Submit the Schedule of Values to Project Representative at earliest possible date but no later than 10 days after effective date of notice to proceed and prior to commencement of work.
- B. Format and Content: Use the Specification Index as a guide to establish line items for the Schedule of Values. Provide at least one line item for each applicable technical Specification Section.
  - 1. Identification: Include the following Project identification on the Schedule of Values:
    - a. Project name and location.
    - b. Name of Engineer.
    - c. Engineer's project number.
    - d. Contractor's name and address.
    - e. Date of submittal.
  - 2. Submit draft Schedule of Values for approval.
  - 3. Provide a breakdown of the Contract Sum items in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Provide several line items for principal subcontract amounts in excess of five percent of the Contract Sum.
  - 4. Round amounts to nearest whole dollar; total shall equal the Contract Sum.

5. Provide a separate line item in the Schedule of Values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
6. Provide separate line items in the Schedule of Values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
7. Each item in the Schedule of Values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.
  - a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the Schedule of Values or distributed as general overhead expense, at Contractor's option.
8. Schedule Updating: Update and resubmit the Schedule of Values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

### **1.3 APPLICATIONS FOR PAYMENT**

- A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments as certified by Project Representative and paid for by Owner.
- B. Payment Application Times: The date for each progress payment is indicated in the General Conditions. The period of construction work covered by each Application for Payment is the period indicated in the General Conditions.
- C. Payment Application Forms: Use form EJCDC No. C-620 and additional supporting forms as provided by Owner or other mutually agreeable form.
- D. Application Preparation: Complete every entry on form. Execute by a person authorized to sign legal documents on behalf of Contractor. Project Representative will return incomplete applications without action.
  1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
  2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
  3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
- E. Transmittal: Submit one (1) signed copy of each Application for Payment to Project Representative. Include waivers of lien and similar attachments as required.

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1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.
  2. Attach copies of Certified Payroll Reports submitted to the Alaska DOL during the period covered by the Application.
  3. Attach monthly DBE Utilization Report.
- F. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's lien from every entity who is lawfully entitled to file a mechanic's lien arising out of the Contract and related to the Work covered by the payment.
1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
  2. When an application shows completion of an item, submit final or full waivers.
  3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
  4. Waiver Forms: Submit executed waivers of lien on forms acceptable to Owner.
- G. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:
1. List of subcontractors.
  2. Schedule of values.
  3. Contractor's construction schedule (preliminary if not final).
  4. Submittal schedule (preliminary if not final).
  5. List of Contractor's staff assignments.
  6. Copies of building permits.
  7. Initial progress report.
  8. Report of preconstruction conference.
  9. Certificates of insurance and insurance policies.
  10. Notice of Work submitted to Alaska DOL.
  11. Fully executed copies of all Subcontracts.
- H. Final Payment Application: After completing Project closeout requirements, submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:
1. Evidence of completion of Project closeout requirements.

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2. Contract Completion and Acceptance Certificate
3. Contractor's Statement Concerning Claims
4. AIA Document G707, "Consent of Surety to Final Payment."
5. Evidence that claims have been settled.
6. Final, liquidated damages settlement statement.
7. Notice of Completion of Public Works submitted to Alaska DOL.

**PART 2 PRODUCTS (NOT USED)**

**PART 3 EXECUTION (NOT USED)**

**END OF SECTION 01 29 00**

## **SECTION 01 31 00 - PROJECT MANAGEMENT AND COORDINATION**

### **PART 1 GENERAL**

#### **1.1 SUMMARY**

- A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
  - 1. General coordination procedures
  - 2. Request for Information (RFI)
  - 3. Project meetings.
- B. Related Requirements:
  - 1. Section 01 73 00 - Execution

#### **1.2 DEFINITIONS**

- A. RFI: Request from Contractor seeking interpretation or clarification of the Contract Documents.

#### **1.3 INFORMATIONAL SUBMITTALS**

- A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:
  - 1. Name, address, telephone number, and email address of entity performing subcontract or supplying products.
  - 2. Number and title of related Specification Section(s) covered by subcontract.
  - 3. Drawing number and detail references, as appropriate, covered by subcontract.

#### **1.4 GENERAL COORDINATION PROCEDURES**

- A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations included in different Sections that depend on each other for proper installation, connection, and operation.
  - 1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
  - 2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
  - 3. Make adequate provisions to accommodate items scheduled for later installation.

- B. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
1. Preparation of Contractor's construction schedule.
  2. Preparation of the schedule of values.
  3. Installation and removal of temporary facilities and controls.
  4. Delivery and processing of submittals.
  5. Progress meetings.
  6. Preinstallation conferences.
  7. Project closeout activities.
  8. Startup and adjustment of systems.

#### **1.5 REQUEST FOR INFORMATION (RFI)**

- A. General: Immediately on discovery of the need for additional information, clarification, or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.
1. Project Representative will return without response those RFIs submitted to Project Representative or Engineer by other entities controlled by Contractor.
  2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.
- B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:
1. Project name.
  2. Date.
  3. Name of Contractor.
  4. Name of Engineer
  5. RFI number, numbered sequentially.
  6. RFI subject
  7. Specification Section number and title and related paragraphs, as appropriate.
  8. Drawing number and detail references, as appropriate.
  9. Field dimensions and conditions, as appropriate.

10. Contractor's suggested solution(s). If Contractor's solution(s) impact the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
  11. Contractor's signature.
  12. Attachments: Include drawings, descriptions, measurements, photos, Product Data, Shop Drawings, and other information necessary to fully describe items needing interpretation. Each page of attachments shall be identified with the RFI number and sequential page number.
- C. RFI Forms: Mutually acceptable form with the same content as indicated above, acceptable to Project Representative and Engineer.
- D. Project Representative's Action: Project Representative will review each RFI, determine action required, and respond. Allow seven days for Project Representative's response for each RFI. RFIs received by Project Representative after 1:00 p.m. will be considered as received the following working day.
1. The following Contractor-generated RFIs will be returned without action:
    - a. Requests for approval of submittals.
    - b. Requests for approval of substitutions.
    - c. Requests for approval of Contractor's means and methods.
    - d. Requests for coordination information already indicated in the Contract Documents.
    - e. Requests for adjustments in the Contract Time or the Contract Sum.
    - f. Requests for interpretation of Project Representative's actions on submittals.
    - g. Incomplete RFIs or inaccurately prepared RFIs.
  2. Project Representative's action may include a request for additional information, in which case Project Representative's time for response will date from time of receipt by Project Representative of additional information.
  3. Project Representative's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Section 012600 "Contract Modification Procedures."
    - a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Project Representative in writing within seven days of receipt of the RFI response.
- E. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly. Use mutually acceptable form, including the following:
1. Project name.



2. Name and address of Contractor.
  3. Name and address of Engineer.
  4. RFI number including RFIs that were returned without action or withdrawn.
  5. RFI subject.
  6. Date the RFI was submitted.
  7. Date Project Representative's response was received.
  8. Identification of related Field Order, Work Change Directive, and Proposal Request, as appropriate.
- F. On receipt of Project Representative's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Project Representative within seven days if Contractor disagrees with response.

## **1.6 PROJECT MEETINGS**

- A. General: Schedule and conduct meetings and conferences at Project site, unless otherwise indicated.
- B. Preconstruction Conference: Project Representative will schedule a preconstruction conference before Contractor starts construction, at a time convenient to Owner, Project Representative, Engineer, and Contractor, but no later than 15 days after execution of the Agreement. The Project Representative will conduct the meeting to review responsibilities and personnel assignments.
1. Attendees: Authorized representatives of Owner, Engineer, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
  2. Agenda: Discuss items of significance that could affect progress, including the following:
    - a. Responsibilities and personnel assignments.
    - b. Tentative construction schedule.
    - c. Phasing.
    - d. Critical work sequencing and long-lead items.
    - e. Designation of key personnel and their duties.
    - f. Lines of communication.
    - g. Procedures for processing field decisions and Change Orders.

- h. Procedures for RFIs.
- i. Procedures for testing and inspecting.
- j. Procedures for processing Applications for Payment.
- k. Distribution of the Contract Documents.
- l. Submittal procedures.
- m. Preparation of Record Documents.
- n. Use of the premises.
- o. Work restrictions.
- p. Owner's occupancy requirements.
- q. Responsibility for temporary facilities and controls.
- r. Procedures for disruptions and shutdowns.
- s. Construction waste management and recycling.
- t. Office, work, and storage areas.
- u. Equipment deliveries and priorities.
- v. First aid.
- w. Security.
- x. Progress cleaning.
- y. Working hours.

3. Minutes: Project Representative will record and distribute meeting minutes.

C. Progress Meetings: Project Representative will conduct progress meetings weekly, or at other intervals approved by the Owner.

- 1. Attendees: In addition to representatives of Owner and Engineer, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
- 2. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.

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- a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's Construction Schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
    - 1) Review schedule for next period.
  - b. Review present and future needs of each entity present, including the following:
    - 1) Interface requirements.
    - 2) Sequence of operations.
    - 3) Status of submittals.
    - 4) Deliveries.
    - 5) Off-site fabrication.
    - 6) Access.
    - 7) Site utilization.
    - 8) Temporary facilities and controls.
    - 9) Work hours.
    - 10) Hazards and risks.
    - 11) Progress cleaning.
    - 12) Quality and work standards.
    - 13) Status of correction of deficient items.
    - 14) Field observations.
    - 15) RFIs.
    - 16) Status of proposal requests.
    - 17) Pending changes.
    - 18) Status of Change Orders.
    - 19) Pending claims and disputes.
    - 20) Documentation of information for payment requests.
  - c. Other topics listed and included in the Construction Safety and Phasing Plan (CSPP).
3. Minutes: Project Representative will record the meeting minutes.
  4. Reporting: Project Representative will distribute minutes of the meeting to each party present and to parties who should have been present.
    - a. Schedule Updating: Revise Contractor's Construction Schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule within three working days of each meeting.

### **PART 2 PRODUCTS (NOT USED)**

### **PART 3 EXECUTION (NOT USED)**

**END OF SECTION 01 31 00**

## **SECTION 01 32 00 - CONSTRUCTION PROGRESS DOCUMENTATION**

### **PART 1 GENERAL**

#### **1.1 SUMMARY**

- A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
  - 1. Contractor's Construction Schedule.
  - 2. Construction schedule updating reports.
  - 3. Daily construction reports.
  - 4. Site condition reports.

#### **1.2 DEFINITIONS**

- A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction Project. Activities included in a construction schedule consume time and resources.
  - 1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
  - 2. Predecessor Activity: An activity that precedes another activity in the network.
  - 3. Successor Activity: An activity that follows another activity in the network.
- B. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of Project.
- C. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.
- D. Event: The starting or ending point of an activity.
- E. Float: The measure of leeway in starting and completing an activity.
  - 1. Float time is not for the exclusive use or benefit of either Owner or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.

#### **1.3 SUBMITTALS**

- A. Format for Submittals: Submit required submittals in the following format:
  - 1. Working electronic copy of schedule file.
  - 2. PDF file.

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- B. Startup Network Diagram: Of size required to display entire network for entire construction period. Show logic ties for activities.
- C. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.
- D. CPM Reports: Concurrent with CPM schedule, submit each of the following reports. Format for each activity in reports shall contain activity number, activity description, original duration, remaining duration, early start date, early finish date, late start date, late finish date, and total float in calendar days.
  - 1. Activity Report: List of activities sorted by activity number and then early start date, or actual start date if known.
  - 2. Logic Report: List of preceding and succeeding activities for each activity, sorted in ascending order by activity number and then by early start date, or actual start date if known.
  - 3. Total Float Report: List of activities sorted in ascending order of total float.
- E. Construction Schedule Updating Reports: Submit with Applications for Payment.
- F. Daily Construction Reports: Submit at weekly intervals.
- G. Site Condition Reports: Submit at time of discovery of differing conditions.

### **1.4 COORDINATION**

- A. Coordinate Contractor's Construction Schedule with the schedule of values, submittal schedule, progress reports, payment requests, and other required schedules and reports.
  - 1. Secure time commitments for performing critical elements of the Work from entities involved.
  - 2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

### **1.5 CONTRACTOR'S CONSTRUCTION SCHEDULE**

- A. Computer Scheduling Software: Prepare schedules using current version of a program that has been developed specifically to manage construction schedules.
- B. Time Frame: Extend schedule from date established for the Notice to Proceed to date of final completion.
  - 1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.
- C. Activities: Comply with the following:
  - 1. Activity Duration: Define activities so no activity is longer than 20 days, unless specifically allowed by Project Representative.
  - 2. Procurement Activities: Include procurement process activities for the following long lead items and major items, requiring a cycle of more than 30 days, as separate ac-

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- activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
3. Submittal Review Time: Include review and resubmittal times indicated in Section 013300 "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's Construction Schedule with submittal schedule.
  4. Startup and Testing Time: Include no fewer than 10 days for startup and testing.
  5. Commissioning Time: Include no fewer than 10 days for commissioning.
  6. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Project Representative's administrative procedures necessary for certification of Substantial Completion.
  7. Punch List and Final Completion: Include not more than 30 days for completion of punch list items and final completion.
- D. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.
1. Phasing: Arrange list of activities on schedule by phase.
  2. Work Restrictions: Show the effect of the following items on the schedule:
    - a. Coordination with existing construction.
    - b. Limitations of continued occupancies.
    - c. Uninterruptible services.
    - d. Partial occupancy before Substantial Completion.
    - e. Use-of-premises restrictions.
    - f. Provisions for future construction.
    - g. Seasonal variations.
    - h. Environmental control.
- E. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and final completion and the following interim milestones:
1. Temporary enclosure and space conditioning.
- F. Upcoming Work Summary: Prepare summary report indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:
1. Unresolved issues.
  2. Unanswered Requests for Information.

3. Rejected or unreturned submittals.
  4. Notations on returned submittals.
  5. Pending modifications affecting the Work and the Contract Time.
- G. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before the next regularly scheduled progress meeting.
1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
  2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
  3. As the Work progresses, indicate final completion percentage for each activity.
- H. Recovery Schedule: When periodic update indicates the Work is 14 or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule. Indicate changes to working hours, working days, crew sizes, equipment required to achieve compliance, and date by which recovery will be accomplished.
- I. Distribution: Distribute copies of approved schedule to Project Representative, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.
- a. Post copies in Project meeting rooms and temporary field offices.
  - b. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

## **1.6 CPM SCHEDULE REQUIREMENTS**

- A. Prepare network diagrams using AON (activity-on-node) format.
- B. Startup Network Diagram: Submit diagram within 14 days of date established for Notice to Proceed. Outline significant construction activities for the first 60 days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.
- C. CPM Schedule: Prepare Contractor's Construction Schedule using a time-scaled CPM network analysis diagram for the Work.
  1. Develop network diagram in sufficient time to submit CPM schedule so it can be accepted for use no later than 30 days after date established for the Notice to Proceed.

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- a. Failure to include any work item required for performance of this Contract shall not excuse Contractor from completing all work within applicable completion dates.
  2. Conduct educational workshops to train and inform key Project personnel, including subcontractors' personnel, in proper methods of providing data and using CPM schedule information.
  3. Establish procedures for monitoring and updating CPM schedule and for reporting progress. Coordinate procedures with progress meeting and payment request dates.
  4. Use "one workday" as the unit of time for individual activities. Indicate nonworking days and holidays incorporated into the schedule to coordinate with the Contract Time.
- D. CPM Schedule Preparation: Prepare a list of all activities required to complete the Work. Using the startup network diagram, prepare a skeleton network to identify probable critical paths.
1. Activities: Indicate the estimated time duration, sequence requirements, and relationship of each activity in relation to other activities. Include estimated time frames for the following activities:
    - a. Preparation and processing of submittals.
    - b. Mobilization and demobilization.
    - c. Purchase of materials.
    - d. Delivery.
    - e. Fabrication.
    - f. Utility interruptions.
    - g. Installation.
    - h. Work by Owner that may affect or be affected by Contractor's activities.
    - i. Testing and inspection.
    - j. Commissioning.
    - k. Punch list and final completion.
    - l. Activities occurring following final completion.
  2. Critical Path Activities: Identify critical path activities, including those for interim completion dates. Scheduled start and completion dates shall be consistent with Contract milestone dates.



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3. Processing: Process data to produce output data on a computer-drawn, time-scaled network. Revise data, reorganize activity sequences, and reproduce as often as necessary to produce the CPM schedule within the limitations of the Contract Time.
4. Format: Mark the critical path. Locate the critical path near center of network; locate paths with most float near the edges.
  - a. Subnetworks on separate sheets are permissible for activities clearly off the critical path.
- E. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using a network fragment to demonstrate the effect of the proposed change on the overall Project schedule.
- F. Initial Issue of Schedule: Prepare initial network diagram from a sorted activity list indicating straight "early start-total float." Identify critical activities. Prepare tabulated reports showing the following:
  1. Contractor or subcontractor and the Work or activity.
  2. Description of activity.
  3. Main events of activity.
  4. Immediate preceding and succeeding activities.
  5. Early and late start dates.
  6. Early and late finish dates.
  7. Activity duration in workdays.
  8. Total float or slack time.
  9. Average size of workforce.
  10. Dollar value of activity (coordinated with the schedule of values).
- G. Schedule Updating: Concurrent with making revisions to schedule, prepare tabulated reports showing the following:
  1. Identification of activities that have changed.
  2. Changes in early and late start dates.
  3. Changes in early and late finish dates.
  4. Changes in activity durations in workdays.
  5. Changes in the critical path.
  6. Changes in total float or slack time.
  7. Changes in the Contract Time.

**1.7 REPORTS**

- A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:
1. List of subcontractors at Project site.
  2. List of separate contractors at Project site.
  3. Approximate count of personnel at Project site.
  4. Equipment at Project site.
  5. Material deliveries.
  6. High and low temperatures and general weather conditions, including presence of rain or snow.
  7. Testing and inspection.
  8. Accidents.
  9. Meetings and significant decisions.
  10. Stoppages, delays, shortages, and losses.
  11. Meter readings and similar recordings.
  12. Emergency procedures.
  13. Orders and requests of authorities having jurisdiction.
  14. Change Orders received and implemented.
  15. Work Change Directives received and implemented.
  16. Services connected and disconnected.
  17. Equipment or system tests and startups.
  18. Partial completions and occupancies.
  19. Substantial Completions authorized.
- B. Site Condition Reports: Immediately on discovery of a difference between site conditions and the Contract Documents, prepare and submit a detailed report. Submit with a Request for Information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

**PART 2 PRODUCTS (NOT USED)**

**PART 3 EXECUTION (NOT USED)**

**END OF SECTION 01 32 00**

## **SECTION 01 33 00 - SUBMITTAL PROCEDURES**

### **PART 1 GENERAL**

#### **1.1 SUMMARY**

A. Section Includes:

1. Submittal schedule requirements.
2. Administrative and procedural requirements for submittals.

#### **1.2 DEFINITIONS**

- A. Action Submittals: Written and graphic information and physical samples that require Project Representative's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."
- B. Informational Submittals: Written and graphic information and physical samples that do not require Project Representative's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."

#### **1.3 SUBMITTAL SCHEDULE**

- A. Submittal Schedule: Submit, as an action submittal, a list of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Project Representative and additional time for handling and reviewing submittals required by those corrections.

#### **1.4 SUBMITTAL FORMATS**

A. Submittal Information: Include the following information in each submittal:

1. Project name.
2. Date.
3. Name of Engineer.
4. Name of Contractor.
5. Name of firm or entity that prepared submittal.
6. Names of subcontractor, manufacturer, and supplier.
7. Unique submittal number, including revision identifier. Include Specification Section number with sequential alphanumeric identifier; and alphanumeric suffix for resubmittals.
8. Category and type of submittal.
9. Submittal purpose and description.

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10. Number and title of Specification Section, with paragraph number and generic name for each of multiple items.
  11. Drawing number and detail references, as appropriate.
  12. Indication of full or partial submittal.
  13. Location(s) where product is to be installed, as appropriate.
  14. Other necessary identification.
  15. Remarks.
  16. Signature of transmitter.
- B. Options: Identify options requiring selection by Project Representative.
- C. Deviations and Additional Information: On each submittal, clearly indicate deviations from requirements in the Contract Documents, including minor variations and limitations; include relevant additional information and revisions, other than those requested by Project Representative on previous submittals. Indicate by highlighting on each submittal or noting on attached separate sheet.
1. Transmittal for Submittals: Assemble each submittal individually and appropriately for transmittal and handling.
- D. Electronic Submittals: Prepare submittals as PDF package, incorporating complete information into each PDF file. Name PDF file with submittal number.

### **1.5 SUBMITTAL PROCEDURES**

- A. Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
1. Email: Prepare submittals as PDF package, and transmit to Project Representative by sending via email. Include PDF transmittal form. Include information in email subject line as requested by Project Representative.
- B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
  2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
  3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
- C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Project Representative's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.

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1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Project Representative will advise Contractor when a submittal being processed must be delayed for coordination.
  2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
  3. Resubmittal Review: Allow 15 days for review of each resubmittal.
- D. Resubmittals: Make resubmittals in same form and number of copies as initial submittal. Contractor shall pay all review costs associated with more than two reviews, unless a resubmittal is required due to the new comments addressing previously submitted information.
- E. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.
- F. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Project Representative's action stamp.

### **1.6 SUBMITTAL REQUIREMENTS**

- A. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
1. If information must be specially prepared for submittal because standard published data are unsuitable for use, submit as Shop Drawings, not as Product Data.
  2. Mark each copy of each submittal to show which products and options are applicable.
  3. Include the following information, as applicable:
    - a. Manufacturer's catalog cuts.
    - b. Manufacturer's product specifications.
    - c. Standard color charts.
    - d. Statement of compliance with specified referenced standards.
    - e. Testing by recognized testing agency.
    - f. Application of testing agency labels and seals.
    - g. Notation of coordination requirements.
    - h. Availability and delivery time information.
  4. For equipment, include the following in addition to the above, as applicable:
    - a. Wiring diagrams that show factory-installed wiring.

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- b. Printed performance curves.
  - c. Operational range diagrams.
  - d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
- 5. Submit Product Data before Shop Drawings, and before or concurrent with Samples.
- B. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.
  - 1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
    - 2. Identification of products.
    - 3. Schedules.
    - 4. Compliance with specified standards.
    - 5. Notation of coordination requirements.
    - 6. Notation of dimensions established by field measurement.
    - 7. Relationship and attachment to adjoining construction clearly indicated.
    - 8. Seal and signature of professional engineer if specified.
- C. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other materials.
  - 1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
  - 2. Identification: Permanently attach label on unexposed side of Samples that includes the following:
    - a. Project name and submittal number.
    - b. Generic description of Sample.
    - c. Product name and name of manufacturer.
    - d. Sample source.
    - e. Number and title of applicable Specification Section.
    - f. Specification paragraph number and generic name of each item.
  - 3. Email Transmittal: Provide PDF transmittal. Include digital image file illustrating Sample characteristics, and identification information for record.

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4. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
  - a. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.
5. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
  - a. Number of Samples: Submit one full set of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Engineer, through Project Representative, will return submittal with options selected.
6. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
  - a. Number of Samples: Submit three sets of Samples. Project Representative will retain two Sample sets; remainder will be returned.
    - 1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
    - 2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.
- D. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
- E. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.
- F. Design Data: Prepare and submit written and graphic information indicating compliance with indicated performance and design criteria in individual Specification Sections. Include list of assumptions and summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Number each page of submittal.
- G. Certificates:

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1. Certificates and Certifications Submittals: Submit a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity. Provide a notarized signature where indicated.
2. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
3. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
4. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
5. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
6. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.

#### **H. Test and Research Reports:**

1. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for substrate preparation and primers required.
2. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.
3. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
4. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
5. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
6. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
  - a. Name of evaluation organization.



- b. Date of evaluation.
- c. Time period when report is in effect.
- d. Product and manufacturers' names.
- e. Description of product.
- f. Test procedures and results.
- g. Limitations of use.

### **1.7 DELEGATED-DESIGN SERVICES**

- A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
  - 1. If criteria indicated are insufficient to perform services or certification required, submit a written request for additional information to Engineer.
- B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF file, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.
  - 1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

### **1.8 CONTRACTOR'S REVIEW**

- A. Action Submittals and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Project Representative.
- B. Contractor's Approval: Indicate Contractor's approval for each submittal with a uniform approval stamp. Include name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.
  - 1. Engineer will not review submittals received from Contractor that do not have Contractor's review and approval.

### **1.9 ENGINEER'S REVIEW**

- A. Action Submittals: Engineer will review each submittal, indicate corrections or revisions required and return it through the Project Representative.
  - 1. PDF Submittals: Engineer will indicate, via markup on each submittal, the appropriate action.

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2. Informational Submittals: Project Representative and Engineer will review each submittal and will not return it, or will return it if it does not comply with requirements. Project Representative will forward each submittal to appropriate party.
3. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Engineer.
4. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.
5. Project Representative will return without review submittals received from sources other than Contractor.
6. Submittals not required by the Contract Documents will be returned by Project Representative without action.

**PART 2 PRODUCTS (NOT USED)**

**PART 3 EXECUTION (NOT USED)**

**END OF SECTION 01 33 00**

## **SECTION 01 40 00 - QUALITY REQUIREMENTS**

### **PART 1 GENERAL**

#### **1.1 SUMMARY**

- A. This Section includes administrative and procedural requirements for quality assurance and quality control.
- B. Contractor shall develop and maintain a project specific Quality Control Plan that defines their approach to meeting each requirement of this Section. Submit a Quality Control Plan for Engineer review and approval prior to the Pre-Construction Conference. No payment will be made until the Contractor has an approved Quality Control Plan.
- C. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
  - 1. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
  - 2. Requirements for Contractor to provide quality-assurance and -control services required by Engineer, Owner, or authorities having jurisdiction are not limited by provisions of this Section.
- D. See Divisions 2 through 46 Sections for specific test and inspection requirements.
- E. Provide Engineer with a copy of all quality control test results and reports. No payment will be made for any portion of the work when the specified amount of quality control documentation is not provided or quality control testing indicates the work fails to meet the minimum requirements specified.
- F. The Owner will perform acceptance testing. No payment will be made for materials that do not meet the contract requirements based on the Owner's acceptance testing results.

#### **1.2 DEFINITIONS**

- A. Experienced: When used with an entity or individual, "experienced" unless otherwise further described means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.
- B. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.
- C. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.
- D. Product Tests: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with industry standards.

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- E. Source Quality-Control Testing: Tests and inspections that are performed at the source, i.e., plant, mill, factory, or shop.
- F. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.
- G. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.
- H. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Project Representative.

### **1.3 CONFLICTING REQUIREMENTS**

- A. General: If 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 Project Representative for a decision before proceeding.
- B. 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 requirements. Refer uncertainties to Project Representative for a decision before proceeding.

### **1.4 INFORMATIONAL SUBMITTALS**

- A. Contractor's Statement of Responsibility: When required by authorities having jurisdiction, submit copy of written statement of responsibility submitted to authorities having jurisdiction before starting work on the following systems:
  - 1. Seismic-force-resisting system, designated seismic system, or component listed in the Statement of Special Inspections.
  - 2. Main wind-force-resisting system or a wind-resisting component listed in the Statement of Special Inspections.
- B. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.
- C. Permits, Licenses, and Certificates: For Owner's record, 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.

### **1.5 REPORTS AND DOCUMENTS**

- A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:

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1. Date of issue.
  2. Project title and number.
  3. Name, address, and telephone number of testing agency.
  4. Dates and locations of samples and tests or inspections.
  5. Names of individuals making tests and inspections.
  6. Description of the Work and test and inspection method.
  7. Identification of product and Specification Section.
  8. Complete test or inspection data.
  9. Test and inspection results and an interpretation of test results.
  10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
  11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
  12. Name and signature of laboratory inspector.
  13. Recommendations on retesting and reinspecting.
- B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:
1. Statement on condition of substrates and their acceptability for installation of product.
  2. Statement that products at Project site comply with requirements.
  3. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
  4. Results of operational and other tests and a statement of whether observed performance complies with requirements.
  5. Other required items indicated in individual Specification Sections.
- C. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:
1. Statement that equipment complies with requirements.
  2. Results of operational and other tests and a statement of whether observed performance complies with requirements.
  3. Other required items indicated in individual Specification Sections.

## **1.6 QUALITY ASSURANCE**

- A. Qualifications paragraphs in this Article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.
- B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units. As applicable, procure products from manufacturers able to meet qualification requirements, warranty requirements, and technical or factory-authorized service representative requirements.
- C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- D. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.
- E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or products that are similar to those indicated for this Project in material, design, and extent.
- F. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 548; and with additional qualifications specified in individual Sections; and where required by authorities having jurisdiction, that is acceptable to authorities.
  - 1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
  - 2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.
- G. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- H. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

## **1.7 QUALITY CONTROL**

- A. Contractor is responsible for all work required for Quality Control and Quality Assurance. Owner will perform separate testing for acceptance, as required to verify the results of the Contractor's Quality Control. Owner will engage a qualified testing agency to perform acceptance testing.
  - 1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.

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2. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor, and the Contract Sum will be adjusted by Change Order.
- B. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
1. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.
    - a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
  2. Arrange and coordinate testing or inspection, as required.
  3. Submit a certified written report, in duplicate, of each quality-control service.
  4. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
  5. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.
- C. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Division 1 Section "Submittal Procedures."
- D. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.
- E. Employ a testing agency that cooperates with Engineer and Contractor in performance of duties and provides qualified personnel to perform required tests and inspections. Contractor's testing agency shall:
1. Notify Project Representative and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
  2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
  3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
  4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
- F. Cooperate with agencies and representatives performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:

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1. Access to the Work.
  2. Incidental labor and facilities necessary to facilitate tests and inspections.
  3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
  4. Facilities for storage and field curing of test samples.
  5. Delivery of samples to testing agencies.
  6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
  7. Security and protection for samples and for testing and inspecting equipment at Project site.
- G. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
1. Schedule times for tests, inspections, obtaining samples, and similar activities.

### **1.8 SPECIAL TESTS AND INSPECTIONS**

- A. Special Tests and Inspections: Owner will engage a qualified testing agency to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner, and as follows:
1. Notifying Project Representative and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
  2. Submitting a certified written report of each test, inspection, and similar quality-control service to Project Representative with copy to Contractor and to authorities having jurisdiction.
  3. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
  4. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
  5. Retesting and reinspecting corrected Work.

### **PART 2 PRODUCTS (NOT USED)**

### **PART 3 EXECUTION**

#### **3.1 TEST AND INSPECTION LOG**

- A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:
1. Date test or inspection was conducted.
  2. Description of the Work tested or inspected.



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3. Date test or inspection results were transmitted to Architect.
  4. Identification of testing agency or special inspector conducting test or inspection.
- B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Project Representative's and authorities' having jurisdiction reference during normal working hours.
1. Submit log at Project closeout as part of Project Record Documents.

**3.2 REPAIR AND PROTECTION**

- A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
1. Provide materials and comply with installation requirements specified in other Specification Sections. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible.
- B. Protect construction exposed by or for quality-control service activities.
- C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

**END OF SECTION 01 40 00**

## **SECTION 01 42 00 - REFERENCES**

### **PART 1 GENERAL**

#### **1.1 DEFINITIONS**

- A. General: Basic Contract definitions are included in the General Conditions of the Contract and the Agreement Between Owner and Contractor.
- B. "Approved": When used to convey Engineer's action on Contractor's submittals, applications, and requests, "approved" is limited to Engineer's duties and responsibilities as stated in the Conditions of the Contract.
- C. "Directed": A command or instruction by Project Representative. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."
- D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."
- E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.
- F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
- G. "Install": Unload, temporarily store, unpack, assemble, erect, place, anchor, apply, work to dimension, finish, cure, protect, clean, and similar operations at Project site.
- H. "Provide": Furnish and install, complete and ready for the intended use.
- I. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

#### **1.2 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 standards in effect as of date of the Contract Documents unless otherwise indicated.
- C. Copies of Standards: Each entity engaged in construction on Project should 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, obtain copies directly from publication source.

### **1.3 ABBREVIATIONS AND ACRONYMS**

- A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities indicated in Gale's "Encyclopedia of Associations: National Organizations of the U.S." or in Columbia Books' "National Trade & Professional Associations of the United States."
- B. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. This information is believed to be accurate as of the date of the Contract Documents.
1. DIN - Deutsches Institut für Normung e.V.; [www.din.de](http://www.din.de).
  2. IAPMO - International Association of Plumbing and Mechanical Officials; [www.iapmo.org](http://www.iapmo.org).
  3. ICC - International Code Council; [www.iccsafe.org](http://www.iccsafe.org).
  4. ICC-ES - ICC Evaluation Service, LLC; [www.icc-es.org](http://www.icc-es.org).
- C. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Information is subject to change and is up to date as of the date of the Contract Documents.
1. COE - Army Corps of Engineers; [www.usace.army.mil](http://www.usace.army.mil).
  2. CPSC - Consumer Product Safety Commission; [www.cpsc.gov](http://www.cpsc.gov).
  3. DOC - Department of Commerce; National Institute of Standards and Technology; [www.nist.gov](http://www.nist.gov).
  4. DOD - Department of Defense; [www.quicksearch.dla.mil](http://www.quicksearch.dla.mil).
  5. DOE - Department of Energy; [www.energy.gov](http://www.energy.gov).
  6. EPA - Environmental Protection Agency; [www.epa.gov](http://www.epa.gov).
  7. FAA - Federal Aviation Administration; [www.faa.gov](http://www.faa.gov).
  8. FG - Federal Government Publications; [www.gpo.gov/fdsys](http://www.gpo.gov/fdsys).
  9. GSA - General Services Administration; [www.gsa.gov](http://www.gsa.gov).
  10. HUD - Department of Housing and Urban Development; [www.hud.gov](http://www.hud.gov).
  11. LBL - Lawrence Berkeley National Laboratory; Environmental Energy Technologies Division; [www.eetd.lbl.gov](http://www.eetd.lbl.gov).
  12. OSHA - Occupational Safety & Health Administration; [www.osha.gov](http://www.osha.gov).
  13. SD - Department of State; [www.state.gov](http://www.state.gov).
  14. TRB - Transportation Research Board; National Cooperative Highway Research Program; The National Academies; [www.trb.org](http://www.trb.org).
  15. USDA - Department of Agriculture; Agriculture Research Service; U.S. Salinity Laboratory; [www.ars.usda.gov](http://www.ars.usda.gov).
  16. USDA - Department of Agriculture; Rural Utilities Service; [www.usda.gov](http://www.usda.gov).
  17. USDOJ - Department of Justice; Office of Justice Programs; National Institute of Justice; [www.ojp.usdoj.gov](http://www.ojp.usdoj.gov).
  18. USP - U.S. Pharmacopeial Convention; [www.usp.org](http://www.usp.org).
  19. USPS - United States Postal Service; [www.usps.com](http://www.usps.com).
- D. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.

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1. CFR - Code of Federal Regulations; Available from Government Printing Office; [www.gpo.gov/fdsys](http://www.gpo.gov/fdsys).
2. DOD - Department of Defense; Military Specifications and Standards; Available from DLA Document Services; [www.quicksearch.dla.mil](http://www.quicksearch.dla.mil).
3. DSCC - Defense Supply Center Columbus; (See FS).
4. FED-STD - Federal Standard; (See FS).
5. FS - Federal Specification; Available from DLA Document Services; [www.quicksearch.dla.mil](http://www.quicksearch.dla.mil).
6. Available from Defense Standardization Program; [www.dsp.dla.mil](http://www.dsp.dla.mil).
7. Available from General Services Administration; [www.gsa.gov](http://www.gsa.gov).
8. Available from National Institute of Building Sciences/Whole Building Design Guide; [www.wbdg.org](http://www.wbdg.org).
9. MILSPEC - Military Specification and Standards; (See DOD).
10. USAB - United States Access Board; [www.access-board.gov](http://www.access-board.gov).
11. USATBCB - U.S. Architectural & Transportation Barriers Compliance Board; (See USAB).

#### **PART 2 PRODUCTS (NOT USED)**

#### **PART 3 EXECUTION (NOT USED)**

**END OF SECTION 01 42 00**

## **SECTION 01 50 00 - TEMPORARY FACILITIES AND CONTROLS**

### **PART 1 GENERAL**

#### **1.1 SUMMARY**

- A. This Section includes requirements for temporary utilities, support facilities, and security and protection facilities.
- B. Related Requirements:
  - 1. Section 01 10 00 "Summary" for work restrictions and limitations on utility interruptions.

#### **1.2 USE CHARGES**

- A. General: Cost or use charges for temporary facilities shall be included in the Contract Sum. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Project Representative, Engineer, testing agencies, and authorities having jurisdiction.

#### **1.3 INFORMATIONAL SUBMITTALS**

- A. Site Utilization Plan: Show temporary facilities, temporary utility lines and connections, staging areas, construction site entrances, and parking areas for construction personnel.
- B. Project Identification and Temporary Signs: Show fabrication and installation details, including plans, elevations, details, layouts, typestyles, graphic elements, and message content.

#### **1.4 QUALITY ASSURANCE**

- A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70 and utility company, as applicable.
- B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

#### **1.5 PROJECT CONDITIONS**

- A. Temporary Use of Permanent Facilities: Installer of each permanent service shall assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

### **PART 2 PRODUCTS**

#### **2.1 TEMPORARY FACILITIES**

- A. Field Offices, General: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.

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- B. Contractor's Field Office: Of sufficient size to accommodate needs of construction personnel office activities and to accommodate Project meetings specified in other Division 01 Sections. Keep office clean and orderly. Furnish and equip offices as follows:
  - 1. Furniture required for Project-site documents including file cabinets, plan tables, plan racks, and bookcases.
  - 2. Conference room of sufficient size to accommodate meetings of 10 individuals. Provide electrical power service and 120-V ac duplex receptacles, with no fewer than one receptacle on each wall. Furnish room with conference table, chairs, and 4-foot-square tack and marker boards.
  - 3. Drinking water and private toilet.
  - 4. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 72 deg F.
  - 5. Lighting fixtures capable of maintaining average illumination of 20 fc at desk height.
- C. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.

### **2.2 EQUIPMENT**

- A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.
- B. Heating Equipment: Provide vented, self-contained, electric, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.
  - 1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
  - 2. Heating Units: Listed and labeled for type of fuel being consumed, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

## **PART 3 EXECUTION**

### **3.1 INSTALLATION, GENERAL**

- A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work and the operation of the existing facility. Relocate and modify facilities as required by progress of the Work.
- B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

### **3.2 TEMPORARY UTILITY INSTALLATION**

- A. General: Install temporary service or connect to existing service.
  - 1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.

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- B. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.
- C. Heating: Provide temporary heating required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.
- D. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.
- E. Electronic Communication Service: Provide secure WiFi wireless connection to internet with provisions for access by Project Representative, Engineer, and Owner.

### **3.3 SUPPORT FACILITIES INSTALLATION**

- A. Traffic Controls: Comply with requirements of authorities having jurisdiction.
  - 1. Protect existing site improvements to remain.
  - 2. Maintain access for fire-fighting equipment and access to fire hydrants.
- B. Parking: Provide temporary parking areas for construction personnel.
- C. Storage and Staging: Use offsite area or approved areas of Project site for storage and staging needs.
- D. Project Signs: Provide Project signs as indicated. Unauthorized signs are not permitted.
  - 1. Identification Signs: Provide Project identification signs as indicated on Drawings.
  - 2. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.
- E. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction. Comply with Division 1 Section "Execution Requirements" for progress cleaning requirements.

### **3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION**

- A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.
  - 1. Where access to adjacent properties is required in order to affect protection of existing facilities, obtain written permission from adjacent property owner to access property for that purpose.
- B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.
- C. Temporary Erosion and Sedimentation Control: Provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to adjacent properties and walkways, according to requirements of EPA Construction General Permit or authorities having ju-

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jurisdiction, whichever is more stringent. Comply with Division 1 Section "Temporary Storm Water Pollution Control."

- D. Stormwater Control: Comply with authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains. Comply with Division 1 Section "Temporary Storm Water Pollution Control."
- E. Tree and Plant Protection: Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from damage from construction operations. Protect tree root systems from damage, flooding, and erosion.
- F. Site Enclosure Fence: Before construction operations begin, furnish and install site enclosure fence in a manner that will prevent people and animals from easily entering site except by entrance gates.
  - 1. Extent of Fence: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations.
  - 2. Maintain security by limiting number of keys and restricting distribution to authorized personnel. Provide Owner with one set of keys.
- G. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.
- H. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities.
- I. Comply with all requirements of the Construction Safety and Phasing Plan (CSPP).

### **3.5 OPERATION, TERMINATION, AND REMOVAL**

- A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.
- B. Maintenance: Maintain facilities in good operating condition until removal.
  - 1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
- C. Termination and Removal: Remove each temporary facility when need for its service has ended or no later than Final Inspection. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
  - 1. Materials and facilities that constitute temporary facilities are property of Contractor.

**END OF SECTION 01 50 00**



## **SECTION 01 57 23 – TEMPORARY STORMWATER POLLUTION CONTROLS**

### **PART 1 GENERAL**

#### **1.1 SUMMARY**

- A. This Section requires the Contractor to plan, provide, inspect, and maintain control of erosion, sedimentation, and discharge of pollutants according to this section and applicable local, state, and federal requirements including the APDES Construction General Permit.

#### **1.2 DEFINITIONS**

- A. Alaska Certified Erosion and Sediment Control Lead (AK-CESCL). A person who has completed training, testing, and other requirements of, and is currently certified as, an AK-CESCL from an AK-CESCL Training Program. AK-CESCLs are recognized as “qualified personnel” as required by the CGP. An AK-CESCL must be recertified every three years.
- B. Alaska Department of Environmental Conservation (DEC). The state agency authorized by EPA to administer the Clean Water Act’s National Pollutant Discharge Elimination System.
- C. Alaska Pollutant Discharge Elimination (APDES). A system administered by DEC that issues and tracks permits for stormwater discharges.
- D. Best Management Practices (BMP). A wide range of project management practices, schedules, activities, or prohibition of practices, that when used alone or in combination, prevent or reduce erosion, sedimentation, and/or pollution of adjacent water bodies and wetlands. BMPs include temporary or permanent structural and non-structural devices and practices. Common BMP's are described in DOT&PF’s Alaska Storm Water Pollution Prevention Plan Guide, latest edition.
- E. Construction General Permit (CGP). The permit authorizing stormwater discharges from Construction Activities, issued and enforced by DEC. It authorizes stormwater discharges provided permit conditions and water quality standards are met.
- F. Construction Activity. Physical activity by the Contractor, Subcontractor or utility company; that may result in erosion, sedimentation, or a discharge of pollutants into stormwater. Construction Activity includes soil disturbing activities (e.g. clearing, grubbing, grading, excavating); and establishment of construction materials or equipment storage or maintenance areas (e.g. material piles, borrow area, concrete truck chute washdown, fueling); and industrial activities that may discharge stormwater and are directly related to the construction process (e.g. concrete or asphalt batch plants).
- G. Final Stabilization is defined in this section as it is defined in the CGP.
- H. Hazardous Material Control Plan. The Contractor's detailed project specific plan for prevention of pollution from storage, use, transfer, containment, cleanup, and disposal of hazardous material (including, but are not limited to, petroleum products related to construction activities and equipment). The HMCP is included as an appendix to the SWPPP.
- I. Inspection. An inspection required by the CGP or the SWPPP, performed by the Contractor's qualified personnel.
- J. Notice of Intent (NOI). The electronic Notice of Intent submitted to DEC, to obtain coverage under the CGP.

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- K. Notice of Termination (NOT). The electronic Notice of Termination submitted to DEC, to end coverage under the CGP.
- L. Project Zone. The physical area provided by the Owner for Construction. The Project Zone includes the area of highway, site, or facility under construction, project staging and equipment areas, and material and disposal sites; when those areas, routes and sites, are provided by the Contract. Material sites, material processing sites, disposal sites, haul routes, staging and equipment storage areas; that are furnished by the Contractor or a commercial operator, are not included in the Project Zone.
- M. Spill Prevention, Control, and Countermeasure Plan (SPCC PLAN). The Contractor's detailed plan for petroleum spill prevention and control measures that meet the requirements of 40 CFR 112.
- N. Storm Event. A rainfall event that produces 0.5 inch or more of precipitation in 24 hours and that is separated from the previous storm event by at least 3 days of less than 0.1 inch of rain per day.
- O. Storm Water Pollution Prevention Plan (SWPPP). The Contractor's detailed project specific plan to minimize erosion and contain sediment within the Project Zone, and to prevent discharge of pollutants that exceed applicable water quality standards. The SWPPP includes, but is not limited to, amendments, records of activities, inspection schedules and reports, qualifications of key personnel, and all other documentation, required by the CGP and this specification, and other applicable local, state, and federal laws and regulations.
- P. SWPPP Amendment. A revision or document that adds to, deletes from, or modifies the SWPPP.
- Q. Temporary Stabilization. Protecting soils from erosion and sediment loss by rainfall, snow melt, runoff, or wind with a temporary vegetative and/or non-vegetative protection cover. Temporary stabilization may include a combination of seeding, geotextiles, mulches, surface tackifiers, rolled erosion control products, non-erodible gravel or paving, or the mentioned BMP's combined together with trackwalking.

### **1.3 SUBMITTALS**

- A. Submit the SWPPP to the Project Representative for approval.
- B. When required by the CGP, submit the SWPPP to DEC for approval.
- C. After the SWPPP is approved by the Project Representative and, if required, DEC, it shall be signed by an authorized representative according to the GCP, and an NOI submitted to DEC with the required fee. NOIs can be submitted by Certified mail or through DEC's electronic NOI system (eNOI).

For regular U.S. Mail delivery:

Alaska Dept. of Environmental Conservation  
Wastewater Discharge Authorization Program  
555 Cordova Street  
Anchorage, AK 99501

For electronic mail, the Contractor must register online with DEC thru the DEC Water Online Application System (OASys) at: <https://my.alaska.gov/>. This website has instructions and guidance on how to set up and use the eNOI system.

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- Provide a copy of the signed NOI and DEC's written acknowledgement to the Project Representative.
- D. The Owner will submit an NOI to DEC for Construction Activities inside the Project Zone. The Project Representative will provide the Contractor with a copy of the Owner's NOI and DEC's written acknowledgment for inclusion in the SWPPP.
  - E. Submit a copy of approved SWPPP and NOI to the Project Representative at least 24 hours before ground-disturbing activities. The Project Representative will issue a written statement when all documents have been provided. Do not begin Construction Activity until the Project Representative has issued this written statement. The active status NOI and approved SWPPP, become the basis of the work required for the project's erosion, sediment, and pollution control.
  - F. Once the Project Representative has determined the site has achieved Final Stabilization, the Project Representative will provide written notification that the NOT may be submitted to DEC. Provide a copy of the NOT and DEC's acknowledgement to the Project Representative. The Owner will also file a NOT and provide a copy to the Contractor.

## **PART 2 PRODUCTS**

### **2.1 STORM WATER POLLUTION PREVENTION PLAN (SWPPP)**

- A. Prepare a Storm Water Pollution Prevention Plan based on scheduling, equipment, and use of alternative BMPs. Follow the format presented in the Alaska Storm Water Pollution Prevention Plan Guide, latest edition. The plan must consider first preventing erosion, then minimizing erosion, and finally trapping sediment before it enters waterways. Include information required by the Contract and described in the CGP.
- B. The SWPPP Preparer must meet at least one of the following qualifications:
  - 1. Current certification as a Certified Professional in Erosion and Sediment Control (CPESC);
  - 2. Current certification as AK-CESCL, and at least two years' experience in erosion and sediment control. Provide documentation including project names, project timelines, and work responsibilities demonstrating the experience requirement; or
  - 3. Professional Engineer registered in the State of Alaska with current certification as AK-CESCL.
- C. For Projects disturbing more than 20 acres, the SWPPP Preparer must also have completed a SWPPP Preparation course.
- D. The plan must address site-specific controls and management plan for the construction site as well as for all material sites, waste disposal sites, haul roads, and other affected areas, public or private. The plan must also incorporate all the requirements of the project permits.
- E. Specify the line of authority and designate a field representative for implementing SWPPP compliance. Designate one representative for each subcontractor who performs earth-disturbing activities or who install and maintain erosion and sediment control measures.
- F. Materials. Use materials suitable to withstand hydraulic, wind, and soil forces, and to control erosion and trap sediments according to the requirements of the CGP and the Specifications. Use the temporary seed mixture specified by special provision, or use annual rye grass if no

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temporary seed mix is specified. Use straw that is certified as free of noxious weed by the United States Department of Agriculture, Natural Resources Conservation Service, Local Soil and Water Conservative District. Alaska Weed Free Forage Certification Program must be used when available. Hay may not be substituted for straw.

### **PART 3 EXECUTION**

#### **3.1 CONSTRUCTION REQUIREMENTS**

- A. Do not begin Construction Activities until the Project Representative provides a written statement that Construction Activities can begin.
- B. Post at the construction site:
  - 1. Copy of all NOIs,
  - 2. Name and phone number of Contractor's local contact person, and
  - 3. Location of a SWPPP available for viewing by the public.
- C. Comply with all requirements of the CGP and the Kenai Airport Multi-Sector General Permit (MSGP), implement all temporary and permanent erosion and sediment control measures identified in the SWPPP, and ensure that the SWPPP remains current. Maintain all temporary and permanent erosion and sediment control measures in effective operating condition.
- D. Delineate the site for both land disturbing activities and areas that will be left undisturbed. Install sediment controls and other BMPs that must be placed prior to the initiation of Construction Activity.
- E. Implement BMP maintenance as required by the CGP, SWPPP, and manufacturer's specifications, whichever is more restrictive.
- F. Stabilization may be accomplished using temporary or permanent measures. Initiate stabilization of disturbed soils, erodible stockpiles, disposal sites, and of erodible aggregate layers in compliance with CGP requirements.
- G. Perform inspections and prepare inspection reports in compliance with the project SWPPP and the CGP. Conduct Inspections of the areas required by the SWPPP and CGP.
  - 1. Preconstruction Inspection. Prior to start of construction, conduct a joint on-site inspection with the Project Representative and the Contractor's field representative to discuss the implementation of the SWPPP.
  - 2. Regular Inspection. Conduct Inspections according to the schedule and requirements of the SWPPP and CGP. Inspections required by the SWPPP and CGP must be performed jointly by the Contractor and the Project Representative unless approved by the Project Representative.
  - 3. Inspection before Seasonal Suspension of Work. Conduct an Inspection before seasonal suspension of work to confirm BMPs are installed and functioning according to the requirements of the SWPPP and CGP.
  - 4. Reduced Inspection Frequencies. Conduct Inspections according to the inspection schedule indicated in the approved SWPPP. Any change in inspection frequency must be approved by the Project Representative, and beginning and ending dates documented as an amendment to the SWPPP. If the Project Representative ap-

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proves and the entire site is stabilized, the frequency of inspections may be reduced to at least one inspection every 30 days. At actively staffed sites, inspect within two business days of the end of a storm event that results in a discharge from the site.

When work is suspended due to fall freeze-up, the Project Representative may suspend inspection requirements after fourteen days of freezing conditions if:

- a. Soil disturbing activities are suspended; and
- b. Soil stabilizing activities are suspended.

Inspections must resume according to the normal inspection schedule identified in the SWPPP, at least 21 days before anticipated spring thaw. See CGP Part 6.2.3.

- 5. Inspection before Project Completion. Conduct Inspection to ensure Final Stabilization is complete throughout the Project, and temporary BMPs that are required to be removed are removed. Temporary BMPs that are biodegradable and are specifically designed and installed with the intent of remaining in place until they degrade, may remain in place after project completion.
- 6. Inspection Reports. Prepare and submit, within three working days of each inspection, a report on DOT&PF Form 25D-100, with the following information:
  - a. A summary of the scope of the inspection.
  - b. Name(s) of personnel making the inspection.
  - c. The date of the inspection.
  - d. Observations relating to the implementation of the SWPPP.
  - e. Any actions taken as the result of the inspection.
  - f. Incidents of non-compliance.

Where a report does not identify any incidents of non-compliance, certify that the facility is in compliance with the SWPPP and CGP. Contractor and the Project Representative will sign the report according to the CGP. Include all reports as an appendix to the SWPPP.

- H. Retain copies of the SWPPP and all other records required by the CGP, for at least three years from the date of final stabilization.
- I. If unanticipated or emergency conditions threaten water quality, take immediate suitable action to preclude erosion and pollution.
- J. Submit amendments to the SWPPP when there is a revision or document that adds to, deletes from, or modifies the SWPPP. Amendments must occur:
  - 1. Whenever there is a change in design, construction operation, or maintenance at the construction site that has or could cause erosion, sedimentation or the discharge of pollutants that has not been previously addressed in the SWPPP;

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2. If an Inspection identifies that any portion of the SWPPP is ineffective in preventing erosion, sedimentation, or the discharge of pollutants;
3. Whenever an Inspection identifies a problem that requires additional or modified BMPs
4. Whenever a BMP is modified during construction, or a BMP not shown in the original SWPPP is added;
5. If the Inspection frequency is modified (note beginning and ending dates); or
6. When there is a change in personnel who are named in the SWPPP.

Submit SWPPP amendments to the Project Representative within seven days following the identification of the need for an amendment. SWPPP Amendments must be approved by the Project Representative.

Maintain a SWPPP Amendment Log as an appendix to the SWPPP.

- K. Stabilize all areas disturbed after the seeding deadline within seven days of the temporary or permanent cessation of ground-disturbing activities.
- L. Submit a signed NOT to DEC and a copy to the Project Representative:
  1. When the Project Representative has acknowledged in writing that the project site (including all material sources, disposal sites, etc.) has achieved final stabilization in accordance with the CGP and all storm water discharges from construction activities authorized by this permit have ceased, or
  2. When the construction activity operator (as defined in the CGP) has changed and the Project Representative provides written notification that Contractor's responsibilities with respect to compliance with the CGP on the project have ceased.
- M. If Contractor fails to coordinate temporary or permanent stabilization measures with the earthwork operations in a manner to effectively control erosion and prevent water pollution, the Project Representative may suspend earthwork operations and withhold monies due on current estimates for such earthwork items until all aspects of the work are coordinated in a satisfactory manner.
- N. If Contractor fails to pursue work required by the approved SWPPP, respond to inspection recommendations and/or deficiencies in the SWPPP, or implement erosion and sedimentation controls identified by the Project Representative, the Project Representative may, after giving written notice, proceed to perform such work and deduct the cost thereof, including project engineering costs, from your progress payments.

**END OF SECTION 01 57 23**

## **SECTION 01 60 00 - PRODUCT REQUIREMENTS**

### **PART 1 GENERAL**

#### **1.1 SUMMARY**

- A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.
- B. Related Requirements:
  - 1. Section 01 25 00 - Substitution Procedures
  - 2. Section 01 33 00 – Submittal Procedures

#### **1.2 DEFINITIONS**

- A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
  - 1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.
  - 2. New Products: Items that have not previously been incorporated into another project or facility. Salvaged items or items reused from other projects are not considered new products. Items that are manufactured or fabricated to include recycled content materials are considered new products, unless indicated otherwise.
  - 3. Comparable Product: Product by named manufacturer that is demonstrated and approved through the comparable product submittal process described in Part 2 "Comparable Products" Article, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.
- B. Basis-of-Design Product Specification: A specification in which a single manufacturer's product is named including make or model number or other designation. Published attributes and characteristics of basis-of-design product establish salient characteristics of products.
  - 1. Evaluation of Comparable Products: In addition to the basis-of-design product description, product attributes and characteristics may be listed to establish the significant qualities related to type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other special features and requirements for purposes of evaluating comparable products of additional manufacturers named in the specification. Manufacturer's published attributes and characteristics of basis-of-design product also establish salient characteristics of products for purposes of evaluating comparable products.

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- C. Subject to Compliance with Requirements: Where the phrase "Subject to compliance with requirements" introduces a product selection procedure in an individual Specification Section, provide products qualified under the specified product procedure. In the event that a named product or product by a named manufacturer does not meet the other requirements of the specifications, select another named product or product from another named manufacturer that does meet the requirements of the specifications; submit a comparable product request or substitution request, if applicable.
- D. Comparable Product Request Submittal: An action submittal requesting consideration of a comparable product, including the following information:
  - 1. Identification of basis-of-design product or fabrication or installation method to be replaced, including Specification Section number and title and Drawing numbers and titles.
  - 2. Data indicating compliance with the requirements specified in Part 2 "Comparable Products" Article.
- E. Basis-of-Design Product Specification Submittal: An action submittal complying with requirements in Section 01 33 00 "Submittal Procedures."
- F. Substitution: Refer to Section 01 25 00 "Substitution Procedures" for definition and limitations on substitutions.

### **1.3 QUALITY ASSURANCE**

- A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.

### **1.4 PRODUCT DELIVERY, STORAGE, AND HANDLING**

- A. Deliver, store, and handle products, using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.

### **1.5 PRODUCT WARRANTIES**

- A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
  - 1. Manufacturer's Warranty: Written standard warranty form furnished by individual manufacturer for a particular product and issued in the name of the Owner or endorsed by manufacturer to Owner.
  - 2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner and issued in the name of the Owner or endorsed by manufacturer to Owner.
- B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.



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1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
2. Specified Form: When specified forms are included in the Project Manual, prepare a written document, using indicated form properly executed.
3. See other Sections for specific content requirements and particular requirements for submitting special warranties.

## **PART 2 PRODUCTS**

### **2.1 PRODUCT SELECTION PROCEDURES**

- A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.
  1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
  2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
  3. Owner reserves the right to limit selection to products with warranties meeting requirements of the Contract Documents.
  4. Where products are accompanied by the term "as selected," Architect will make selection.
  5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
- B. Product Selection Procedures:
  1. Sole Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
    - a. Sole product may be indicated by the phrase "Subject to compliance with requirements, provide the following."
  2. Sole Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
    - a. Sole manufacturer/source may be indicated by the phrase "Subject to compliance with requirements, provide products by the following."
  3. Limited List of Products: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will be considered unless otherwise indicated.

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- a. Limited list of products may be indicated by the phrase "Subject to compliance with requirements, provide one of the following."
4. Non-Limited List of Products: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed or an unnamed product that complies with requirements.
  - a. Non-limited list of products is indicated by the phrase "Subject to compliance with requirements, available products that may be incorporated in the Work include, but are not limited to, the following."
  - b. Provision of an unnamed product is not considered a substitution, if the product complies with requirements.
5. Limited List of Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will be considered unless otherwise indicated.
  - a. Limited list of manufacturers is indicated by the phrase "Subject to compliance with requirements, provide products by one of the following."
6. Non-Limited List of Manufacturers: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed or a product by an unnamed manufacturer that complies with requirements.
  - a. Non-limited list of manufacturers is indicated by the phrase "Subject to compliance with requirements, available manufacturers whose products may be incorporated in the Work include, but are not limited to, the following."
  - b. Provision of products of an unnamed manufacturer is not considered a substitution, if the product complies with requirements.
7. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications may additionally indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.
  - a. For approval of products by unnamed manufacturers, comply with requirements in Section 012500 "Substitution Procedures" for substitutions for convenience.

### **C. Buy America:**

1. Comply with Buy America requirements of the Contract.

## **2.2 COMPARABLE PRODUCTS**

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- A. Conditions for Consideration of Comparable Products: Project Representative will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Project Representative may return requests without action, except to record noncompliance with the following requirements:
  - 1. Evidence that proposed product does not require revisions to the Contract Documents, is consistent with the Contract Documents, will produce the indicated results, and is compatible with other portions of the Work.
  - 2. Detailed comparison of significant qualities of proposed product with those of the named basis-of-design product. Significant product qualities include attributes, such as type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other specific features and requirements.
  - 3. Evidence that proposed product provides specified warranty.
  - 4. List of similar installations for completed projects, with project names and addresses and names and addresses of architects and owners, if requested.
  - 5. Samples, if requested.
- B. Project Representative's Action on Comparable Products Submittal: If necessary, Project Representative will request additional information or documentation for evaluation, as specified in Section 013300 "Submittal Procedures."
  - 1. Form of Approval of Submittal: As specified in Section 013300 "Submittal Procedures."
  - 2. Use product specified if Project Representative does not issue a decision on use of a comparable product request within time allocated.
- C. Submittal Requirements, Single-Step Process: When acceptable to Project Representative, incorporate specified submittal requirements of individual Specification Section in combined submittal for comparable products. Approval by the Project Representative of Contractor's request for use of comparable product and of individual submittal requirements will also satisfy other submittal requirements.

### **PART 3 EXECUTION (NOT USED)**

### **END OF SECTION 01 60 00**

## **SECTION 01 73 00 - EXECUTION**

### **PART 1 GENERAL**

#### **1.1 SUMMARY**

- A. Section includes general administrative and procedural requirements governing execution of the Work, including, but not limited to, the following:
  - 1. Construction layout.
  - 2. Field engineering and surveying.
  - 3. Installation of the Work.
  - 4. Progress cleaning.
  - 5. Starting and adjusting.
  - 6. Protection of installed construction.
- B. Related Requirements:
  - 1. Section 01 10 00 – Summary
  - 2. Section 01 40 00 – Quality Requirements
  - 3. Section 01 77 00 - Closeout Procedures

#### **1.2 QUALITY ASSURANCE**

- A. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of specified products and equipment.

### **PART 2 PRODUCTS**

#### **2.1 MATERIALS**

- A. Comply with requirements specified in other Sections.
- B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
  - 1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Engineer for the visual and functional performance of in-place materials. Use materials that are not considered hazardous.
- C. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

**PART 3 EXECUTION**

**3.1 EXAMINATION**

- A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities and other construction affecting the Work.
  - 1. Before construction, verify the location and invert elevation at points of connection of gas service piping, water-service piping, underground electrical services, roof drain leaders, and other utilities.
  - 2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.
- B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
  - 1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
  - 2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
  - 3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
- C. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

**3.2 PREPARATION**

- A. Existing Utility Information: Furnish information to local utility that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.
- B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents, submit a request for information to Project Representative in accordance with requirements in Section 01 31 00 "Project Management and Coordination."

### **3.3 CONSTRUCTION LAYOUT**

- A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks and existing conditions. If discrepancies are discovered, notify Project Representative promptly.
- B. Engage a land surveyor experienced in laying out the Work, using the following accepted surveying practices:
  - 1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
  - 2. Establish limits on use of Project site.
  - 3. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
  - 4. Inform installers of lines and levels to which they must comply.
  - 5. Check the location, level and plumb, of every major element as the Work progresses.
  - 6. Notify Project Representative when deviations from required lines and levels exceed allowable tolerances.
  - 7. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.
- C. Site Improvements: Locate and lay out site improvements, including clearing limits, pavements, grading, fill and topsoil placement, and water service and other underground piping, including alignment, slopes, and rim and invert elevations.
- D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.
- E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Project Representative

### **3.4 FIELD ENGINEERING**

- A. Identification: Engineer has identified existing benchmarks, control points, and property corners on the Drawings.
- B. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.

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1. Do not change or relocate existing benchmarks or control points without prior written approval of Project Representative. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Project Representative before proceeding.
2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.

### **3.5 INSTALLATION**

- A. Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
  1. Make vertical work plumb, and make horizontal work level.
  2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
  3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
- B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
- C. Install products at the time and under conditions that will ensure satisfactory results as judged by Engineer. Maintain conditions required for product performance until Substantial Completion.
- D. Conduct construction operations, so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy of type expected for Project.
- E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on-site and placement in permanent locations.
- F. Tools and Equipment: Select tools or equipment that minimize production of excessive noise levels.
- G. Templates: Obtain and distribute to the parties involved templates for Work specified to be factory prepared and field installed. Check Shop Drawings of other portions of the Work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.
- H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions with manufacturer.
  1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Project Representative.
  2. Allow for building movement, including thermal expansion and contraction.

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3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- I. Joints: Make joints of uniform width. Where joint locations in exposed Work are not indicated, arrange joints for the best visual effect, as judged by Project Representative. Fit exposed connections together to form hairline joints.
- J. Repair or remove and replace damaged, defective, or nonconforming Work.
  1. Comply with Section 01 77 00 "Closeout Procedures" for repairing or removing and replacing defective Work.

### **3.6 PROGRESS CLEANING**

- A. Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.
  1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
  2. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
    - a. Use containers intended for holding waste materials of type to be stored.
- B. Site: Maintain Project site free of waste materials and debris.
- C. Work Areas: Clean areas where Work is in progress to the level of cleanliness necessary for proper execution of the Work.
  1. Remove liquid spills promptly.
  2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.
- D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.
- E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.
- F. Exposed Surfaces: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
- G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways.
- H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.



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- I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
- J. Limiting Exposures: Supervise construction operations to ensure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

### **3.7 STARTING AND ADJUSTING**

- A. Coordinate startup and adjusting of equipment and operating components with requirements in Section 019113 "General Commissioning Requirements."
- B. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
- C. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.
- D. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- E. Manufacturer's Field Service: Comply with qualification requirements in Section 014000 "Quality Requirements."

### **3.8 PROTECTION AND REPAIR OF INSTALLED CONSTRUCTION**

- A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.
- B. Repair Work previously completed and subsequently damaged during construction period. Repair to like-new condition.
- C. Protection of Existing Items: Provide protection and ensure that existing items to remain undisturbed by construction are maintained in condition that existed at commencement of the Work.
- D. Comply with manufacturer's written instructions for temperature and relative humidity.

**END OF SECTION 01 73 00**

## **SECTION 01 77 00 - CLOSEOUT PROCEDURES**

### **PART 1 GENERAL**

#### **1.1 SUMMARY**

- A. Section includes administrative and procedural requirements for Contract closeout, including, but not limited to, the following:
  - 1. Substantial Completion procedures.
  - 2. Final completion procedures.
  - 3. Warranties.
  - 4. Final cleaning.
- B. Related Requirements:
  - 1. Section 01 78 23 - Operation and Maintenance Data
  - 2. Section 01 78 39 - Project Record Documents
  - 3. Section 01 79 00 - Demonstration and Training

#### **1.2 SUBSTANTIAL COMPLETION PROCEDURES**

- A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's "punch list"), indicating the value of each item on the list and reasons why the Work is incomplete.
- B. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
  - 1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction, permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
  - 2. Submit closeout submittals specified in other Division 01 Sections, including Project Record Documents, operation and maintenance manuals, damage or settlement surveys, property surveys, and similar final record information.
  - 3. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
  - 4. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Project Representative. Label with manufacturer's name and model number.
  - 5. Submit testing, adjusting, and balancing records.

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- C. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
1. Advise Owner of pending insurance changeover requirements.
  2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
  3. Complete startup and testing of systems and equipment.
  4. Perform preventive maintenance on equipment used prior to Substantial Completion.
  5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Section 017900 "Demonstration and Training."
  6. Advise Owner of changeover in utility services.
  7. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
  8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
  9. Complete final cleaning requirements.
  10. Touch up paint and otherwise repair and restore marred exposed finishes to eliminate visual defects.
- D. Inspection: Submit a written request for inspection for Substantial Completion at least 10 days prior to date the Work will be completed and ready for inspection. On receipt of request, Project Representative will either proceed with inspection or notify Contractor of unfulfilled requirements. Project Representative will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Engineer, that must be completed or corrected before certificate will be issued.
1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
  2. Results of completed inspection will form the basis of requirements for Final Completion.

### **1.3 FINAL COMPLETION PROCEDURES**

- A. Submittals Prior to Final Completion: Before requesting final inspection for determining Final Completion, complete the following:
1. Submit a final Application for Payment in accordance with Section 01 29 00 "Payment Procedures."
  2. Submit certified copy of Engineer's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Engineer. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.

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3. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
  4. Submit final Certified Payroll Reports.
  5. Submit final DBE Utilization.
- B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 days prior to date the Work will be completed and ready for final inspection and tests. On receipt of request, Engineer will either proceed with inspection or notify Contractor of unfulfilled requirements. Engineer will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.
1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

### **1.4 LIST OF INCOMPLETE ITEMS (PUNCH LIST)**

- A. Preparation: Submit three copies of list. Include name and identification of each area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.
1. Organize list of area in sequential order, starting with exterior first.
  2. Organize items applying to each area by major element.

### **1.5 SUBMITTAL OF PROJECT WARRANTIES**

- A. Time of Submittal: Submit written warranties on request of Project Representative for designated portions of the Work where warranties are indicated to commence on dates other than date of Substantial Completion, or when delay in submittal of warranties might limit Owner's rights under warranty.
- B. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.
- C. Warranty Electronic File: Provide warranties and bonds in PDF format. Assemble complete warranty and bond submittal package into a single electronic PDF file with bookmarks enabling navigation to each item. Provide bookmarked table of contents at beginning of document.
1. Submit by email to Project Representative.
- D. Provide additional copies of each warranty to include in operation and maintenance manuals.

## **PART 2 PRODUCTS (NOT USED)**

## **PART 3 EXECUTION**

### **3.1 FINAL CLEANING**

- A. Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

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1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:
2. Clean Project site of rubbish, waste material, litter, and other foreign substances.
3. Remove debris and surface dust from limited-access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
4. Sweep concrete.
5. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
6. Remove labels that are not permanent.
7. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
8. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
9. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
10. Clean strainers.
11. Leave Project clean and ready for occupancy.

### **3.2 REPAIR OF THE WORK**

- A. Complete repair and restoration operations required by Section 017300 "Execution" before requesting inspection for determination of Substantial Completion.

**END OF SECTION 01 77 00**

## **SECTION 01 78 23 - OPERATION AND MAINTENANCE DATA**

### **PART 1 GENERAL**

#### **1.1 SUMMARY**

- A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
  - 1. Operation and maintenance documentation directory manuals.
  - 2. Emergency manuals.
  - 3. Systems and equipment operation manuals.
  - 4. Systems and equipment maintenance manuals.
  - 5. Product maintenance manuals.

#### **1.2 CLOSEOUT SUBMITTALS**

- A. Submit operation and maintenance manuals indicated. Provide content for each manual as specified in individual Specification Sections, and as reviewed and approved at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
  - 1. Project Representative will comment on whether content of operation and maintenance submittals is acceptable.
  - 2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.
- B. Format: Submit operation and maintenance manuals in the following format:
  - 1. Submit on digital media acceptable to Project Representative. Enable reviewer comments on draft submittals.
  - 2. Submit two paper copies.
- C. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Project Representative will return copy with comments.
  - 1. Correct or revise each manual to comply with Project Representative's comments. Submit copies of each corrected manual within 15 days of receipt of Project Representative's comments and prior to commencing demonstration and training.
- D. Comply with Section 01 77 00 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

#### **1.3 FORMAT OF OPERATION AND MAINTENANCE MANUALS**

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- A. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.
  - 1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
  - 2. File Names and Bookmarks: Bookmark individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.
- B. Manuals, Paper Copy: Submit manuals in the form of hard-copy, bound and labeled volumes.
  - 1. Binders: Heavy-duty, three-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
  - 2. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
    - a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
    - b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

#### **1.4 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS**

- A. Organization of Manuals: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
  - 1. Title page.
  - 2. Table of contents.
  - 3. Manual contents.
- B. Title Page: Include the following information:
  - 1. Subject matter included in manual.
  - 2. Name and address of Project.
  - 3. Name and address of Owner.
  - 4. Date of submittal.

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5. Name and contact information for Contractor.
  6. Name and contact information for Project Representative.
  7. Name and contact information for Engineer.
  8. Names and contact information for major consultants to the Engineer that designed the systems contained in the manuals.
  9. Cross-reference to related systems in other operation and maintenance manuals.
- C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.
- D. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

#### **1.5 EMERGENCY MANUALS**

- A. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.
- B. Content: Organize manual into a separate section for each of the following.
- C. Type of emergency.
1. Emergency instructions.
  2. Emergency procedures.
  3. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:
  4. Fire.
  5. Flood.
  6. Gas leak.
  7. Water leak.
  8. Power failure.
  9. Water outage.
  10. System, subsystem, or equipment failure.
  11. Chemical release or spill.



- D. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.
- E. Emergency Procedures: Include the following, as applicable:
  - 1. Instructions on stopping.
  - 2. Shutdown instructions for each type of emergency.
  - 3. Operating instructions for conditions outside normal operating limits.
  - 4. Required sequences for electric or electronic systems.
  - 5. Special operating instructions and procedures.

## **1.6 SYSTEMS AND EQUIPMENT OPERATION MANUALS**

- A. Systems and Equipment Operation Manual: Assemble a complete set of data indicating operation of each system, subsystem, and piece of equipment not part of a system. Include information required for daily operation and management, operating standards, and routine and special operating procedures.
- B. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
  - 1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
  - 2. Performance and design criteria if Contractor has delegated design responsibility.
  - 3. Operating standards.
  - 4. Operating procedures.
  - 5. Operating logs.
  - 6. Wiring diagrams.
  - 7. Control diagrams.
  - 8. Piped system diagrams.
  - 9. Precautions against improper use.
  - 10. License requirements including inspection and renewal dates.
- C. Descriptions: Include the following:
  - 1. Product name and model number.
  - 2. Manufacturer's name.
  - 3. Equipment identification with serial number of each component.

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4. Equipment function.
  5. Operating characteristics.
  6. Limiting conditions.
  7. Performance curves.
  8. Engineering data and tests.
  9. Complete nomenclature and number of replacement parts.
- D. Operating Procedures: Include the following, as applicable:
1. Startup procedures.
  2. Equipment or system break-in procedures.
  3. Routine and normal operating instructions.
  4. Regulation and control procedures.
  5. Instructions on stopping.
  6. Normal shutdown instructions.
  7. Seasonal and weekend operating instructions.
  8. Required sequences for electric or electronic systems.
  9. Special operating instructions and procedures.
- E. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.
- F. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

#### **1.7 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS**

- A. Systems and Equipment Maintenance Manuals: Assemble a complete set of data indicating maintenance of each system, subsystem, and piece of equipment not part of a system. Include manufacturers' maintenance documentation, preventive maintenance procedures and frequency, repair procedures, wiring and systems diagrams, lists of spare parts, and warranty information.
- B. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranties and bonds, as described below.
- C. Manufacturers' Maintenance Documentation: Include the following information for each component part or piece of equipment:
1. Standard maintenance instructions and bulletins; include only sheets pertinent to product or component installed. Mark each sheet to identify each product or compo-

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nent incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.

- a. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.
  2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
  3. Identification and nomenclature of parts and components.
  4. List of items recommended to be stocked as spare parts.
- D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
1. Test and inspection instructions.
  2. Troubleshooting guide.
  3. Precautions against improper maintenance.
  4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
  5. Aligning, adjusting, and checking instructions.
  6. Demonstration and training video recording, if available.
- E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
- F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.
- G. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
1. Include procedures to follow and required notifications for warranty claims.
- H. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.

## **1.8 PRODUCT MAINTENANCE MANUAL**

- A. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

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- B. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.
- C. Product Information: Include the following, as applicable:
  - 1. Product name and model number.
  - 2. Manufacturer's name.
  - 3. Color, pattern, and texture.
  - 4. Material and chemical composition.
  - 5. Reordering information for specially manufactured products.
- D. Maintenance Procedures: Include manufacturer's written recommendations and the following:
  - 1. Inspection procedures.
  - 2. Types of cleaning agents to be used and methods of cleaning.
  - 3. List of cleaning agents and methods of cleaning detrimental to product.
  - 4. Schedule for routine cleaning and maintenance.
  - 5. Repair instructions.
- E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.
- F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
  - 1. Include procedures to follow and required notifications for warranty claims.

### **PART 2 PRODUCTS (NOT USED)**

### **PART 3 EXECUTION (NOT USED)**

### **END OF SECTION 01 78 23**

## **SECTION 01 78 39 - PROJECT RECORD DOCUMENTS**

### **PART 1 GENERAL**

#### **1.1 SUMMARY**

- A. Section includes administrative and procedural requirements for Project Record Documents, including the following:
  - 1. Record Drawings.
  - 2. Record specifications.
  - 3. Record Product Data.
- B. Related Requirements:
  - 1. Section 01 78 23 - Operation and Maintenance Data

#### **1.2 CLOSEOUT SUBMITTALS**

- A. Record Drawings: Comply with the following:
  - 1. Number of Copies: Submit one set of full-size marked-up record prints.
- B. Miscellaneous Record Submittals: Submit one electronic copy in PDF format.

#### **1.3 RECORD DRAWINGS**

- A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.
  - 1. Preparation: Mark record prints to show the actual installation, where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.
    - a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
    - b. Accurately record information in an acceptable drawing technique.
    - c. Record data as soon as possible after obtaining it.
    - d. Record and check the markup before enclosing concealed installations.
    - e. Cross-reference record prints to corresponding photographic documentation.
  - 2. Content: Types of items requiring marking include, but are not limited to, the following:
    - a. Dimensional changes to Drawings.

- b. Revisions to details shown on Drawings.
  - c. Depths of foundations.
  - d. Locations and depths of underground utilities.
  - e. Revisions to routing of piping and conduits.
  - f. Revisions to electrical circuitry.
  - g. Actual equipment locations.
  - h. Duct size and routing.
  - i. Locations of concealed internal utilities.
  - j. Changes made by Change Order or Work Change Directive.
  - k. Changes made following Project Representative's written orders.
  - l. Details not on the original Contract Drawings.
  - m. Field records for variable and concealed conditions.
  - n. Record information on the Work that is shown only schematically.
- 3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
  - 4. Mark record prints with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
  - 5. Mark important additional information that was either shown schematically or omitted from original Drawings.
  - 6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

#### **1.4 MISCELLANEOUS RECORD SUBMITTALS**

- A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference. Examples of miscellaneous records include:
  - 1. Test reports,
  - 2. Inspections by authorities having jurisdiction.

#### **1.5 MAINTENANCE OF RECORD DOCUMENTS**

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- A. Maintenance of Record Documents: Store Record Documents in the field office apart from the Contract Documents used for construction. Do not use Project Record Documents for construction purposes. Maintain Record Documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to Project Record Documents for Engineer's reference during normal working hours.

**PART 2 PRODUCTS (NOT USED)**

**PART 3 EXECUTION (NOT USED)**

**END OF SECTION 01 78 39**

## **SECTION 01 79 00 - DEMONSTRATION AND TRAINING**

### **PART 1 GENERAL**

#### **1.1 SUMMARY**

- A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:
  - 1. Instruction in operation and maintenance of systems, subsystems, and equipment.

#### **1.2 INFORMATIONAL SUBMITTALS**

- A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.

#### **1.3 QUALITY ASSURANCE**

- A. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Section 01 40 00 "Quality Requirements," experienced in operation and maintenance procedures and training.

#### **1.4 COORDINATION**

- A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.
- B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.
- C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data have been reviewed and approved by Project Representative.

#### **1.5 INSTRUCTION PROGRAM**

- A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.
- B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:
  - 1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
    - a. System, subsystem, and equipment descriptions.



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- b. Performance and design criteria if Contractor is delegated design responsibility.
  - c. Operating standards.
  - d. Regulatory requirements.
  - e. Equipment function.
  - f. Operating characteristics.
  - g. Limiting conditions.
  - h. Performance curves.
- 2. Documentation: Review the following items in detail:
  - a. Emergency manuals.
  - b. Systems and equipment operation manuals.
  - c. Systems and equipment maintenance manuals.
  - d. Product maintenance manuals.
  - e. Project Record Documents.
  - f. Identification systems.
  - g. Warranties and bonds.
  - h. Maintenance service agreements and similar continuing commitments.
- 3. Emergencies: Include the following, as applicable:
  - a. Instructions on meaning of warnings, trouble indications, and error messages.
  - b. Instructions on stopping.
  - c. Shutdown instructions for each type of emergency.
  - d. Operating instructions for conditions outside of normal operating limits.
  - e. Sequences for electric or electronic systems.
  - f. Special operating instructions and procedures.
- 4. Operations: Include the following, as applicable:

- a. Startup procedures.
  - b. Equipment or system break-in procedures.
  - c. Routine and normal operating instructions.
  - d. Regulation and control procedures.
  - e. Control sequences.
  - f. Safety procedures.
  - g. Instructions on stopping.
  - h. Normal shutdown instructions.
  - i. Operating procedures for emergencies.
  - j. Operating procedures for system, subsystem, or equipment failure.
  - k. Seasonal and weekend operating instructions.
  - l. Required sequences for electric or electronic systems.
  - m. Special operating instructions and procedures.
5. Adjustments: Include the following:
- a. Alignments.
  - b. Checking adjustments.
  - c. Noise and vibration adjustments.
  - d. Economy and efficiency adjustments.
6. Troubleshooting: Include the following:
- a. Diagnostic instructions.
  - b. Test and inspection procedures.
7. Maintenance: Include the following:
- a. Inspection procedures.
  - b. Types of cleaning agents to be used and methods of cleaning.
  - c. List of cleaning agents and methods of cleaning detrimental to product.

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- d. Procedures for routine cleaning.
  - e. Procedures for preventive maintenance.
  - f. Procedures for routine maintenance.
  - g. Instruction on use of special tools.
8. Repairs: Include the following:
- a. Diagnosis instructions.
  - b. Repair instructions.
  - c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
  - d. Instructions for identifying parts and components.
  - e. Review of spare parts needed for operation and maintenance.

#### **1.6 PREPARATION**

- A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Section 017823 "Operation and Maintenance Data."
- B. Set up instructional equipment at instruction location.

#### **1.7 INSTRUCTION**

- A. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
- B. Scheduling: Provide instruction at mutually agreed-on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
  - 1. Schedule training with Owner, through Project Representative, with at least seven days' advance notice.
- C. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.

#### **PART 2 PRODUCTS (NOT USED)**

#### **PART 3 EXECUTION (NOT USED)**

**END OF SECTION 01 79 00**

**SECTION 03 30 00 – CAST IN PLACE CONCRETE**

**PART 1 GENERAL**

**1.1 DESCRIPTION**

A. Work Included:

1. Cast in place concrete required for this project is shown in the Drawings and includes, but is not necessarily limited to footings, foundation walls, slabs on grade, floor slabs, concrete tanks, exterior apron slab, and concrete reinforcement.

B. Related Work Described Elsewhere:

1. None

**1.2 QUALITY ASSURANCE**

A. Codes and Standards:

In general, all concrete work on this Project shall comply with current American Concrete Institute Manuals of Concrete Practices. Comply with all applicable codes and regulations and pertinent portions of the following referenced standards and other standard publications referenced in subsequent articles, which shall become a part of these specifications to the extent of their applicability to the particular product, system, assembly, or item specified:

1. ACI 301: "Specifications for Structural Concrete for Buildings".
  1. ACI 302: "Guide for Concrete Floor and Slab Construction."
  2. ACI 304: "Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete."
  3. ACI 311: "Recommended Practice for Concrete Inspection".
  4. ACI 315: "Manual of Standard Practice for Detailing Reinforced Concrete Structures."
  5. ACI 318: "Building Code Requirements for Reinforced Concrete".
  6. ACI 347: "Recommended Practice for Concrete Formwork".

B. Conflicts:

In the event of conflict or inconsistency between or among referenced standards and any provisions of this specification, or other Contract Documents, the most stringent requirement shall prevail, and shall be enforced.

C. Testing:

1. Conduct tests of the concrete during construction in accordance with ACI 301. Submit results of tests for approval. Remove and replace concrete which fails to achieve minimum 28 day compressive strength shown on the Drawings, at Contractor's expense.
2. Test all concrete for footings, slabs, walls, curbs and sidewalks.

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3. Reject concrete which fails to meet specified criteria for slump, air content, and temperature.

### **D. Frequency of Testing:**

1. Slump tests - ASTM C-143:  
Perform one test for each set of compressive strength test specimens.
2. Air content - ASTM C-231:  
Perform one test for each set of compressive strength test specimens.
3. Concrete temperature:  
Test hourly when ambient air temperature is 40°F and below, and each time a set of compression test specimens are made.
4. Compression test specimen - ASTM C-31:  
One set of three standard cylinders for each compressive strength test. Field cure.
5. Compressive strength tests - ASTM C-39:  
Samples for strength tests for each class of concrete placed each day shall be taken not less than one a day nor less than once for each 20 cu. yd. of concrete, nor less than once for each 1,000 sq. ft. of surface area for slabs.

## **1.3 SUBMITTALS**

Make all submittals in conformance with applicable section of these specifications. Conform with ACI 315 for nomenclature and conventions used in shop and placement drawings:

### **A. Concrete Materials:**

Submit concrete design specification, laboratory test results, and materials list showing source and gradation of all aggregates, type and brand of Portland cement, admixtures source and quality of mixing water, and other aspects of the concrete design.

### **B. Reinforcing Steel:**

Provide Materials Certificates signed by manufacturer and Contractor certifying that each material item complies with, or exceeds, specified requirements.

### **C. Admixtures:**

Provide Materials Certificates signed by manufacturer and Contractor certifying that each material item complies with, or exceeds, specified requirements and that chloride content complies with specification requirements.

## **1.4 PRODUCT HANDLING**

### **A. Delivery and Storage:**

Do not permit delivery of any of the products of this section to the project site until proper facilities, away from traffic, are available for their proper storage and which will permit sorting and handling without endangering the materials themselves or materials for installations of other sections. Store all reinforcing steel on wood dunnage to keep it from direct contact with the ground surface.

### **B. Environmental Requirements:**

In the event of damage make all repairs and replacements necessary to restore to undamaged condition and do not proceed in those areas until all repairs have been made. Repairs and

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replacements shall be subject to approval of the Contracting Agency and shall be accomplished at no additional expense to the Owner.

### **1.5 PRODUCT CONDITIONS**

#### **A. Protection Against Freezing:**

Cover work with temporary or permanent cover as required to protect concrete against possibility of freezing during placement of concrete, and for at least 14 days after placement of concrete.

## **PART 2 PRODUCTS**

### **2.1 FORMS**

#### **A. Material:**

Provide new, except as permitted in PART 3 of this section for re-use:

##### **1. Plywood:**

U.S. Product Standard PS-1 "B-B (Concrete Form) Plywood", Class I, Exterior Grade or better, mill oiled and edge sealed, with each piece bearing legible grade mark of a recognized and approved inspection agency.

##### **1. Dimensional lumber:**

Hem-Fir Number two grade, seasoned

#### **B. Ties and Spreaders:**

2. Provide type providing minimum working strength of 3,000 lbs. when fully assembled, which does not leave open holes through the concrete, and which permits neat and solid patching.

3. Metal shall not be closer than 3/4" to surface when forms are removed.

4. Do not use wire ties and wood spreaders.

#### **C. Alternate Forming Systems:**

Alternate systems will be considered upon submittal.

#### **D. Coatings and Parting Compounds:**

Provide commercial fabrication that will not bond with stain or adversely affect concrete surfaces and will not impair subsequent treatment of concrete surfaces to be cured with water or compounds conforming to FSTT-3-001657.

#### **E. Joint Fillers:**

Provide pre-molded, resilient, waterproof, compressible type with minimum 75% recovery conforming to FS HH-F- 341E, Type II; 1/2" thick for interior joints and 1/2" thick for exterior walks.

#### **F. Other Materials:**

Provide all other materials required for complete installation as selected by Contractor subject to the approval of the Contracting Agency.

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**2.2 REINFORCING**

All concrete reinforcement shall be new, free from rust, and shall comply with the following reference standards:

A. Reinforcing Bars:

Provide ASTM A-615 grade 40 or 60 except where noted otherwise.

B. Wire:

Provide ASTM A-82 #16 double annealed iron wire.

C. Welded Wire Fabric:

Provide ASTM A-185 in Flat Sheets.

D. Accessories and Supports:

Provide supports, bolsters, chairs, spacers and other devices and accessories conforming to recommended Concrete Reinforcing Steel Institute (CRSI) practices. Provide galvanized accessories within 1-1/2" of surface of concrete with plastic tip chairs for exposed finish surfaces. Concrete dobie or other block, brick, or wood supports will not be permitted, except where specifically noted.

E. Welding Electrodes:

Conform to AWS Code D12.1.

F. Other Materials:

Provide all other materials, not specifically described but required for a complete and proper installation of concrete reinforcement, as selected by the Contractor, subject to the approval of the Contracting Agency

**2.3 CONCRETE**

A. General:

Concrete mixes shall be designed to produce the tabulated properties below, and shall be subject to the approval of the Owner's Representative.

B. Quality:

1. Provide concrete having 3,000 psi minimum 28 day compressive strengths for footings, walls and slabs, unless noted otherwise in drawings.
2. Provide concrete with maximum aggregate of 3/4" for all concrete except concrete for exposed aggregate surfaces, which shall have a maximum aggregate size of 3/8".
  1. Slump at placement shall conform to the following:

	Concrete Without Super Plasticizer	Concrete with Super Plasticizer
<u>Location</u>		
Slab on Grade	3 inches	6 to 9 inches
Footings, Walls, Slabs and Beams	4 inches	6 to 9 inches
Exterior Apron Slab	3 inches	6 to 9 inches

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2. Entrained air content at placement shall be 6% with 1.5% tolerance.

#### C. Cement:

Provide portland cement conforming to ASTM C-150, type I or II the product of a single manufacturer.

#### D. Aggregates:

1. Provide aggregates conforming to ASTM C-33, current edition, except as expressly permitted by the Contracting Agency.
  1. Course aggregate size shall not exceed one-fifth the narrowest dimension between forms, one-third the depth of slabs, nor three-fourths the minimum clear spacing between individual bars or bundles of bars.
  2. Fine aggregates shall be clean, sharp, natural sand, free from loam, clay, lumps, alkali, organic matter, or other deleterious substances.
  3. Aggregates shall be well graded, clean, hard gravel and coarse sand, non-frost susceptible material, and free of vegetable matter and coatings of silt or clay. The graduations shall be determined by standard laboratory sieves with square openings. Material retained on a No. 4 screen shall be classified as coarse aggregate, which shall conform to the requirements of AASHTO M-80 and have the following limits of gradation:

#### COARSE AGGREGATE FOR PCC

Designated Sizes (AASHTO Gradation)	Percent by weight passing Laboratory Sieve having square openings in inches						
	2	1-1/2	1	3/4	1/2	3/8	No.4
No.67 (3/4" to No.4)	..	..	100	90-100	..	20-55	0-10*

\*Not more than 5% shall pass a No. 8 sieve.

All material passing a No. 4 sieve shall be classified as fine aggregate and shall conform to the requirements of AASHTO M-6 and have the following gradation:

#### FINE AGGREGATE FOR PCC

SIEVE SIZE	PERCENT PASSING SIEVE
Passing a 3/8 inch sieve	100
Passing a No. 4 inch sieve	95-100
Passing a No. 8 inch sieve	80-100
Passing a No. 16 inch sieve	45-80
Passing a No. 30 inch sieve	25-60
Passing a No. 50 inch sieve	10-30
Passing a No. 100 inch sieve	2-10

#### E. Water:

Provide mixing water from an approved source, clean, fresh, and free of acids, alkalis, oil, organic



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or other deleterious matter.

**F. Miscellaneous Inserts:**

Provide ASTM A-36 steel.

**G. Air Entrainment:**

Comply with ASTM C-260.

**H. Water Reducing Admixture:**

Comply with ASTM C-494.

**I. Epoxy Grout:**

Provide Master Builder's "Masterflow 713", Sonneborn "Ferrolith", or approved equal.

**J. Joint Sealer:**

Provide Grace "Daraweld-U Traffic Grade" or approved equal.

**K. Other Materials:**

Provide all other materials not specifically described but required for a complete and proper concrete installation, as selected by Contractor and subject to the approval of the Contracting Agency.

**L. Calcium chloride additives are not permitted.**

**M. Latex - cement leveling compound - Laticrete 4237 or approved equal.**

Provide a smooth trowel finish to accept finishes as scheduled.

**N. Curing Compound:**

Provide curing compound after concrete is placed.

1. Curing compound shall meet the requirements of ASTM C-309
2. Curing compound shall be removed from the concrete surface prior to allocation of further surface treatments. Curing compound shall not interfere with application of hardener/sealer.
3. Recommended Product: Dayton Superior Clear Resin Cure J7WB

**O. Hardener/Sealer:**

Water soluble sealer/densifier, that when applied in accordance with manufacturers application recommendations will produce a dense surface resistant to abrasion, moisture, tire marking and provides added gloss to the floor finish.

1. Acceptable Product: Dayton Superior Penta-Hard Densifier

**P. Superplasticizers:**

1. Meet ASTM C 494, Type F or G, of second or third generation type.

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2. Do not use first generation superplasticizer
3. Hold slump to 6" or greater for 2 hours.

Meet ASTM C 494, Type F or G, of second or third generation type.

1. Do not use first generation superplasticizer
  2. Hold slump to 6" or greater for 2 hours.
  3. Second Generation Superplasticizer: Batch plant added to extend plasticity time up to 2-1/2 hours, control temperature of fresh concrete, reduce water 20 to 30 percent, and give higher strengths at all ages.
  4. Third Generation Superplasticizer: Batch plant added to extend plasticity time up to 2-1/2 hours, maintain setting characteristics similar to normal concrete throughout its recommended dosage range and at varying concrete temperatures, reduce water to 30 to 40 percent, and give high-early and ultimate strengths.
1. Manufacturer and Product:
    - b. Master Builders, Inc., Cleveland, OH, Rheobuild
    - c. W.R. Grace & Co., Cambridge, MA, Darecem 100.

### **Q. Synthetic Fiber Reinforcement for Concrete Slabs:**

1. 'Forte Fibre' synthetic fiber. Add to mix at rates recommended by fiber manufacturer.

## **PART 3 EXECUTION**

### **3.1 JOB CONDITIONS**

#### **A. Inspection:**

Examine the surface of areas to which the concrete work is to be applied and determine that prior work complete, that all subgrades have been properly compacted, graded, that all slab cushions are in place, and that all previous work is complete and ready for erection of forms, setting of reinforcement, and placement of concrete.

#### **B. Discrepancies:**

In the event of discrepancy, ambiguity, interference, or any other unanticipated condition which might impede the timely execution of the work of this section, promptly notify the Contracting Agency and do not proceed in the area of discrepancy until all questions in regard thereto have been resolved.

#### **C. Certificates:**

Obtain written acknowledgment(s) from the subcontractors or installers of the formwork, reinforcement, and concrete placement that the substrates affecting their work have been examined and found satisfactory for subsequent operations. Such acknowledgments countersigned by the Contractor and delivered to the Contracting Agency prior to the final inspection, shall be a condition of the acceptance of the work of this section.

#### **D. Admixtures:**

Superplasticizers:

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1. Add at concrete plant only through equipment furnished and/or approved by admixture manufacturer.
2. Equipment shall provide for easy and quick visual verification of admixture amount used for each dose.
3. Discharge amount to be added to each load of concrete into separate dispensing container, measured verified as to amount, then add to concrete.
4. Redosing of Concrete: Not permitted except when approved by inspection agency monitoring concrete quality and only after quality tests show this practice does not decrease the quality specified for concrete.

### **3.2 NOTICE**

Notify the Owner's Representative at least 48 hours prior to beginning any pour of concrete, or 24 hours prior to closing any forms.

### **3.3 FORMWORK**

#### **A. Design:**

Design forms to support vertical and lateral loads that might be applied until such loads can be supported by the concrete structure, so that they may be readily removed without impact, shock, or damage to in place concrete and adjacent materials.

#### **B. Construction:**

1. Construct forms to conform with ACI 347, to sizes, shapes, lines, and dimensions shown or as required to obtain accurate alignment, location, grades, and level and plumb work in finished structure. Forms shall be set straight, plumb and true to within 1/4" in 10' of length.
2. Provide for openings, offsets, recesses, linkages, keyways, moldings, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts and other features required to attain the required configuration.
3. Use materials selected to achieve the indicated finishes. Solidly butt joints and provide back up to prevent leakage of cement paste.
4. Fabricate for easy removal without hammering or prying against concrete surfaces. Provide crush plates where stripping might damage cast concrete surfaces. Provide top forms for inclined surfaces where 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 for easy removal.
5. Where interior area of formwork is inaccessible, provide temporary openings for cleanout, inspection prior to concrete placement, and for final placement. Securely brace temporary openings and set tightly to forms to prevent loss of concrete mortar. Locate temporary openings on forms at inconspicuous locations.
6. Chamfer exposed corners and edges as shown or required using wood, metal, PVC, or rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints.

#### **C. Form Ties:**

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Use factory fabricated, adjustable length, removable or snap-off metal form ties, designed to prevent form deflection, and prevent spalling concrete surfaces upon removal. Position ties so portion remaining within concrete after removal is at least 1-1/2" inside the concrete and which will not leave holes larger than 1" diameter in the concrete surface.

#### **D. Coordination with Other Trades:**

Provide necessary coordination with other trades to determine size and location of openings necessary for work of those trades. Accurately place and securely support items built into forms.

#### **E. Cleaning & Tightening:**

Thoroughly clean forms and adjacent surfaces receiving concrete. Remove chips, wood, sawdust, dirt, and other debris prior to placement of concrete. Retighten forms after concrete placement if required to eliminate mortar leaks.

### **3.4 PLACING REINFORCEMENT**

#### **A. General:**

Comply with specified codes and standards and CRSI recommended placing practices for details and methods of placing reinforcement and supports.

#### **B. Cleaning:**

Clean reinforcement of loose rust and mill scale, earth, ice, and other materials which reduce or destroy bond with concrete.

#### **C. Positioning:**

1. 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.
2. Place reinforcement to obtain the minimum coverages for concrete protection. Arrange, space, and securely tie bars and bar supports to hold in position during concrete placement. Set wire ties so ends are directed into concrete, not toward exposed surfaces.
3. Do not place reinforcing bars more than 2" beyond the last leg of continuous bar support. Do not use supports as bases for runways for conveying equipment or similar construction loads.

#### **D. Welded Wire Fabric:**

1. Install welded wire fabric. Mats only. No rolled material will be acceptable. Lap adjoining mats a minimum of one and one half meshes and lace splices with wire. Offset end laps in adjacent widths to prevent continuous laps.
2. Support welded wire fabric with plastic chairs at intervals not exceeding 4 feet measured along both directions of the mesh. Support welded wire fabric to the middle of the slab thickness.
3. The practice of lifting the welded wire fabric off the subgrade as concrete is poured will be allowed only if after lifting the wire it is supported per Item D, 2 above.

### **3.5 JOINTS**

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### **A. Construction Joints:**

Locate and install construction joints which are not shown on the drawings so as not to impair the strength and appearance of the structure, subject to the approval of the Contracting Agency.

Place construction joints perpendicular to the main reinforcement. Continue all reinforcement across construction joints.

### **B. Keyways:**

Provide keyways at least 1-1/2" deep in all construction joints in walls, slabs, and between walls and footings; approved bulkheads designed for this purpose may be used for slabs.

### **C. Contraction Control Joints:**

Construct preformed contraction control joints in slabs to form panels of patterns as shown on the drawings.

### **D. Expansion:**

#### **1. Expansion joints:**

Expansion joint material shall conform to the requirements at ASTM D-994 and AASHTO M-33. Expansion joint material shall extend the full width of the structure and shall be cut to such dimensions that the base of the expansion joint shall extend to the subgrade and the top shall be depressed not less than one-quarter (1/4) inch nor more than one-half (1/2) inch below the finished surface of the concrete.

The material shall be of one (1) piece in the vertical dimension and shall be securely fastened in a vertical position to the existing concrete face against which fresh concrete is to be poured. After the concrete has set, the expansion joints shall be filled flush to the finish concrete surface with asphalt cement, two hundred (200) to three hundred (300) penetration. Application temperature of the sealing asphalt shall be between 250 degrees and 350 degrees Fahrenheit.

Sealing asphalt shall be applied by pouring from a bucket with a V-shaped spout, equipped with a positive shutoff to prevent spilling or dripping of asphalt. Before sealing, the joint shall be cleaned of all dirt, gravel, concrete mortar or other extraneous material. Sealing shall be done in a neat workmanlike manner. Sloppy work in sealing of expansion joints will not be tolerated.

## **3.6 EMBEDDED ITEMS**

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 approved setting drawings, diagrams, instructions, and directions provided by suppliers of the items to be attached thereto.

## **3.7 PREPARATION OF FORMS**

Coat the contact surfaces of forms with an approved coating compound before placement of concrete, and according to manufacturer's instructions. Thin only with approved thinners according to manufacturer's recommendations. Do not permit application of excessive coating compound or allow it to accumulate in the forms or come into contact with concrete surfaces against which fresh concrete will be placed.

Coat steel forms with a non-staining, rust preventative form oil or otherwise protect against rusting. Rust stained steel formwork will not be acceptable and will be rejected.

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#### **3.8 CONCRETE PLACEMENT**

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##### **A. Pre-placement Inspection:**

Before placement of concrete, inspect the formwork and reinforcement and verify that all prior work has been completed to the point that placement of the concrete may be executed in complete conformance with the original design, the approved submittals and the referenced standards. Determine that all embedded items, supports, backing, and other provisions for items supported by or attached to the concrete have been provided for. Coordinate with other trades whose work will be affected by the operations of this section. Obtain all written acknowledgments specified in 3.01C above.

##### **B. General:**

Comply with ACI 304 and as herein specified. Deposit continuously or in layers of such thickness that no concrete will be placed on concrete which has hardened sufficiently to cause formation of seams or planes of weakness within the section. If a section cannot be placed continuously, provide construction joints as specified in 3.05. Deposit concrete as nearly as practicable to its final location to avoid segregation due to re-handling or flowing.

##### **C. Footings and Walls:**

1. Deposit in forms in horizontal layers not exceeding 24" in depth and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while previous layer is still plastic to avoid cold joints. Where vertical drop is more than three feet, elephant trunks shall be used.
2. Consolidate by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping. Use equipment and procedures for consolidation of concrete in accordance with the recommended practices of ACI 309 to suit type of concrete and project conditions.
3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than the visible effectiveness of the machine. Place vibrators to rapidly penetrate the placed layer and at least 6" into the previous layer. Do not insert vibrators into lower layers of concrete that have begun to set. Limit the duration of vibration to the time necessary to consolidate the concrete and complete embedment of reinforcement and other embedded items without causing segregation of the mix.

##### **D. Interior Slabs and Exterior Apron Slabs:**

1. Deposit and consolidate in a continuous operation within the limits of construction joints, until the placing of a panel or section is completed.
2. Consolidate by previously specified methods, working concrete around reinforcement, embedded items, and into corners.
3. Bring slab surfaces to the correct level with a straight edge and strike off. Use bull floats or darbies to smooth the surface, leaving it free of humps and hollows. Do not sprinkle water onto the plastic surface. Do not disturb the slab surfaces prior to beginning finishing operations.
4. Maintain reinforcing in the proper position during all placement and consolidating operations.

##### **E. Cold Weather Placement:**

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Protect placed concrete from physical damage or reduced strength which could be caused by frost, freezing action, or low temperatures, in compliance with ACI 306 and as follows:

1. When ambient temperature has fallen to or is expected to fall below 40°F., uniformly heat water and aggregates prior to mixing to maintain mixture temperature not less than 50°F. and not more than 80°F. at point of placement.
2. Do not use frozen materials or materials containing ice or snow and do not allow concrete to be placed on frozen subgrade or on subgrade containing frozen materials.
3. Do not use calcium chloride, salt, or other material containing anti-freeze agents or chemical accelerators unless specifically permitted by the Contracting Agency for the particular situation encountered.

### **3.9 FINISHING FORMED SURFACES**

#### **A. Rough Form Finish:**

For formed surfaces not exposed to view in the finish work or by other construction, unless otherwise indicated, provide a surface having the texture imparted by the form facing material used with tie holes and defective areas repaired and patched and fins and other projections chipped down and rubbed off.

#### **B. Smooth Form Finish:**

For formed surfaces exposed to view, or that are to be covered with a coating or covering material applied to or bonded directly to the concrete, such as waterproofing, damp proofing, painting or other similar system, provide a surface obtained by selecting form facing material, arranged symmetrically orderly with a minimum of seams. Repair and patch defective areas with fins and projections completely removed and smoothed.

#### **C. Smooth Rubbed Finish:**

Provide smooth rubbed finish which has received smooth form finish treatment not later than the day after removal of the forms. Moisten the surfaces and rub with carborundum brick or other abrasive until a uniform color and texture is attained. Do not apply cement grout other than the created by the rubbing process.

#### **D. Grout Cleaned Finish:**

Provide grout cleaned finish as scheduled to surfaces which have received smooth form finish by combining one part of portland cement to 1-1/2 parts fine sand by volume, and mixing with water to the consistency of thick paint. Blend standard portland cement and white portland cement in amounts determined by trial patches so that final color of dry grout will closely match adjacent surfaces. Thoroughly wet concrete surfaces and apply grout immediately to coat surfaces and fill small holes. Remove excess grout by scraping and rubbing with clean burlap. Keep damp by fog spray for at least 36 hours after rubbing.

#### **E. 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 surface. Continue the final surface treatment uniformly across adjacent informed surfaces unless otherwise indicated.

### **3.10 SLAB FINISHES**

#### **A. Scratch Finish:**

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Where scheduled or shown provide scratch finish on monolithic slab surfaces that are to receive topping or mortar setting beds for tile, terrazzo, or other bonded cementitious finishes.

After placement of slab, plane surface to a tolerance not exceeding 1/4" in 24". Slope surfaces uniformly to drains where required. After leveling, roughen surface before final set, with stiff brushes, rakes, or brooms.

### **B. Float Finish:**

Apply float finish to monolithic slab surfaces that are to receive trowel finish and other finishes described in subsequent paragraphs, and surfaces which are to be covered by membrane or elastic waterproofing, roofing, or other finishes as scheduled.

After screeding and consolidating concrete slabs, do not work surface until ready for floating. Begin floating when surface water has disappeared or when concrete has stiffened sufficiently to permit floating of surface. Consolidate surface with power or hand floats or both, using hand floats in small or inaccessible areas. Float surface to a tolerance not exceeding 1/4" in 10' when tested with a 10' straight edge. Cut down high spots and fill in low spots by floating. Do not apply cement or cement and sand mixture for filling in, use only grout removed from high spots. Uniformly slope to drains. Immediately after leveling refloat surface to a uniform, smooth, granular texture.

### **C. Trowel Finish:**

Apply trowel finish to slab surfaces that are to be exposed to view and surfaces that are to be covered by resilient flooring, paint, or other thin-film finish systems.

After floating, begin first troweling operation with power driven or hand trowels. Begin troweling when surface produces a ringing sound as trowel is moved over surface. Hand trowel as necessary to obtain a smooth surface free of trowel marks and of a uniform texture and appearance, and with a tolerance not exceeding 1/8" in 10' when tested with a 10' straightedge.

### **D. Broom Finish:**

Apply broom finish to exterior and interior platforms, exterior apron slab, steps, stoops, walks, and ramps, and elsewhere as shown or scheduled.

Immediately after trowel finishing, slightly roughen surface by brooming with a fiber bristle broom perpendicular to direction of travel. Coordinate final finish with Contracting Agency before application.

### **E. Chemical Hardener/Sealer Finish:**

Apply chemical hardener/Sealer finish to interior and exterior slabs, after complete curing and drying of the concrete surface. Chemical hardeners shall be coordinated with adhesive to be used in conjunction with other flooring materials. Membrane curing compounds shall be completely removed from the surface prior to application of Chemical Hardener/Sealer.

1. Apply per manufacturer's recommendations.

### **F. Exposed Aggregate:**

1. Provide exposed aggregate surface at locations indicated in the Drawings.
2. Concrete with a maximum slump of 3" shall be used in exposed aggregate areas. Air entrainment shall be in accordance with specifications.
3. Aggregate shall be 3/8" maximum.



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4. Screed concrete to proper level. Do not jitterbug or tamp concrete.
5. Floating shall be limited to amount required to ensure that aggregate is surrounded and only slightly covered by mortar, leaving no holes in the surface.
6. Shortly after floating, Masterbuilders Confilm surface retarder may be sprayed over the surface to allow sufficient time to elapse before exposing operation begins.
7. Exposing operation should begin as soon as brushing and hosing of the surface can be done without over-exposing or dislodging the aggregate. Finishers are to stay off the newly exposed surface to avoid breaking the aggregate bond. If it is necessary for finishers to move about on the newly exposed surface, kneeboards are to be used. Kneeboards shall be gently placed on the surface, and shall not be slid or twisted when on the surface.
8. Exposed aggregate slabs shall be cured thoroughly.

### **3.11 CURING & PROTECTION**

#### **A. General:**

Protect freshly placed concrete from premature drying and excessive cold, and maintain without drying at a relatively constant temperature for a period of time necessary for hydration of cement and proper hardening. Conduct all curing operations in compliance with ACI 301 & ACI 308.

1. Initiate curing process as soon as free water has disappeared from the concrete surface. Weather permitting, keep continuously moist for not less than 72 hours.
2. Begin final curing procedures immediately following initial curing and before concrete has dried.
3. Continue curing for a minimum of 10 days after initial placement unless otherwise permitted in writing by Contracting Agency.
4. Avoid rapid drying at end of curing period.
5. Maintain concrete surface temperature at least 50°F. for 7 days after following placement of concrete. At least once each shift and once per day on non-work days, an inspection shall be made of all areas subject to cold-weather protection. Any deficiencies shall be noted, corrected, and reported.

#### **B. Curing Methods:**

1. Moisture Curing:
  - a. Keep concrete surface continuously wet by covering with water or continuous fog spray.
  - b. Cover concrete surface with specified absorptive cover, thoroughly saturated with water, and keeping continuously wet. Place absorptive cover to provide coverage at edges, with 4" lap over adjacent absorptive covers.
2. Moisture-cover Curing:

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Cover concrete surfaces with moisture retaining cover, placed in widest practicable width with sides and lapped a minimum of 3" and sealed with waterproof tape or adhesive. Immediately repair any holes or tears occurring during curing period using cover material and waterproof tape.

### **3. Membrane Curing:**

Apply curing compound per manufacturer's recommendations. Ensure membrane curing compound is compatible with adhesives and/or sealer/densifier compounds prior to application.

### **C. Formed Surfaces:**

Cure formed surfaces including undersides of beams, supported slabs, and other similar surfaces by moist curing with forms in place for full curing period or until forms are removed. If forms are removed, continue curing by methods specified above as applicable.

### **D. Unformed Surfaces:**

Cure formed surfaces such as slabs, floor topping and other similar flat surfaces by application of the approved curing method.

Use moisture retaining curing method for surfaces which are to receive liquid floor hardener or finish flooring, unless otherwise specifically directed in writing by the Contracting Agency.

## **3.12 FORM REMOVAL**

### **A. Non-Supporting Forms:**

Formwork not supporting concrete, such as sides of footings, may be removed after cumulatively curing at not less than 50°F. for a minimum of 24 hours after placement, provided concrete has sufficiently hardened not to be damaged by removal operations, and providing curing operations are maintained.

### **B. Supporting Forms:**

Formwork supporting weight of concrete such as beam soffits, joints, slabs and other similar structural elements shall not be removed in less than 14 days, and not until design minimum compressive strength for 28 days has been attained, as determined by testing of field cured specimens' representative of actual location of the members in question.

### **C. Metal decking forms shall be left in place.**

## **3.13 RE-USE OF FORMS**

Re-use of forms will be permitted only under the following conditions, subject to the approval of the Contracting Agency in each instance:

A. Clean and repair all contact surfaces to achieve capability equal to that of new forms.

B. Split, frayed, delaminated, or otherwise deteriorated facing or supporting materials will not be permitted.

C. Apply new coating compound to contact surfaces as specified for new work.

D. Where forms are extended for successive placement, thoroughly clean all surfaces and tighten to close joints. Align and secure joints to avoid offsets.

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- E. Do not use "Patched" forms for expressed surfaces unless specifically permitted in writing by Contracting Agency in each particular instance.

#### **3.14 SURFACE REPAIRS**

##### **A. General:**

Repair and patch defective areas with cement mortar immediately after removal of forms, but only when acceptable to Contracting Agency.

1. Cut out honeycomb, rock pockets, voids over 1/4" in any dimension, and holes left by tie rods and bolts, down to solid concrete, but in no case greater than 1".
2. Make edges of cuts perpendicular to the concrete surface.
3. Dampen the area to be patched with water and brush coat with neat cement grout or proprietary bonding agent.

##### **B. Exposed to View Surfaces:**

1. Blend white portland cement and standard portland cement so that when dry patching mortar will match color of surrounding surface. Provide test areas at inconspicuous location to verify match.
2. Compact mortar in place and stake off slightly higher than surrounding surface.
3. Apply appropriate finish as provided in 3.09.

##### **C. High Areas:**

Correct high areas by grinding, after concrete has cured at least 14 days.

##### **D. Low Areas:**

Correct low areas during or immediately after completion of surface finishing operations by cutting out the low area and replacing with fresh concrete. Finish repaired areas to blend into adjacent concrete. Proprietary patching compounds may be used upon approval of the Contracting Agency.

##### **E. Other Repairs:**

1. Repair defective areas, except random cracks and single holes not exceeding 1" dia. 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 3/4" clearance all around. Dampen concrete surfaces in contact with patching concrete, and brush with neat cement grout coating or concrete bonding agent. Mix patching concrete of same materials to provide concrete of the same type or class as original concrete. Place, compact, and finish to blend with adjacent finished concrete. Cure in the same manner as adjacent concrete.
2. Repair isolated random cracks and single holes not over 1" in dia. by dry-pack method. Groove top of cracks and cut out holes to sound concrete and clean of dust, dirt, and loose cement grout coating or concrete bonding agent. Mix dry-pack, consisting of one-part portland cement to 2-1/2 parts fine aggregate passing #16 screen, using only enough water as required for handling and placing. Compact dry-pack mixture in place and finish to match adjacent concrete. Keep patched area continuously moist for not less than 72 hours.

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F. Other Methods:

Repair methods not specified may be used, subject to the approval of the Contracting Agency.

**END OF SECTION 03 30 00**

## **SECTION 05 50 00 – METAL FABRICATIONS**

### **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. Steel framing and supports for overhead doors.
- 2. Steel framing and supports for mechanical and electrical equipment.
- 3. Steel framing and supports for applications where framing and supports are not specified in other Sections.
- 4. Metal bollards.
- 5. Loose bearing and leveling plates for applications where they are not specified in other Sections.

- B. Related sections:

- 1. Section 03 30 00 Cast in Place Concrete
- 2. Section 13 34 19 Metal Building Systems
- 3. Section 09 91 13 Exterior Painting
- 4. Section 09 22 16 Non-Structural Metal Framing

#### **1.3 PERFORMANCE REQUIREMENTS**

- A. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.

- 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

#### **1.4 ACTION SUBMITTALS**

- A. Product Data: For the Following:

- 1. Nonslip aggregates and nonslip-aggregate surface finishes.
- 2. Paint products.
- 3. Grout.

- B. Shop Drawings: show fabrication and installation for metal fabrications.

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1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.
- C. Samples for Verification: For each type and finish of aluminum support members for translucent canopy system.

### **1.5 INFORMATIONAL SUBMITTALS**

- A. Mill Certificates: Signed by manufacturers of stainless-steel certifying that products furnished comply with requirements.
- B. Welding certificates.
- C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats.

### **1.6 QUALITY ASSURANCE**

- A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Welding Qualifications: Qualify procedures and personnel according to the following:
1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
  2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
  3. AWS D1.6, "Structural Welding Code - Stainless Steel."

### **1.7 PROJECT CONDITIONS**

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.
- B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

### **1.8 COORDINATION**

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- C. Coordinate installation of transparent canopy system support members. Furnish setting drawings, templates, and directions for installing support members, including connectors, clips, bolts, and other items necessary for the support of translucent canopy system. Deliver such items to Project site in time for installation.

## **PART 2 PRODUCTS**

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#### **2.1 METALS, GENERAL**

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

#### **2.2 FERROUS METALS**

- A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- B. Steel Tubing: ASTM A 500, cold-formed steel tubing.
- C. Steel Pipe: ASTM A 53/A 53M, standard weight (Schedule 40) unless otherwise indicated.

#### **2.3 NON-FERROUS METALS**

- A. Aluminum Plate and Sheet: ASTM B 209, Alloy 6061-T6 or 6061-T651.
- B. Aluminum Extrusions: ASTM B 221, Alloy 6061-T6.

#### **2.4 FASTENERS**

- A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.
  - 1. Provide stainless-steel fasteners for fastening aluminum.
  - 2. Provide stainless-steel fasteners for fastening stainless steel.
  - 3. Provide stainless-steel fasteners for fastening nickel silver.
  - 4. Provide bronze fasteners for fastening bronze.
- B. Steel Bolts and Nuts: Bolts to be provided as detailed by Metal Building Supplier minimum bolts to be regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.
- C. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563; and, where indicated, flat washers.
  - 1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.
- D. Machine Screws: ASME B18.6.3.
- E. Lag Screws: ASME B18.2.1.
- F. Wood Screws: Flat head, ASME B18.6.1.
- G. Plain Washers: Round, ASME B18.22.1.
- H. Lock Washers: Helical, spring type, ASME B18.21.1.
- I. Anchors, General: Anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in

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- concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
- J. Cast-in-Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F 2329.
  - K. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.
    - 1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941 Class Fe/Zn 5, unless otherwise indicated.
    - 2. Material for Exterior Locations and Where Stainless Steel is Indicated: Alloy Group 1 stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594.

### **2.5 MISCELLANEOUS MATERIALS**

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- B. Shop Primers: Provide primers that comply with Section 09 91 13 Exterior Paint and Section 09 91 23 Interior Paint
- C. Hot Dipped Galvanizing: Perform Hot Dipped Galvanizing in accordance with ASTM A123
- D. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
  - 1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
- E. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- F. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.
- G. Non-shrink, Metallic Grout: Factory-packaged, ferrous-aggregate grout complying with ASTM C 1107, specifically recommended by manufacturer for heavy-duty loading applications.
- H. Non-shrink, Nonmetallic Grout: Factory-packaged, non-staining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- I. Concrete: Comply with requirements in Section 03 30 00 "Cast-in-Place Concrete" for normal-weight, air-entrained, concrete with a minimum 28-day compressive strength of 3000 psi.
- J. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

### **2.6 FABRICATION, GENERAL**

- A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.



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- B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- D. Form exposed work with accurate angles and surfaces and straight edges.
- E. Weld corners and seams continuously to comply with the following:
  - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  - 2. Obtain fusion without undercut or overlap.
  - 3. Remove welding flux immediately.
  - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing.
- F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.
- G. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
- I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

### **2.7 MISCELLANEOUS FRAMING AND SUPPORTS**

- A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.
- B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.
  - 1. Furnish inserts for units installed after concrete is placed.
- C. Galvanize miscellaneous framing and supports where indicated.
- D. Prime miscellaneous framing and supports with zinc-rich primer for interior applications and with primer specified in Section 09 91 13 Exterior Paint and Section 09 91 23 Interior Paint where indicated.

### **2.8 METAL BOLLARDS**

- A. Fabricate metal bollards from Schedule 40 steel pipe.

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- B. Fabricate sleeves for bollard anchorage from steel pipe with 1/4-inch- thick steel plate welded to bottom of sleeve. Make sleeves not less than 8 inches deep and 3/4 inch larger than OD of bollard.
- C. Prime bollards with primer specified in Section 09 91 13 Exterior Paint

### **2.9 LOOSE BEARING AND LEVELING PLATES**

- A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.
- B. Hot Dip Galvanize plates.

### **2.10 STEEL WELD PLATES AND ANGLES**

- A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with no fewer than two integrally welded steel strap anchors for embedding in concrete.

### **2.11 FINISHES, GENERAL**

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish metal fabrications after assembly.
- C. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

### **2.12 STEEL AND IRON FINISHES**

- A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.
- B. Hot Dip Galvanize plates.

## **PART 3 EXECUTION**

### **3.1 INSTALLATION, GENERAL**

- A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- C. Field Welding: Comply with the following requirements:
  - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  - 2. Obtain fusion without undercut or overlap.

3. Remove welding flux immediately.
  4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.
- E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- F. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with the following:
1. Cast Aluminum: Heavy coat of bituminous paint.
  2. Extruded Aluminum: Two coats of clear lacquer.

### **3.2 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS**

- A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

### **3.3 INSTALLING METAL BOLLARDS**

- A. Fill metal-capped bollards solidly with concrete and allow concrete to cure seven days before installing.
- B. Anchor bollards in concrete with pipe sleeves preset and anchored into concrete or in formed or core-drilled holes not less than 8 inches deep and 3/4 inch larger than OD of bollard. Fill annular space around bollard solidly with non-shrink, nonmetallic grout; mixed and placed to comply with grout manufacturer's written instructions. Slope grout up approximately 1/8 inch toward bollard.
- C. Anchor bollards in place with concrete footings. Center and align bollards in holes 3 inches above bottom of excavation. Place concrete and vibrate or tamp for consolidation. Support and brace bollards in position until concrete has cured.
- D. Fill bollards solidly with concrete, mounding top surface to shed water.
- E. Fill metal-capped bollards solidly with concrete and allow concrete to cure seven days before installing.

### **3.4 INSTALLING BEARING AND LEVELING PLATES**

- A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.
- B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.

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1. Use non-shrink grout, either metallic or nonmetallic, in concealed locations where not exposed to moisture; use non-shrink, nonmetallic grout in exposed locations unless otherwise indicated.
2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

### **3.5 ADJUSTING AND CLEANING**

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
  1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.
- B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 09 91 13 Exterior Painting.
- C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

**END OF SECTION 05 50 00**

**SECTION 06 01 00 – LUMBER**

**PART 1 GENERAL**

**1.1 DESCRIPTION**

A. Work Included:

1. Materials required under this section include, but are not necessarily limited to all wood, plywood, nails, bolts, framing anchors and other hardware, and all other materials or items needed for rough and finish carpentry, but not specifically described in other sections.

B. Related Work Elsewhere:

1. Section 06 10 00 Rough Carpentry
2. Section 06 20 14 Plywood Siding

**1.2 QUALITY ASSURANCE**

In addition to complying with applicable codes and regulations, comply with the following standards:

A. Lumber Grading Rules and Wood Species to be in conformance with ANSI/AF&PA NDS-1997.

B. Grading rules of the following associations apply to materials furnished under this Section.

1. West Coast Lumber Inspection Bureau (WCLB).
2. American Plywood Association (APA).

C. Grade marks of the above association shall appear on all wood products furnished under this section.

D. Regulatory Agencies:

1. International Building Code (IBC) published by the International Conference of Building Officials.
2. Lumber Treatment:
  - a. Preservative treatment of lumber and plywood:  
American Wood Preserves Bureau Standards. (AWPB)
  - b. Fire retardant treatment of lumber and plywood:  
American Wood Preserves Bureau Standards. (AWPB)

E. Referenced Standards:

1. American Society for Testing and Materials (ASTM)
2. American Wood Preserves Bureau (AWPB)
  - a. AWPB LP-2 Standard for Softwood Lumber, timber and plywood treated with Waterbone Preservatives for above ground locations.
3. American Forest and Paper Association

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- a. ANSI/AF&PA NDS-1997
- 4. American Institute of Timber Construction (AITC)

### **1.3 SUBMITTALS**

Submit the following in accordance with Conditions of Contract and Division 1 Specifications Sections:

- A. Materials List:  
A complete list of all the types of materials proposed to be furnished under this section.

## **PART 2 PRODUCTS**

### **2.1 GRADE STAMPS**

- A. Framing Lumber:  
Identify all framing lumber by the grade stamp of the West Coast Lumber Inspection Bureau.
- B. Plywood:  
Identify all plywood by the grade of the American Plywood Association.
- C. Other:  
Identify all other products by the grade stamp of the appropriate grading agency for that particular product.

### **2.2 DIMENSIONAL LUMBER**

- A. Material:
  - 1. Provide kiln dried dimension lumber of the species and grade noted on the Drawings with not more than 19% moisture content, and complying with the dry size requirements of the appropriate grading agency.
  - 2. Dress dimension lumber s4s unless otherwise specifically called out.
- B. Appearance:
  - 1. Where framing lumber will be exposed to view and is shown or scheduled to receive a transparent or natural finish, provide lumber of "Appearance" grade.
- C. Pressure Treated:
  - 1. Provide where wood is in contact with masonry or concrete, or where noted on drawings. Cut ends to be treated with Ammoniacal Copper Arsenate (ACA) to a retention of 0.60 pcf per UBC Standard 25-12 and American Wood Preserves Bureau AWPB "FDN".

### **2.3 PLYWOOD**

- A. Rough Carpentry:
  - 1. Provide interior type with exterior glue of the grade and type indicated on the Drawings.
- B. Appearance:
  - 1. Where plywood will not be concealed by other work, provide A-B plugged grade with 'A' side showing unless otherwise noted.

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#### **2.4 ORIENTED STRAND BOARD SHEATHING**

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- A. 7/16" STRUCTURAL 1 panels with exterior glue.

#### **2.5 SOFFIT BOARDS**

- A. T-11 plywood, 5/8" thick. Class 303-18, 303-18W Grade.

#### **2.6 FASCIA BOARDS**

- A. Provide "Hardiplank" 1 x 4 and 1 x 8 fascia board and 7/16" hardipanel siding. James Hardie Building Products, 1-800-9-HARDIE

#### **2.7 MISCELLANEOUS MATERIALS**

- A. Anchorage and Fastenings:

1. Nails and staples:	FS FF-N-105
2. Tacks:	FS FF-N-103
3. Wood screws:	FS FF-N-111
4. Bolts and studs:	FS FF-B-575
5. Nuts:	FS FF-B-836
6. Washers:	FS FF-W-92
7. Lag bolts:	FS FF-B-561
8. Toggle bolts:	FS FF-B-588
9. Bar or strap anchors:	ASTM A-575

### **PART 3 EXECUTION**

#### **3.1 PRODUCT HANDLING**

- A. Storage and Protection:

- 1. Do not deliver any of the products of this section to the jobsite until a secure, dry, sheltered area, away from traffic, is available for their storage. Use all means necessary to protect the products of this section before, during, and after installation and to protect the installed materials and work of all other trades.

- B. Repairs and Replacement:

- 1. In the event of damage make all repairs and replacements necessary to restore the item to original undamaged condition. Repairs and replacements shall be subject to approval of the Architect and shall be accomplished at no additional expense to the Owner.

- C. Damaged Material:

- 1. Segregate all damaged material to ensure against its incorporation into the Work, until all necessary repairs, where authorized, have been accomplished.

- D. Stockpiling:

- 1. Stockpile all materials sufficiently in advance to ensure their availability in a timely manner for the work of all related sections.

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E. Compliance:

1. Do not permit non-complying materials to be delivered to the jobsite and immediately remove any which are delivered, replacing them with materials complying with the requirements of this section.

**END OF SECTION 06 01 00**



## **SECTION 06 10 00 – ROUGH CARPENTRY**

### **PART 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- A. Rough carpentry work, including but not limited to the following:
  - 1. Exterior and interior wood wall framing and sheathing
  - 2. Roof Fascia and Overbuild
  - 3. Miscellaneous furring and stripping for wall finishes
  - 4. In wall wood blocking for support of accessories.
- B. Coordination with the appropriate sections of all requirements for backing and blocking.
- C. Related Work Described elsewhere:
  - 1. Section 06 01 00 Lumber
  - 2. Section 06 20 14 Plywood Siding

#### **1.2 REFERENCES**

- A. SPIB Southern Pine Inspection Bureau.
- B. WCLIB West Coast Lumber Inspection Bureau.
- C. WWPA Western Wood Products Association.
- D. APA American Plywood Association.
- E. AWPB American Wood Preservers Association.
- F. AWPB American Wood Preservers Bureau
- G. PS 1 Construction and Industrial Plywood.
- H. PS 20 American Softwood Lumber Standard.
- I. N.F.P.A. National Design Specification for Wood Construction.

#### **1.3 QUALITY ASSURANCE**

- A. All wood materials to bear a visible grade stamp, of agency certified by National Forest Products Association (N.F.P.A.).

#### **1.4 DELIVERY, STORAGE, AND HANDLING**

- A. Store in weather protected, ventilated areas with a constant, minimum temperature of 60 degrees F maximum relative humidity of 25 to 55 percent.

### **PART 2 PRODUCTS**

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#### **2.1 MATERIALS**

- J. Dimensions: Specified dimensions are nominal, actual dimensions to conform to PS 20.
- K. Surfacing: Surface four sides (S4S), unless specified otherwise.
- L. Lumber: Provide new, sound and thoroughly seasoned lumber conforming to requirements of PS 20; graded in accordance with established Grading rules; fire retardant treated if required by code; of following species and grades:
- M. Non Structural Light Framing (less than 2 in thick): Hem-Fir (WCLIB or WWPA), SPF (WWPA) or Southern Pine kiln dried (SPIB); moisture content 19% maximum at time of dressing "S DRY", or 15% maximum "MC 15" or "K D"; graded as follows:
  - 1. General framing: No. 2 & Better.
  - 2. Plates, blocking, curbs, and nailers:
    - a. Over 2X6 in. No. 2 & Better
    - b. Over 2X6 in. No. 2 & Better
  - 3. General utility purposes: No. 2 & Better.
- N. Softwood Plywood/Sheathing: Conform to requirements of PS-1. Provide panels bearing appropriate APA grade, and trade mark. Provide exterior grade plywood where any face or edge is exposed to the weather.
  - 1. Equipment Backing Panels: Plywood, APA B C EXT, Plugged, Exterior glue; identification index Group 2; fire retardant treated if required by code; 5/8 in. min thickness or as shown on plans.
  - 2. Wall Wainscot Panels: APA B-C EXT., Plugged, Exterior glue; identification index Group 2; fire retardant treated if required by code; 3/4" min. thickness or as shown on plans.
  - 3. F.R.T. Plywood: (location—200-series room interior non-load-bearing partitions.) Plywood, APA B-C EXT, Plugged, Exterior glue, identification index Group 2; Fire Retardant Treated, 5/8 inch thick or as shown on plans. Pressure-treated kiln-dried fire retardant product, type: FR-S. Basis of design: Boise Cascade, Hoover Treated Wood Products, "Exterior Fire-X" F.R.T. plywood.
- O. Nails, Spikes and Staples: Galvanized or zinc-coated for unheated locations, high humidity locations and treated wood; plain finish for other interior locations; size and type to suit application and in accordance with manufacturer's recommendations.
- P. Bolts, Nuts, Washers, Lags, Pins and Screws: Medium carbon steel; sized to suit application and in accordance with manufacturer's recommendations; galvanized or zinc-coated for unheated locations, high humidity locations and treated wood; plain finish for other interior locations.
- Q. Joist Hangers and Framing Accessories: Simpson Company or prior approved equal, sized and profiled to suit application and in accordance with manufacturer's recommendations; galvanized finish.
- R. Fasteners: Toggle bolt type for anchorage to hollow masonry. Expansion shield and lag bolt type for anchorage to solid masonry or concrete. Bolts or power activated type for anchorage to steel.
- S. Building Paper: ASTM D336, 15 lb. asphalt felt.

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### **T. Power Driven Fasteners:**

1. Pnuetek, Inc.: Pneumatically driven fastener with .143" shank diameter, .315" head diameter, and .073" head thickness installed with 1 1/2" wide 18 gauge galvanized steel strap, ICBO #3447. Contact local Pnuetek representative or Pnuetek, Inc.; Hudson, NH.; 603/883 1660.
2. Hilti: "DN" powder driven fastener with 1 7/16" diameter by .060" thick washer, ICBO #2388.

## **2.2 ACCESSORIES**

- A. Dust and Vapor Barrier (07210): reinforced flame retardant polyethylene sheets, 6 mil minimum thickness.
- B. Polypropylene Vapor Barrier Tape (07210): Flame retardant self adhering type, 2" wide.

## **2.3 PRESERVATIVE TREATMENT**

- A. Shop pressure treat and deliver to site ready for installation.
- B. Wood Preservative (Pressure Treatment): Apply in conformance with AWP Standard P5, using water borne preservatives complying with AWP Standard C27-93, ASTM D2898-94 and ASTM D3201-94. After treatment, kiln dry to maximum moisture content of 15%.
  1. Apply treatment complying with AWP Standard C2.

## **2.4 FIRE RETARDANT TREATMENT**

- A. Factory treat and deliver to site ready for installation, wood materials requiring UL fire rating. Provide UL approved identification on treated materials.
- B. Comply with the applicable AWP Standard as follows:
  1. Plywood: AWP Standard U1, Doug Fir sheathing, UL data: BUGV R7003, Exterior Type (at interior rooms).

## **PART 3 EXECUTION**

### **3.1 BLOCKING**

- A. Fasten wood blocking to framing with fasteners capable of withstanding loads to be applied to blocking. Install blocking for support of items as required.
- B. Install continuous pieces of longest possible lengths, cut to fit and fully bearing on framing

### **3.2 ROOF RELATED WOOD BLOCKING**

- A. Anchor blocking to metal decking and framing as detailed with 1/2" bolts set a maximum of 4'-0" o.c.
- B. Where blocking is more than 6" wide, anchor with 1/2" bolts set at 2'-6" o.c. and stagger alignment.
- C. Where blocking is required on roof deck, build-up, shim, or cut as required to set top of blocking flush with the top of the adjacent insulation.

- D. Cover wood blocking with temporary waterproof covering until permanent flashing is installed.

### **3.3 PLYWOOD SHEATHING**

- E. Install with face grain perpendicular to direction of framing.
- F. Allow minimum space 1/16" between end joints and 1/8" at edge joints for expansion and contraction of panels; double these spaces under wet or humid conditions.
- G. Fasten per structural drawings or minimum of 6" o.c. along panel edges and 12" o.c. at intermediate supports with non-corrosive nails.
- H. Install telephone and electrical panel backboards with plywood sheathing material where required.

**END OF SECTION 06 10 00**

**SECTION 06 20 14 PLYWOOD SIDING**

**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. Plywood Siding
- B. Related Requirements:
  - 1. Section 06 01 00 "Lumber" and Section 06 10 00 "Rough Carpentry" for furring, blocking, other plywood, and other carpentry work not exposed to view and for framing exposed to view.

**1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials, dimensions, profiles, textures, and colors and include construction and application details.

**1.4 INFORMATIONAL SUBMITTALS**

- A. Compliance Certificates:
  - 1. For lumber that is not marked with grade stamp.
  - 2. For preservative-treated wood that is not marked with treatment-quality mark.
  - 3. For fire-retardant-treated wood that is not marked with classification marking of testing and inspecting agency.

**1.5 DELIVERY, STORAGE, AND HANDLING**

- A. Stack plywood, flat with spacers between each bundle to provide air circulation. Protect materials from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

**1.6 FIELD CONDITIONS**

- A. Weather Limitations: Proceed with installation only when existing and forecast weather conditions permit work to be performed and at least one coat of specified finish can be applied without exposure to rain, snow, or dampness.
- B. Do not install plywood siding materials that are wet, moisture damaged, or mold damaged.

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1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

### **PART 2 - PRODUCTS**

#### **2.1 MATERIALS, GENERAL**

- A. Softwood Plywood: DOC PS 1.

#### **2.2 PLYWOOD SIDING**

- A. Plywood Type: Exterior, Grade C-C, plugged and touch sanded.
- B. Plywood Type: APA-rated siding.
  1. Face Grade: 303-NR.
  2. Face Grade: 303-18 30 W.
- C. Thickness: 5/8 inch.
- D. Face Species: Douglas fir.
- E. Pattern: Plain.
- F. Surface: Smooth.

#### **2.3 MISCELLANEOUS MATERIALS**

- A. Fasteners for Plywood siding: Provide screws, in sufficient length to penetrate not less than 1-1/2 inch into substrate indicated.
  1. For face-fastening siding, provide ringed-shank siding nails or hot-dip galvanized-steel siding fasteners.

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Examine plywood siding materials before installation. Reject materials that are wet, moisture damaged, and mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

**3.2 PREPARATION**

- A. Clean substrates of projections and substances detrimental to application.

**3.3 INSTALLATION, GENERAL**

- A. Do not use materials that are unsound, warped, improperly treated or finished, inadequately seasoned, or too small to fabricate with proper jointing arrangements.
  - 1. Do not use manufactured units with defective surfaces, sizes, or patterns.
- B. Install plywood siding level, plumb, true, and aligned with adjacent materials. Use concealed shims where necessary for alignment.
  - 1. Scribe and cut plywood siding to fit adjoining work. Refinish and seal cuts as recommended by manufacturer.
  - 2. Install to tolerance of 1/8 inch in 96 inches for level and plumb. Install adjoining plywood siding with 1/32-inch maximum offset for flush installation and 1/16-inch maximum offset for reveal installation.
  - 3. Coordinate plywood siding with materials and systems in or adjacent to it. Provide cutouts for mechanical and electrical items that penetrate plywood siding.

**3.4 SIDING INSTALLATION**

- A. Install siding to comply with manufacturer's written instructions.
- B. Plywood Siding: Install panels with edges over framing or blocking. Screw fasteners at 6 inches o.c. at panel perimeter and 12 inches o.c. at intermediate supports unless manufacturer recommends closer spacing. Leave 1/16-inch gap between adjacent panels and 1/8-inch gap at perimeter, openings, and horizontal joints unless otherwise recommended by panel manufacturer.
  - 1. Seal butt joints at inside and outside corners and at trim locations.

**3.5 ADJUSTING**

- A. Replace plywood siding that is damaged or does not comply with requirements. Plywood siding may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing. Adjust joinery for uniform appearance.

**3.6 CLEANING**

- A. Clean plywood siding on exposed and semi-exposed surfaces. Touch up factory-applied finishes to restore damaged or soiled areas.

**3.7 PROTECTION**

- A. Protect installed products from damage from weather and other causes during construction.
- B. Remove and replace plywood siding materials that are wet, moisture damaged, and mold damaged.

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1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

**END OF SECTION 06 20 14**



## **SECTION 07 21 00 - THERMAL INSULATION**

### **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. Extruded polystyrene foam-plastic board.
- B. **Related Requirements:**
  - 1. Section 07 21 19 "Foamed-in-Place Insulation" for spray-applied polyurethane foam insulation.
  - 2. Section 07 41 13 "Formed Metal Roof and Wall Panels" for insulation in formed metal roof and wall panels.

#### **1.3 ACTION SUBMITTALS**

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

#### **1.4 INFORMATIONAL SUBMITTALS**

- A. Product Test Reports: For each product, for tests performed by a qualified testing agency.
- B. Evaluation Reports: For foam-plastic insulation, from ICC-ES.

#### **1.5 DELIVERY, STORAGE, AND HANDLING**

- A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.
- B. Protect foam-plastic board insulation as follows:
  - 1. Do not expose to sunlight except to necessary extent for period of installation and concealment.
  - 2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site until just before installation time.
  - 3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

**PART 2 - PRODUCTS**

**2.1 EXTRUDED POLYSTYRENE FOAM-PLASTIC BOARD**

- A. Extruded Polystyrene Board, Type VII (Rigid Foundation Insulation: ASTM C 578, Type VII, 60-psi minimum compressive strength; maximum flame-spread and smoke-developed indexes of 25 and 450, respectively, per ASTM E 84.

**2.2 ACCESSORIES**

- A. Adhesive for Bonding Insulation: Product compatible with insulation and air and water barrier materials, and with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.

**PART 3 - EXECUTION**

**3.1 PREPARATION**

- A. Clean substrates of substances that are harmful to insulation, including removing projections capable of puncturing insulation or vapor retarders, or that interfere with insulation attachment.

**3.2 INSTALLATION, GENERAL**

- A. Comply with insulation manufacturer's written instructions applicable to products and applications.
- B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.
- C. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- D. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.

**3.3 INSTALLATION OF SLAB INSULATION**

- A. On horizontal surfaces, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.

**3.4 INSTALLATION OF FOUNDATION WALL INSULATION**

- A. Butt panels together for tight fit.
- B. Retain either "Anchor Installation" or "Adhesive Installation" Paragraph below to suit Project.

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- C. Adhesive Installation: Install with adhesive or press into tacky waterproofing or dampproofing according to manufacturer's written instructions.

**3.5 PROTECTION**

- A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

**END OF SECTION 07 21 00**

## **SECTION 07 21 19 - FOAMED-IN-PLACE INSULATION**

### **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. Closed-cell spray polyurethane foam.
- B. Related Requirements:
  - 1. Section 07 21 00 "Thermal Insulation" for foam-plastic board insulation.
  - 2. Section 07 41 13 "Formed Metal Roof and Wall Panels" for insulation in formed metal roof and wall panels.

#### **1.3 ACTION SUBMITTALS**

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

#### **1.4 INFORMATIONAL SUBMITTALS**

- A. Qualification Data: For Installer.
- B. Product Test Reports: For each product, for tests performed by a qualified testing agency.
- C. Evaluation Reports: For spray-applied polyurethane foam-plastic insulation, from ICC-ES.

#### **1.5 QUALITY ASSURANCE**

- A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

### **PART 2 - PRODUCTS**

#### **2.1 CLOSED-CELL SPRAY POLYURETHANE FOAM**

- A. Closed-Cell Spray Polyurethane Foam: ASTM C 1029, Type II, minimum density of 1.5 lb/cu. ft. and minimum aged R-value at 1-inch thickness of 6.2 deg F x h x sq. ft./Btu at 75 deg F.

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1. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
  - a. Flame-Spread Index: 25 or less.
  - b. Smoke-Developed Index: 450 or less.
2. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.

### **2.2 MISCELLANEOUS MATERIALS**

- A. Primer: Material recommended by insulation manufacturer where required for adhesion of insulation to substrates.

## **PART 3 - EXECUTION**

### **3.1 PREPARATION**

- A. Verify that substrates are clean, dry, and free of substances that are harmful to insulation.
- B. Priming: Prime substrates where recommended by insulation manufacturer. Apply primer to comply with insulation manufacturer's written instructions. Confine primers to areas to be insulated; do not allow spillage or migration onto adjoining surfaces.

### **3.2 INSTALLATION**

- A. Comply with insulation manufacturer's written instructions applicable to products and applications.
- B. Spray insulation to envelop entire area to be insulated and fill voids.
- C. Apply in multiple passes to not exceed maximum thicknesses recommended by manufacturer. Do not spray into rising foam.
- D. Miscellaneous Voids: Apply according to manufacturer's written instructions.
- E. Exterior Hollow Metal Door Frames: Apply to fill frame jambs and head. Protect clip and frame installation hardware to facilitate frame and door installation.

### **3.3 PROTECTION**

- A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes.

**END OF SECTION 07 21 19**

## **SECTION 07 41 13 - FORMED METAL ROOF AND WALL PANELS**

### **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. Standing seam, concealed fastener, insulated metal roof panels.
  - 2. Double tongue and groove, concealed fastener, insulated, hard metal wall panels.
  - 3. Related flashings, sealants, tape, and fasteners as required for a complete and finished installation.
- B. Related Requirements:
  - 1. Section 07 72 53 "Snow Guards" for snow guards to be installed on formed metal panel roofs.
  - 2. Section 08 53 13 "Vinyl Windows" for vinyl window units to be installed in formed metal panel walls.
  - 3. Section 08 11 13 "Hollow Metal Doors and Frames" for hollow metal doors and frames to be installed in formed metal panel walls.
  - 4. Section 08 36 13 "Sectional Doors" for sectional overhead doors to be installed in formed metal panel walls.
  - 5. Section 13 34 19 "Metal Building Systems" for building structure to receive formed metal roof and wall panels.
  - 6. Division 22 "Plumbing" for plumbing vents to be installed through metal panel walls.
  - 7. Division 23 "Heating, Ventilation, and Air Conditioning (HVAC)" for louvers, vents, and other mechanical work installed in metal panel walls.
  - 8. Division 27 "Electrical" for lighting fixtures, electrical service, and other electrical work to be installed on or through formed metal panel walls

#### **1.3 PREINSTALLATION MEETINGS**

- A. Preinstallation Conference: Conduct conference at Project site.
  - 1. Meet with Owner's Representative, metal panel Installer, metal panel manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects metal panels, including installers of roof accessories and roof-mounted equipment.
  - 2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
  - 3. Review methods and procedures related to metal panel installation, including manufacturer's written instructions.
  - 4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
  - 5. Review structural loading limitations of deck during and after roofing.

6. Review flashings, special details, drainage, penetrations, equipment curbs, and condition of other construction that affect metal panels.
7. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
8. Review temporary protection requirements for metal panel systems during and after installation.
9. Review procedures for repair of metal panels damaged after installation.
10. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

**B. Related Sections:**

1. Section 13 34 19 "Metal Building Systems" for pre-engineered building frame to receive metal roof and wall panels and for structural criteria not included in this Section.

#### **1.4 ACTION SUBMITTALS**

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

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.

**B. Shop Drawings:**

1. Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, snow guards, accessories; and special details.
2. Accessories: Include details of the flashing, trim, anchorage systems, at a scale of not less than 1-1/2 inches per 12 inches. Details shall include installation of sealants and tapes as recommended by the manufacturer for a complete, finished, and warrantable installation.

**C. Samples for Verification:** For each type of exposed finish required, prepared on Samples of size indicated below:

1. Insulated Metal Roof and Wall Panels: 12 inches long by actual panel width. Include fasteners, closures, and other metal panel accessories. Samples shall be of color indicated on the Drawings.

#### **1.5 INFORMATIONAL SUBMITTALS**

**A. Qualification Data:** For Installer.

**B. Product Test Reports:** For each product, for tests performed by a qualified testing agency.

**C. Field quality-control reports.**

**D. Sample Warranties:** For special warranties.

#### **1.6 SYSTEM DESCRIPTION**

- A. Factory-insulated metal wall and roof panel systems** consisting of insulated metal panels with exterior textured metal skins, CFC-free foamed-in-place insulation and an interior metal skins, flashings, fasteners, and accessories for a complete and finished installation.

**1.7 CLOSEOUT SUBMITTALS**

- A. Maintenance Data: For metal roof and wall panels to include in maintenance manuals.

**1.8 QUALITY ASSURANCE**

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

**1.9 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver components, metal panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.
- B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.
- C. Stack metal panels and flashings horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.
  - 1. Store accessories in dry place with temperature not less than 33 degrees F.
- D. Retain strippable protective covering on metal panels and flashings during installation.

**1.10 FIELD CONDITIONS**

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels to be performed according to manufacturers' written instructions and warranty requirements.

**1.11 COORDINATION**

- A. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.
- B. Coordinate metal panel installation with rain drainage work, section doors, hollow metal door frames, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

**1.12 WARRANTY**

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of roof and wall metal panel systems that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Structural failures including rupturing, cracking, or puncturing.
    - b. Deterioration of metals and other materials beyond normal weathering.



2. Warranty Period: Two years from date of Substantial Completion.
- B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
    - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
    - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
    - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
  2. Finish Warranty Period: 20 years from date of Substantial Completion.

## **PART 2 - PRODUCTS**

### **2.1 PERFORMANCE REQUIREMENTS**

- A. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E 72 Vacuum Chamber Method:
1. Wind Loads: As indicated in Section 13 34 19 "Metal Building Systems."
  2. Snow Loads: As indicated in Section 13 34 19 "Metal Building Systems."
  3. Deflection Limits: For wind loads, no greater than 1/200 of the span.
- B. Thermal Resistance: Provide insulating metal panel systems tested for thermal resistance (R-Value) in accordance with ASTM test C518/C1773 at 40 degrees F mean temperature and adjusted for windspeed of 15 miles per hour.
1. Thermal Resistance (R-Value) Roof Panels: 41 BTU/hr.(sqft.)(degrees F).
  2. Thermal Resistance (R-Value) Wall Panels: 32 BTU/hr.(sqft.)(degrees F).
  3. Thermal Resistance (R-Value) Abuse Resistance Wall Panels: 30 BTU/hr.(sqft.)(degrees F).
- C. Air Infiltration: Provide insulated panel systems with air leakage of not more than 0.06 cfm/sq. ft. when tested according to ASTM E 283 at the following test-pressure difference:
1. Test-Pressure Difference: 1.57 lbf/sq. ft.
- D. Water Penetration: Provide insulated metal panel systems with tested for water penetration under Static Pressure: No water penetration when tested according to ASTM E 331 at the following test-pressure difference:
1. Static Test-Pressure: 20 lbf/sq. ft.
- A. Water Penetration of roof panels under Static Pressure: No water penetration when tested according to ASTM E 1646 at the following test-pressure difference:
1. Static Test-Pressure: 20 lbf/sq. ft.
- B. Hydrostatic-Head Resistance: No water penetration when tested according to ASTM E 2140.
- C. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for wind-uplift-resistance class indicated.
1. Uplift Rating: UL 90.

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- D. FM Global Listing: Provide metal roof panels and component materials that comply with requirements in FM Global 4471 as part of a panel roofing system and that are listed in FM Global's "Approval Guide" for Class 1 or noncombustible construction, as applicable. Identify materials with FM Global markings.
  - 1. Fire/Windstorm Classification: Class 1A-90.
  - 2. Hail Resistance: MH.
- E. Fire Tests:
  - 1. Surface Burning Characteristics: The panel cores shall be tested in accordance with the ASTM E-84 Tunnel Test. The cores shall meet the following requirements:
    - a. Frame Spread: 25
    - b. Smoke Density: 450
- F. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
  - 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces
- G. Bond Strength: Provide panels that when tested per ASTM 1781 for metal face to foam core bond strength shall not show adhesive failure.
- H. Foam Core:
  - 1. Water Absorption: When tested in accordance with ASTM C 209 Maximum absorption rate not greater than 1%.
  - 2. Humidity Test: No evidence of metal primer corrosion when subjected to 100% relative humidity at 140 degrees F for 1,000 hours.
  - 3. Autoclave Test: No evidence of delamination when pressurized to 2 psi at 212 degrees F for 2 ½ hours.
  - 4. Water Vapor Transmission: Panel core shall conform to ASTM E96.
- I. Finish Coatings: Manufacturer's standard PVDF and SMP.
  - 1. Colors: AWIP® standard colors or matching adjacent ARFF building as indicated on the Drawings

### **2.2 STANDING SEAM PREFINISHED INSULATING METAL ROOF PANELS**

- A. General: Provide factory-formed standing seam prefinished insulating metal roof panels designed to be field seamed installation with hidden fasteners.
- B. Standing Seam Prefinished Insulating Metal Roof Panels: Provide SR2 Standing Seam Roof Panels as manufactured by AWIP® or approved equal. Manufacturers offering metal roof panel systems that may be equal include:
  - 1. American Buildings Company
  - 2. ATAS International, Inc.
  - 3. Ceco Building Systems
  - 4. CENTRIA
  - 5. Kingspan Group
  - 6. MBCI
  - 7. Metl-Span

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#### **C. Roof Panel Physical Properties:**

1. Panel Thickness: 5-inches
2. Panel Width: 40-inches
3. Panel Length: Full slope of roof.
4. Panel Joint: Field seamed standing seam.
5. Exposed Surface Texture: Smooth with trapezoidal ribs
6. Insulation Material: CFC-free foamed in place polyisocyanurate foam, density 2.1 – 2.5 pounds per cubic foot.
7. Exterior Sheet Metal Facing:
  - a. Base material: G90 galvanized steel.
  - b. Thickness: 26 gauge.
  - c. Finish Coating: PVF and SMP.
  - d. Color: AWIP® color indicated or color to match existing ARFF Building as indicated on the Drawings.
8. Interior Sheet Metal Facing:
  - a. Base material: G90 galvanized steel.
  - b. Thickness: 26 gauge.
  - c. Finish Coating: PVF and SMP.
  - d. Color: White
9. Accessories
  - a. Fasteners: Manufacturer's standard for conditions indicated.
  - b. Clips: Manufacturer's standard for the conditions indicated.
  - c. Sealants: Manufacturer's standard for the condition indicated.
  - d. Tape: Manufacturer's standard for the condition indicated.
  - e. Flashings: Manufacturer's standard (to match substrate color unless otherwise indicated) break formed ridge, eave, corner and other miscellaneous flashings as required for a watertight, complete and finished roof panel installation.

## **2.3 OVERLAPPING CORRUGATED PREFINISHED INSULATING METAL WALL PANELS**

- A. General: Provide factory-formed, double tongue and groove, corrugated, prefinished, insulating, metal wall panels designed for field seamed installation with hidden fasteners.
- B. Double Tongue and Groove, Corrugated, Prefinished, Insulating, Metal Wall Panels: Provide CW36 Corrugated Wall Panels as manufactured by AWIP® or approved equal. Manufacturers offering metal roof panel systems that may be equal include:
  1. American Buildings Company
  2. ATAS International, Inc.
  3. Ceco Building Systems
  4. CENTRIA
  5. Kingspan Group
  6. MBCI
  7. Metl-Span
- C. Overlapping Corrugated Wall Panel Physical Properties:
  1. Panel Thickness: 4-inches
  2. Panel Width: 36-inches
  3. Panel Length: As indicated on the Drawings but not greater than 50 feet.
  4. Panel Joint: Overlapping with stiffening bead at overlapping edge and sealant and exposed fasteners.

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5. Exterior Surface Texture: Exposed 7/8-inch corrugations.
6. Insulation Material: CFC-free foamed in place polyisocyanurate foam, density 2.1 – 2.5 pounds per cubic foot.
7. Exterior Sheet Metal Facing:
  - a. Base material: G90 galvanized steel.
  - b. Thickness: 26 gauge.
  - c. Finish Coating: PVF and SMP.
  - d. Color: AWIP® color indicated or color to match existing ARFF Building as indicated on the Drawings.
8. Interior Sheet Metal Facing:
  - a. Base material: G90 galvanized steel.
  - b. Thickness: 26 gauge.
  - c. Finish Coating: PVF and SMP.
  - d. Color: White
9. Accessories
  - a. Fasteners: Manufacturer's standard for conditions indicated.
  - b. Clips: Manufacturer's standard for the conditions indicated.
  - c. Sealants: Manufacturer's standard for the condition indicated.
  - d. Tape: Manufacturer's standard for the condition indicated.
10. Flashings: Manufacturer's standard prefinished (color to match substrate unless otherwise indicated) break formed ridge, eave, corner and other miscellaneous flashings as required for a watertight, complete and finished wall panel installation.

#### **2.4 DOUBLE TONGUE AND GROOVE HEAVILY EMBOSSED PREFINISHED INSULATING METAL WALL PANELS**

- A. General: Provide factory-formed, double tongue and groove, heavily embossed, prefinished, insulating, metal wall panels designed for field installation with hidden fasters.
- B. Double Tongue and Groove, Embossed, Prefinished, Insulating, Metal Wall Panels: Provide HE40 Heavy Embossed Wall Panels as manufactured by AWIP® or approved equal. Manufacturers offering metal roof panel systems that may be equal include:
  1. American Buildings Company
  2. ATAS International, Inc.
  3. Ceco Building Systems
  4. CENTRIA
  5. Kingspan Group
  6. MBCI
  7. Metl-Span
- C. Double Tongue and Groove Heavily Embossed Metal Wall Panels Physical Properties.
  1. Panel Thickness: 4-inches
  2. Panel Width: 40-inches
  3. Panel Length: As indicated on the Drawings but not greater than 40 feet.
  4. Panel Joint: Overlapping double tongue and groove. with sealant and concealed fasteners.
  5. Exposed Surface Texture: Heavy embossment.
  6. Insulation Material: CFC-free foamed in place polyisocyanurate foam, density 2.1 – 2.5 pounds per cubic foot.
  7. Exterior Sheet Metal Facing:

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- a. Base material: G90 galvanized steel.
  - b. Thickness: 26 gauge.
  - c. Finish Coating: PVF and SMP.
  - d. Color: AWIP® color or color to match existing ARFF Building as indicated on the Drawings.
8. Interior Sheet Metal Facing:
  - a. Base material: G90 galvanized steel.
  - b. Thickness: 26 gauge.
  - c. Finish Coating: PVF and SMP.
  - d. Color: White
9. Accessories
  - a. Fasteners: Manufacturer's standard for conditions indicated.
  - b. Clips: Manufacturer's standard concealed fastener clips and fasteners for the conditions indicated.
  - c. Sealants: Manufacturer's standard for the condition indicated.
  - d. Tape: Manufacturer's standard for the condition indicated.
10. Flashings: Manufacturer's standard (color to match substrate unless otherwise indicated) break formed corner, window, door, overhead door and other miscellaneous flashings as required for a watertight, complete and finished wall panel installation.

### **2.5 ABUSE RESISTANT DOUBLE TONGUE AND GROOVE EMBOSSED PREFINISHED INSULATING METAL WALL PANELS**

- A. General: Provide factory-formed, abuse resistant double tongue and groove, embossed, prefinished, insulating, metal wall panels designed for field installation with concealed fasteners.
- B. Abuse Resistant, Double Tongue and Groove, Embossed, Prefinished, Insulating, Metal Wall Panels: Provide HW40 Hard Wall Panels as manufactured by AWIP® or approved equal. Manufacturers offering metal roof panel systems that may be equal include:
  1. American Buildings Company
  2. ATAS International, Inc.
  3. Ceko Building Systems
  4. CENTRIA
  5. Kingspan Group
  6. MBCI
  7. Metl-Span
- C. Abuse Resistant Double Tongue and Groove Embossed Metal Panels Physical Properties.
  1. Panel Thickness: 4-inches
  2. Panel Width: 40-inches
  3. Panel Length: As indicated on the Drawings but not greater than 30 feet.
  4. Panel Joint: Overlapping double tongue and groove. with sealant and concealed fasteners.
  5. Exposed Surface Texture: Embossed.
  6. Insulation Material: CFC-free foamed in place polyisocyanurate foam, density 2.1 – 2.5 pounds per cubic foot.
  7. Exterior Sheet Metal and Strengthening Facing:
    - a. Base material: G90 galvanized steel.
    - b. Thickness: 26 gauge.
    - c. Strengthening: Element: 3/8-inch oriented strand board.

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- d. Finish Coating: PVF and SMP.
  - e. Color: AWIP® color indicated or color to match existing ARFF Building as indicated on the Drawings.
- 8. Interior Sheet Metal Facing:
  - a. Base material: G90 galvanized steel.
  - b. Thickness: 26 gauge.
  - c. Finish Coating: PVF and SMP.
  - d. Color: White
- 9. Accessories
  - a. Fasteners: Manufacturer's standard for conditions indicated.
  - b. Clips: Manufacturer's standard concealed fastener clips and fasteners for the conditions indicated.
  - c. Sealants: Manufacturer's standard for the condition indicated.
  - d. Tape: Manufacturer's standard for the condition indicated.
- 10. Flashings: Manufacturer's standard (to match substrate unless otherwise indicated) break formed corner, window, door, overhead door and other miscellaneous flashings as required for a watertight, complete and finished roof panel installation.

## **2.6 MISCELLANEOUS MATERIALS**

- A. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.
  - 1. Closures: Provide closures at eaves and ridges, fabricated of same metal as metal panels unless indicated otherwise. Color to match substrate panel color unless otherwise indicated.
  - 2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
  - 3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- thick, flexible closure strips; cut or pre-molded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
- B. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Color to match substrate panel color unless otherwise indicated. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.
  - 1. Snow retention system: See Section 07 72 53 "Snow Guards."
- C. Panel Fasteners: Self-tapping screws designed to withstand design loads. Provide exposed fasteners with heads matching color of metal panels by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.
- D. Panel Sealants: Provide sealant types recommended by manufacturer that are compatible with panel materials, are non-staining, and do not damage panel finish.
  - 1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, non-sag, nontoxic, non-staining tape 1/2 inch wide and 1/8 inch thick.

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2. Joint Sealant: ASTM C 920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended in writing by metal panel manufacturer.
3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C 1311.

#### **2.7 FABRICATION**

- A. General: Fabricate and finish prefinished insulating metal roof and wall panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.
- B. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.
- C. Fabricate metal panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.
- D. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.
  1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
  2. Finishes: To match panel substrates.
    - a. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
    - b. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are unacceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast
  3. Seams: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
  4. Sealed Joints: Form non-expansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
  5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
  6. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.
    - a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal panel manufacturer for application, but not less than thickness of metal being secured.

#### **2.8 FINISHES**

- A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping

- B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of the Work.
  - 1. Examine primary and secondary roof framing to verify that rafters, purlins, angles, channels, and other structural panel support members and anchorages have been installed within alignment tolerances required by metal roof panel manufacturer.
    - a. Provide additional sub-girts if required to meet the loading conditions specified.
  - 2. Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal wall panel manufacturer.
- B. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 PREPARATION**

- A. Miscellaneous Supports: Install sub-framing, furring, and other miscellaneous panel support members and anchorages according to ASTM C 754 and metal panel manufacturer's written recommendations.

### **3.3 PREFINISHED INSULATING METAL PANEL INSTALLATION**

- A. General: Install prefinished, insulating, metal panels to provide a weathertight installation and according to manufacturer's written instructions in orientation, sizes, and locations indicated. Install panels perpendicular to supports unless otherwise indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.
  - 1. Shim or otherwise plumb substrates receiving metal panels.
  - 2. Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air or water-resistive barriers and flashings that are concealed by metal panels are installed.
  - 3. Install screw fasteners in predrilled holes.
  - 4. Locate and space fastenings in uniform vertical and horizontal alignment.
  - 5. Install flashing and trim as metal panel work proceeds.
  - 6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.



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7. Align bottoms of metal panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
  8. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.
- B. Fasteners:
1. Prefinished Insulating Metal Panels: Use fasteners recommended by prefinished insulating manufacturer for surfaces exposed to the exterior; use galvanized-steel fasteners for surfaces exposed to the interior.
    - a. Exposed fastener heads shall be prefinished with color to match exposed panel face.
- C. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.
- D. Overlapping Edge Metal Panels: Fasten metal panels to supports with fasteners at each lapped joint at location and spacing recommended by manufacturer.
1. Lap ribbed or fluted sheets one full rib. Apply panels and associated items true to line for neat and weathertight enclosure.
  2. Provide metal-backed washers under heads of exposed fasteners bearing on weather side of metal panels.
  3. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.
  4. Install screw fasteners with power tools having controlled torque adjusted to compress washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.
  5. Flash and seal panels with weather closures at perimeter of all openings.
- E. Watertight Installation:
1. Apply a continuous ribbon of sealant or tape to seal lapped joints of metal panels, using sealant or tape as recommend by manufacturer on side laps of nesting-type panels; and elsewhere as needed to make panels watertight.
  2. Provide sealant or tape between panels and protruding equipment, vents, and accessories.
  3. At panel splices, nest panels with minimum 6-inch end lap, sealed with sealant and fastened together by interlocking clamping plates.
- F. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.
1. Install components required for a complete metal panel system including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal panel manufacturer; or, if not indicated, provide types recommended in writing by metal panel manufacturer.
- G. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level. Install work with laps, joints, and seams that are permanently watertight.
1. Install exposed flashing and trim that is without buckling and tool marks, and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and achieve waterproof performance.

- 2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).
- H. Pipe Flashing: Form flashing around pipe penetration and metal wall panels. Fasten and seal to metal wall panels as recommended by manufacturer.

### **3.4 ERECTION TOLERANCES**

- A. Installation Tolerances: Shim and align metal panel units within installed tolerance of 1/4 inch in 20 feet on slope and location lines and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

### **3.5 CLEANING AND PROTECTION**

- A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.
- B. After metal wall panel installation, clear weep holes and drainage channels of obstructions, dirt, tape, and sealant.
- C. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

**END OF SECTION 07 41 13**

## **SECTION 07 62 00 - FLASHING**

### **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. Formed perimeter wall base sheet metal fabrications.
  - 2. Miscellaneous flashing not specified in other Sections.
  - 3. EPDM through-wall penetration flashing.
- B. Related Requirements:
  - 1. Section 07 41 13 "Formed Metal Roof and Wall Panels" for sheet metal flashing and trim to be provided with metal roof and wall panels.
  - 2. Section 07 92 00 "Sealants" for sealants to be used with flashing.

#### **1.3 COORDINATION**

- A. Coordinate sheet metal flashing layout and seams with sizes and locations of penetrations to be flashed, and joints and seams in adjacent materials.
- B. Coordinate sheet metal flashing installation with adjoining roofing and wall materials, joints, and seams to provide leakproof, secure, and noncorrosive installation.
- C. Coordinate size and installation of EPDM flashings with mechanical and electrical pipe and conduit penetrations.

#### **1.4 PREINSTALLATION MEETINGS**

- A. Preinstallation Conference: Conduct conference at Project site.
  - 1. Review construction schedule. Verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
  - 2. Review requirements for insurance and certificates if applicable.
  - 3. Review sheet metal flashing observation and repair procedures after flashing installation.

#### **1.5 ACTION SUBMITTALS**

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

- B. Shop Drawings: For sheet metal flashing and trim.
  - 1. Include plans, elevations, sections, and attachment details.
  - 2. Detail fabrication and installation layouts, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled work.
  - 3. Include identification of material, thickness, weight, and finish for each item and location in Project.
  - 4. Include details for forming, including profiles, shapes, seams, and dimensions.
  - 5. Include details for joining, supporting, and securing, including layout and spacing of fasteners, cleats, clips, and other attachments. Include pattern of seams.
  - 6. Include details of termination points and assemblies.
  - 7. Include details of expansion joints and expansion-joint covers, including showing direction of expansion and contraction from fixed points.
  - 8. Include details of special conditions.
  - 9. Include details of connections to adjoining work.
  - 10. Detail formed flashing and trim at scale of not less 3 inches per 12 inches.
- C. Samples for Verification: For each type of exposed finish.
  - 1. Sheet Metal Flashing: 12 inches long by actual width of unit, including finished seam and in required profile. Include fasteners, cleats, clips, closures, and other attachments.
  - 2. EPDM Penetration Flashing: One unit.

## **1.6 INFORMATIONAL SUBMITTALS**

- A. Qualification Data: For fabricator.
- B. Product Test Reports: For each product, for tests performed by a qualified testing agency.
- C. Sample Warranty: For special warranty.

## **1.7 CLOSEOUT SUBMITTALS**

- A. Maintenance Data: For sheet metal flashing and trim, and its accessories, to include in maintenance manuals.

## **1.8 QUALITY ASSURANCE**

- A. Fabricator Qualifications: Employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.

## **1.9 DELIVERY, STORAGE, AND HANDLING**

- A. Do not store sheet metal and EPDM flashing materials in contact with other materials that might cause staining, denting, or other surface damage. Store sheet metal flashing and trim materials away from uncured concrete and masonry.
- B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to extent necessary for period of sheet metal flashing and trim installation.

## **PART 2 - PRODUCTS**

### **2.1 PERFORMANCE REQUIREMENTS**

- A. General: Sheet metal flashing and EPDM assemblies shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.
- B. Sheet Metal Standard for Flashing: Comply with SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.
- C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
  - 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

### **2.2 EPDM PENETRATION FLASHING**

- A. Product: Provide EPDM penetration flashing DYNA-FLASH® 2D™ as manufactured by Dynamic Fastener or approved equal.
  - 1. Manufacturer's Item: LP2DBL
  - 2. Color: Black.

### **2.3 SHEET METALS**

- A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.
- B. Aluminum Sheet: ASTM B 209, alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required; with smooth, flat surface.
  - 1. As-Milled Finish: Mill.
- C. Metallic-Coated Steel Sheet: Provide zinc-coated (galvanized) steel sheet according to ASTM A 653/A 653M, G90 coating designation pre-painted by coil-coating process to comply with ASTM A 755/A 755M.
  - 1. Surface: Smooth, flat.
  - 2. Exposed Coil-Coated Finish:
    - a. Three-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
    - b. Color: To match substrate color.

3. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with minimum total dry film thickness of 0.5 mil.

## **2.4 MISCELLANEOUS MATERIALS**

- A. General: Provide materials and types of fasteners, solder, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal unless otherwise indicated.
- B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal.
  1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
    - a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.
    - b. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.
  2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
- C. Sealants: As specified in Section 07 92 00 "Sealants."
- D. Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, non-sag, nontoxic, non-staining tape 1/2 inch wide and 1/8 inch thick.
- E. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.
- F. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.

## **2.5 FABRICATION, GENERAL**

- A. General: Custom fabricate sheet metal flashing and trim to comply with details shown and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required. Fabricate sheet metal flashing and trim in shop to greatest extent possible.
  1. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
  2. Obtain field measurements for accurate fit before shop fabrication.
  3. Form sheet metal flashing and trim to fit substrates without excessive oil canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
  4. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.

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- B. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.
- C. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.
  - 1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
  - 2. Use lapped expansion joints only where indicated on Drawings.
- D. Sealant Joints: Where movable, non-expansion-type joints are required, form metal to provide for proper installation of elastomeric sealant according to cited sheet metal standard.
- E. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
- F. Fabricate cleats and attachment devices of sizes as recommended by cited sheet metal standard for application, but not less than thickness of metal being secured.
- G. Seams: Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.
- H. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer.
- I. Do not use graphite pencils to mark metal surfaces.
- J. Base Flashing: Fabricate from the following materials:
  - 1. Aluminum: 0.040 inch thick.
  - 2. Galvanized Steel: 0.028 inch thick.
- K. Counterflashing: Fabricate from the following materials:
  - 1. Aluminum: 0.032 inch thick.
  - 2. Galvanized Steel: 0.022 inch thick.
- L. Flashing Receivers: Fabricate from the following materials:
  - 1. Aluminum: 0.032 inch thick.
  - 2. Galvanized Steel: 0.022 inch thick.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, substrate, and other conditions affecting performance of the Work.
  - 1. Verify compliance with requirements for installation tolerances of substrates.
  - 2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
  - 3. Verify that air- or water-resistant barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 INSTALLATION, GENERAL**

- A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
  - 1. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
  - 2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
  - 3. Space cleats not more than apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.
  - 4. Install exposed sheet metal flashing and trim with limited oil canning, and free of buckling and tool marks.
  - 5. Torch cutting of sheet metal flashing and trim is not permitted.
  - 6. Do not use graphite pencils to mark metal surfaces.
- B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.
  - 1. Coat concealed side of sheet metal flashing and trim with bituminous coating where flashing and trim contact wood, ferrous metal, or cementitious construction.
  - 2. Underlayment: Where installing sheet metal flashing and trim directly on cementitious or wood substrates, install underlayment and cover with slip sheet.
- C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at maximum of 10 feet with no joints within 24 inches of corner or intersection.
- D. Fasteners: Use fastener sizes that penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.
- E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.
- F. Seal joints as required for watertight construction.
  - 1. Use sealant-filled joints unless otherwise indicated. Embed hooked flanges of joint members not less than 1 inch into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is between 40 and 70 deg F, set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F.
  - 2. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."



**3.3 BASE AND MISCELLANEOUS FLASHING INSTALLATION**

- A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to cited sheet metal standard unless otherwise indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.

**3.4 EPDM WALL PENETRATION FLASHING INSTALLATION**

- A. Install EPDM wall penetration flashing in accordance with manufacturer's instruction at all pipe and conduit penetrations and as indicated on the Drawings.

**3.5 ERECTION TOLERANCES**

- A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet) on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

**3.6 CLEANING AND PROTECTION**

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- B. Clean off excess sealants.
- C. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of sheet metal flashing and trim installation, remove unused materials and clean finished surfaces as recommended by sheet metal flashing and trim manufacturer. Maintain sheet metal flashing and trim in clean condition during construction.
- D. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

**END OF SECTION 07 62 00**

## **SECTION 07 72 53 - SNOW GUARDS**

### **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. Angle-type, seam-mounted snow guards.
- B. Related Requirements:
  - 1. Section 07 41 13 "Formed Metal Roof and Wall Panels" for standing seam metal roof panels to receive snow guards.

#### **1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product, include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: Include roof plans showing layouts and attachment details of snow guards.
  - 1. Include details of angle-type snow guards.
- C. Samples:
  - 1. Angle Type Snow Guards: Clamp and 12-inch-long rail.

#### **1.4 FIELD CONDITIONS**

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit seam-clamp-mounted snow guards to be installed according to clamp manufacturer's written instructions.

### **PART 2 - PRODUCTS**

#### **2.1 ANGLE TYPE SNOW GUARDS**

- A. Standing Seam Mounted, Angle Type, Clamp Mounted Snow Guards:
  - 1. Material: ASTM B 209 1/4-inch-thick aluminum angle.
    - a. Finish: Mill.

2. Seam clamps: Provide S-5-S Mini Clamps with one (1) each set screw for attachment to standing seams and one (1) each thru bolt for attachment of aluminum angle snow guard as manufactured by S-!® or approved equal.

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, snow guard attachment, and other conditions affecting performance of the Work.
  1. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

#### **3.2 INSTALLATION**

- A. Install snow guards according to manufacturer's written instructions.
  1. Space rows as indicated on Drawings.
- B. Attachment for Standing-Seam Metal Roofing:
  1. Do not use fasteners that will penetrate metal roofing or fastening methods that void metal roofing finish warranty.
  2. Standing Seam-Mounted, Clip-Type Snow Guards:
    - a. Install snow guards in straight rows at locations indicated.
    - b. Secure in place using specified clamps with stainless-steel set screws, incorporating round nonpenetrating point.
    - c. Torque set screws and fastening thru bolts according to clamp manufacturer's instructions.

**END OF SECTION 07 72 53**

## **SECTION 07 92 00 - JOINT SEALANTS**

### **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. Silicone joint sealants.
- B. Related Requirements:
  - 1. Section 07 41 13 "Formed Metal Roof and Wall Panels" for sealant(s) to be used with insulated metal roof and wall panels.
  - 2. Section 07 62 00 Sheet Metal Flashing and Trim" for sheet metal flashing and trim to receive sealant specified in this Section.
  - 3. Section 08 11 13 "Hollow Metal Doors and Frames" for hollow metal doors and frames to receive sealant specified in this Section.
  - 4. Section 08 80 00 "Glazing" for glazing to be installed using sealant specified in this Section.
  - 5. Section 08 53 13 "Vinyl Window" for sealant(s) to be used in the fabrication and installation of vinyl windows.

#### **1.3 PREINSTALLATION MEETINGS**

- A. Preinstallation Conference: Conduct conference at Project site.

#### **1.4 ACTION SUBMITTALS**

- A. Product Data: For each joint-sealant product.
- B. Joint-Sealant Schedule: Include the following information:
  - 1. Joint-sealant application, joint location, and designation.
  - 2. Joint-sealant manufacturer and product name.

#### **1.5 INFORMATIONAL SUBMITTALS**

- A. Qualification Data: For qualified testing agency.
- B. Product Test Reports: For each kind of joint sealant, for tests performed a qualified testing agency.

- C. Sample Warranties: For special warranties.

## **1.6 QUALITY ASSURANCE**

- A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.
- B. Product Testing: Test joint sealants using a qualified testing agency.
  - 1. Testing Agency Qualifications: Qualified according to ASTM C 1021 to conduct the testing indicated.
- C. Installation of joint sealants: Do not install joint sealants under the following conditions.:
  - 1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
  - 2. When joint substrates are wet.
  - 3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
  - 4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

## **1.7 WARRANTY**

- A. Special Installer's Warranty: Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
  - 1. Warranty Period: Two years from date of Substantial Completion.

## **PART 2 - PRODUCTS**

### **2.1 JOINT SEALANTS, GENERAL**

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.
- B. Colors of Exposed Joint Sealants: Clear unless indicated otherwise.

### **2.2 SILICONE JOINT SEALANTS**

- A. Silicone, S, NS, 100/50, NT: Single-component, non-sag, plus 100 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 100/50, Use NT.

## **2.3 JOINT-SEALANT BACKING**

- A. Sealant Backing Material, General: Non-staining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin), Type O (open-cell material), [Type B (bicellular material with a surface skin) or any of the preceding types, as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
- C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

## **2.4 MISCELLANEOUS MATERIALS**

- A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.
- C. Masking Tape: Non-staining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

# **PART 3 - EXECUTION**

## **3.1 EXAMINATION**

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

## **3.2 PREPARATION**

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
  - 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
  - 2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing

optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:

- a. Concrete.
3. Remove laitance and form-release agents from concrete.
  4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:
    - a. Metal.
    - b. Glass.
- B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

### **3.3 INSTALLATION OF JOINT SEALANTS**

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install sealant backings of kind indicated or recommended by sealant manufacturer to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
1. Do not leave gaps between ends of sealant backings.
  2. Do not stretch, twist, puncture, or tear sealant backings.
  3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
- D. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
1. Place sealants so they directly contact and fully wet joint substrates.
  2. Completely fill recesses in each joint configuration.
  3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- E. Tooling of Non-sag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants at visible location according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
1. Remove excess sealant from surfaces adjacent to joints.

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2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint profile per Figure 8A in ASTM C 1193 unless otherwise indicated.
4. Provide recessed joint configuration of recess depth and at locations indicated on Drawings according to Figure 8C in ASTM C 1193.
  - a. Use masking tape to protect surfaces adjacent to recessed tooled joints.

### **3.4 FIELD QUALITY CONTROL**

- A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:
  1. Extent of Testing: Test completed and cured sealant joints as follows:
    - a. Perform one test for each 1000 feet of joint length thereafter or one test per each floor per elevation.
  2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.
    - a. For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
  3. Inspect tested joints and report on the following:
    - a. Whether sealants filled joint cavities and are free of voids.
    - b. Whether sealant dimensions and configurations comply with specified requirements.
    - c. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. Compare these results to determine if adhesion complies with sealant manufacturer's field-adhesion hand-pull test criteria.
  4. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant material, sealant configuration, and sealant dimensions.
  5. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.
- B. Evaluation of Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

### **3.5 CLEANING**

- A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.



**3.6 PROTECTION**

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

**3.7 JOINT-SEALANT SCHEDULE**

- A. Joint-Sealant Application: Exterior joints in horizontal traffic surfaces: See Structural Drawings.
- B. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces.
  - 1. Joint Locations:
    - a. Joints in aluminum base flashing.
    - b. Joints between hollow metal door frames and substrate.
    - c. Joints between vinyl windows and substrate.
    - d. Other joints as indicated on Drawings.
  - 2. Joint Sealant: Silicone, S, NS, 100/50, NT.

**END OF SECTION 07 92 00**

## **SECTION 08 11 13 - HOLLOW METAL DOORS AND FRAMES**

### **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.
- B. Related Sections:
  - 1. Section 07 21 19 "Foamed -in-Place Insulation" for spray foam insulation to be installed in exterior door frames.
  - 2. Section 07 41 13 "Joint Sealants" for sealant to be installed with exterior door frames.
  - 3. Section 08 71 00 "Door Hardware" for door hardware.
  - 4. Section 09 91 13 "Exterior Paint" for paint finish to be applied to hollow metal doors and frames.

#### **1.2 SUMMARY**

- A. Section includes hollow-metal work.
  - 1. Steel doors.
  - 2. Steel door frames.

#### **1.3 DEFINITIONS**

- A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or SDI A250.8.

#### **1.4 COORDINATION**

- A. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

#### **1.5 PREINSTALLATION MEETINGS**

- A. Preinstallation Conference: Conduct conference at Project site.

#### **1.6 ACTION SUBMITTALS**

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

1. Include door designations construction details, material descriptions, core descriptions, and finishes.
- B. Shop Drawings: Include the following:
1. Elevations of each door type.
  2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
  3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
  4. Details and locations of reinforcement and preparations for hardware.
  5. Details of each different wall opening condition.
  6. Details of anchorages, joints, field splices, and connections.
  7. Details of accessories.
  8. Details of moldings, removable stops, and glazing.
  9. Coordination of glazing frames and stops with glass and glazing requirements.
- C. Door Schedule: Use same reference designations indicated on Drawings in preparing schedule for doors and frames.
- D. Schedule: Provide a schedule of hollow-metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final Door Hardware Schedule.

#### **1.7 INFORMATIONAL SUBMITTALS**

- A. Product Test Reports: For each type of hollow-metal door and frame assembly, for tests performed by a qualified testing agency.

#### **1.8 QUALITY ASSURANCE**

- A. Steel Door and Frame Standard: Comply with ANSI A 250.8, unless more stringent requirements are indicated.
- B. Manufacturer: Company specializing in manufacturing products specified in this section with a minimum of three years documented experience.

#### **1.9 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver doors and frames cardboard-wrapped or crated to provide protection during transit and job storage. Provide additional protection to prevent damage to finish of factory-finished doors and frames.
- B. Inspect doors and frames on delivery for damage, and notify shipper and supplier if damage is found. Minor damages may be repaired provided refinished items match new work and are acceptable to Architect. Remove and replace damaged items that cannot be repaired as directed.
- C. Store doors and frames at building site under cover. Place units on minimum 4-inch- (100-mm-) high wood blocking. Avoid using non-vented plastic or canvas shelters that could create a humidity chamber. If door packaging becomes wet, remove cartons immediately. Provide minimum 1/4-inch spaces between stacked doors to permit air circulation.

**1.10 PROJECT CONDITIONS**

- A. Coordinate frame installation with size, location, and installation of service utilities.
- B. Coordinate work with door opening construction, door frame, and door hardware installation.
- C. Sequence installation to ensure wire connections are achieved without delay of frame installation.

**PART 2 - PRODUCTS**

**2.1 MANUFACTURER**

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Steel Doors and Frames:
  - 2. Ceco Door Products; a United Dominion Company.
  - 3. Curries Company.
  - 4. Republic Builders Products.
  - 5. Steelcraft; a division of Ingersoll-Rand.
  - 6. Source Limitations: Obtain hollow-metal work from single source from single manufacturer.

**2.2 REGULATORY REQUIREMENT**

- A. Smoke- and Draft-Control Assemblies: Provide an assembly with gaskets listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing according to UL 1784 and installed in compliance with NFPA 105.

**2.3 MATERIALS**

- A. Hot-Rolled Steel Sheets: ASTM A 569/A 569M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- B. Cold-Rolled Steel Sheets: ASTM A 366/A 366M, Commercial Steel (CS), or ASTM A 620/A 620M, Drawing Steel (DS), Type B; stretcher-leveled standard of flatness.
- C. Electrolytic Zinc-Coated Steel Sheet: ASTM A 591/A 591M, Commercial Steel (CS), Class B coating; mill phosphatized; suitable for unexposed applications; stretcher-leveled standard of flatness where used for face sheets.

**2.4 INTERIOR DOORS AND FRAMES**

- A. Construct interior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
- B. Heavy-Duty Doors and Frames: SDI A250.8, Level 2.

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1. Physical Performance: Level B according to SDI A250.4.
2. Doors:
  - a. Type: As indicated in the Door and Frame Schedule.
  - b. Thickness: 1-3/4 inches.
  - c. Face: Metallic-coated, cold-rolled steel sheet, minimum thickness of 0.042 inch.
  - d. Edge Construction: Model 1, Full Flush.
  - e. Door Core: Manufacturer's standard polystyrene, polyurethane, or polyisocyanurate, with vertical steel-stiffener core at manufacturer's discretion.
3. Frames:
  - a. Materials: Metallic-coated steel sheet, minimum thickness of 0.053 inch.
  - b. Construction: Full profile welded.
4. Exposed Finish: Prime.

### **2.5 EXTERIOR HOLLOW-METAL DOORS AND FRAMES**

- A. Construct exterior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
- B. Extra-Heavy-Duty Doors and Frames: SDI A250.8, Level 3.
  1. Physical Performance: Level A according to SDI A250.4.
  2. Doors:
    - a. Type: As indicated in the Door and Frame Schedule.
    - b. Thickness: 1-3/4 inches
    - c. Face: Metallic-coated steel sheet, minimum thickness of 0.053 inch, with minimum A40 coating.
    - d. Edge Construction: Model 1, Full Flush
    - e. Core: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, polyisocyanurate, mineral-board, or vertical steel-stiffener core at manufacturer's discretion.
      - 1) Thermal-Rated Doors: Provide doors fabricated with thermal-resistance value (R-value) of not less than 2.1 deg F x h x sq. ft./Btu when tested according to ASTM C 1363.
  3. Frames:
    - a. Materials: Metallic-coated steel sheet, minimum thickness of 0.053 inch, with minimum A40 coating.
    - b. Construction: Full profile welded.
  4. Exposed Finish: Prime.

### **2.6 FRAME ANCHORS**

- A. Jamb Anchors:
  1. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch thick.

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- B. Floor Anchors: Formed from same material as frames, minimum thickness of 0.042 inch, and as follows:
  - 1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.

### **2.7 MATERIALS**

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B.
- D. Frame Anchors: ASTM A 879/A 879M, Commercial Steel (CS), 04Z coating designation; mill phosphatized.
  - 1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.
- E. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.
- F. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.
- G. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.
- H. Glazing: Comply with requirements in Section 08 80 00 "Glazing."

### **2.8 FABRICATION**

- A. Fabricate hollow-metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for metal thickness. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.
- B. Hollow-Metal Doors:
  - 1. Steel-Stiffened Door Cores: Provide minimum thickness 0.026 inch, steel vertical stiffeners of same material as face sheets extending full-door height, with vertical webs spaced not more than 6 inches apart. Spot weld to face sheets no more than 5 inches o.c. Fill spaces between stiffeners with glass- or mineral-fiber insulation.
  - 2. Vertical Edges for Single-Acting Doors: Provide beveled or square edges at manufacturer's discretion.
  - 3. Top Edge Closures: Close top edges of doors with inverted closures of same material as face sheets.

4. Bottom Edge Closures: Close bottom edges of doors with end closures or channels of same material as face sheets.
  5. Exterior Doors: Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
- C. Hollow-Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
1. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
  2. Floor Anchors: Weld anchors to bottoms of jambs with at least four spot welds per anchor; however, for slip-on drywall frames, provide anchor clips or countersunk holes at bottoms of jambs.
  3. Jamb Anchors: Provide number and spacing of anchors as follows:
    - a. Stud-Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
      - 1) Four anchors per jamb from 60 to 90 inches high.
  4. Head Anchors: Two anchors per head for frames more than 42 inches wide and mounted in metal-stud partitions.
  5. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.
    - a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
  6. Terminated Stops: Terminate stops 6 inches above finish floor with a [45] [90]-degree angle cut, and close open end of stop with steel sheet closure. Cover opening in extension of frame with welded-steel filler plate, with welds ground smooth and flush with frame.
- D. Fabricate concealed stiffeners and edge channels from either cold- or hot-rolled steel sheet.
- E. Hardware Preparation: Factory prepare hollow-metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule, and templates.
1. Reinforce doors and frames to receive non-templated, mortised, and surface-mounted door hardware.
  2. Comply with applicable requirements in SDI A250.6 and BHMA A156.115 for preparation of hollow-metal work for hardware.
- F. Stops and Moldings: Provide stops and moldings around glazed lites and louvers where indicated. Form corners of stops and moldings with butted or mitered hairline joints.
1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow-metal work.
  2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
  3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
  4. Provide loose stops and moldings on inside of hollow-metal work.
  5. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.

## **2.9 STEEL FINISHES**

- A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.
  - 1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.
- C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 PREPARATION**

- A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.
- B. Drill and tap doors and frames to receive non-templated, mortised, and surface-mounted door hardware.

### **3.3 INSTALLATION**

- A. General: Install hollow-metal work plumb, rigid, properly aligned, and securely fastened in place. Comply with Drawings and manufacturer's written instructions.
- B. Hollow-Metal Frames: Install hollow-metal frames for doors, of size and profile indicated. Comply with SDI A250.11 or NAAMM-HMMA 840 as required by standards specified.
  - 1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
    - a. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
    - b. Install frames with removable stops located on secure side of opening.
    - c. Remove temporary braces necessary for installation only after frames have been properly set and secured.



- d. Check plumb, square, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
    - e. Field apply bituminous coating to backs of frames that will be filled with grout containing anti-freezing agents.
  - 2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with post-installed expansion anchors.
    - a. Floor anchors may be set with power-actuated fasteners instead of post-installed expansion anchors if so indicated and approved on Shop Drawings.
  - 3. Metal-Stud Partitions: Solidly pack mineral-fiber insulation inside frames.
  - 4. In-Place Metal or Wood-Stud Partitions: Secure slip-on drywall frames in place according to manufacturer's written instructions.
  - 5. Installation Tolerances: Adjust hollow-metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
    - a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
    - b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
    - c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
    - d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.
- C. Hollow-Metal Doors: Fit hollow-metal doors accurately in frames, within clearances specified below. Shim as necessary.
  - 1. Non-Fire-Rated Steel Doors:
    - a. Between Door and Frame Jambs and Head: 1/8 inch plus or minus 1/32 inch.
    - b. At Bottom of Door: 3/4 inch.
    - c. Between Door Face and Stop: 1/16 inch to 1/8 inch plus or minus 1/32 inch.
  - 2. Smoke-Control Doors: Install doors and gaskets according to NFPA 105.
- D. Glazing: Comply with installation requirements in Section 088000 "Glazing" and with hollow-metal manufacturer's written instructions.
  - 1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c. and not more than 2 inches o.c. from each corner.

### **3.4 ADJUSTING AND CLEANING**

- A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow-metal work that is warped, bowed, or otherwise unacceptable.
- B. Remove grout and other bonding material from hollow-metal work immediately after installation.
- C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.
- D. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

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- E. Factory-Finish Touchup: Clean abraded areas and repair with same material used for factory finish according to manufacturer's written instructions.
- F. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

**END OF SECTION 08 11 13**

## **SECTION 08 36 13 - SECTIONAL DOORS**

### **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 **electrically** operated sectional doors.
- B. Related Requirements:
  - 1. Section 05 50 00 "Metal Fabrications" for miscellaneous steel supports.
  - 2. Section 07 41 13 "Formed Metal Roof and Wall Panels" for metal roof and wall panel manufacturer relative to section door colors and gloss.

#### **1.3 ACTION SUBMITTALS**

- A. Product Data: For each type and size of sectional door and accessory.
  - 1. Include construction details, material descriptions, dimensions of individual components, profile door sections, and finishes.
  - 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished accessories.
- B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data.
  - 1. Include plans, elevations, sections, and mounting details.
  - 2. Include details of equipment assemblies. Indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.
  - 3. Include points of attachment and their corresponding static and dynamic loads imposed on structure.
  - 4. Include diagrams for power, signal, and control wiring.
- C. Samples for Initial Selection: For units with factory-applied finishes.
  - 1. Include Samples of accessories involving color selection.
  - 2. Coordinate submittal of color samples with submittal of colors samples for formed metal roof and wall panels specified in Section 07 41 13 "Formed Metal Roof and Wall Panels."
- D. Samples for Verification: For each type of exposed finish on the following components, in manufacturer's standard sizes:
  - 1. Flat door sections with sensor edge on bottom section.

**1.4 INFORMATIONAL SUBMITTALS**

- A. Qualification Data: For Installer.
- B. Sample Warranties: For special warranties.

**1.5 CLOSEOUT SUBMITTALS**

- A. Maintenance Data: For sectional doors to include in maintenance manuals.

**1.6 QUALITY ASSURANCE**

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation and maintenance of units required for this Project.
- B. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC A117.1.

**1.7 WARRANTY**

- A. Special Warranty: Manufacturer agrees to repair or replace components of sectional doors that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Structural failures including, but not limited to, excessive deflection.
    - b. Failure of components or operators before reaching required number of operation cycles.
    - c. Faulty operation of hardware.
    - d. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use; rust through.
    - e. Delamination of exterior or interior facing materials.
  - 2. Warranty Period: One year from date of Substantial Completion.
- B. Special Finish Warranty: Manufacturer agrees to repair or replace components that show evidence of deterioration of factory-applied finishes within specified warranty period.
  - 1. Warranty Period: 10 years from date of Substantial Completion.

**PART 2 - PRODUCTS**

**2.1 MANUFACTURERS, GENERAL**

- A. Source Limitations: Obtain sectional doors from single source from single manufacturer.
  - 1. Obtain operators and controls from sectional door manufacturer.
- B. Acceptable Manufacturers:

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1. Raynor® Garage Doors
2. Overhead Door™
3. Wayne Dalton
4. Amarr®

### **2.2 PERFORMANCE REQUIREMENTS**

- A. General Performance: Sectional doors shall comply with performance requirements specified without failure due to defective manufacture, fabrication, installation, or other defects in construction and without requiring temporary installation of reinforcing components.
- B. Structural Performance, Exterior Doors: Capable of withstanding the design wind loads.
  1. Design Wind Load: As indicated in Section 13 34 19 "Metal Building Systems or on Drawings.
  2. Testing: According to ASTM E 330 or DASMA 108 for garage doors and complying with the acceptance criteria of DASMA 108.
  3. Deflection Limits: Design sectional doors to withstand design wind loads without evidencing permanent deformation or disengagement of door components.
    - a. Deflection of door sections in horizontal position (open) shall not exceed 1/120 of the door width.
    - b. Deflection of horizontal track assembly shall not exceed 1/240 of the door height.
  4. Operability under Wind Load: Design overhead coiling doors to remain operable under design wind load, acting inward and outward.
- C. Seismic Performance: Sectional doors shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
  1. Component Importance Factor: 1.0.

### **2.3 SECTIONAL OVERHEAD DOOR ASSEMBLY**

- A. Product: Provide TM300 Sectional Insulated Steel Doors as manufactured by Raynor® Garage Doors or approved equal.
- B. Steel Sectional Door: Sectional door formed with hinged sections and fabricated according to DASMA 102 unless otherwise indicated.
- C. Operation Cycles: Door components and operators capable of operating for not less than 20,000. One operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position.
- D. Wind Load: Doors shall have a non-certified wind load of 30 psf.
- E. Air Infiltration: Maximum rate of 0.4 cfm/sq. ft. at 15 and 25 mph when tested according to DASMA 105.
- F. R-Value: of Sections: 24.54 deg F x h x sq. ft./Btu.
- G. Steel Sections: Zinc-coated (galvanized) steel sheet with G60 zinc coating.
  1. Section Thickness: 3 inches.

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2. Exterior-Face, Steel Sheet Thickness: 0.016-inch- nominal coated thickness.
    - a. Surface Pattern: Manufacturer's standard, pencil groove
    - b. Surface Texture. Manufacturer's standard stucco.
  3. Insulation: Foamed in place.
  4. Interior Facing Material: Zinc-coated (galvanized) steel sheet with a nominal coated thickness of 0.016 inch.
- H. Track Configuration: Standard-lift.
- I. Weather-seals: Fitted to bottom and top and around entire perimeter of door. Provide combination bottom weather-seal and sensor edge.
- J. Windows: Of size(s) as indicated on the Drawings, with square corners, and spaced apart the approximate distance as indicated on Drawings; in **one** row at height indicated on Drawings; installed with glazing of the following type:
1. Insulating Glass: Manufacturer's standard.
- K. Roller-Tire Material: Manufacturer's standard.
- L. Locking Devices: Equip door with locking device assembly.
1. Locking Device Assembly: Manufacturer's standard slide locks, 1 side, with interlocks to turn of door operator. Padlocks by Owner.
- M. Counterbalance Type: Manufacturer's standard torsion-spring counterbalance.
- N. Electric Door Operator:
1. Usage Classification: Heavy duty, 25 or more cycles per hour and more than 90 cycles per day.
  2. Operator Type: Manufacturer's standard for door requirements.
  3. Safety: Listed according to UL 325 by a qualified testing agency for commercial or industrial use; moving parts of operator enclosed or guarded if exposed and mounted at 8 feet or lower].
  4. Motor Exposure: Suitable for exterior, dusty, wet, or humid.
  5. Emergency Manual Operation: Chain type.
  6. Obstruction-Detection Device: Non-monitored pneumatic safety edge on bottom section in black EPDM rubber seal..
    - a. Sensor Edge Bulb Color: Black.
  7. Control Station: Interior-side mounted.
  8. Other Equipment: Audible and visual signals.
- O. Door Finish:
1. Finish of Exterior Facing Material: Two coat, baked-on paint system, primer and polyester finish coat. Color and gloss shall match formed metal roof and wall panel manufacturer's color and gloss or adjacent ARFF Building color and gloss as indicated on the Drawings.
  2. Finish of Interior Facing Material: Match finish of exterior section face.

**2.4 MATERIALS, GENERAL**

- 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.

**2.5 STEEL DOOR SECTIONS**

- A. Exterior Section Faces and Frames: Zinc-coated (galvanized), cold-rolled, commercial steel (CS) sheet, complying with ASTM A 653/A 653M, with indicated zinc coating and thickness.
  - 1. Fabricate section faces from single sheets to provide sections not more than 24 inches high and of indicated thickness. Roll horizontal meeting edges to a continuous, interlocking, keyed, rabbeted, shiplap, or tongue-in-groove weather-resistant seal, with a reinforcing flange return.
  - 2. For insulated doors, provide sections with continuous thermal-break construction, separating the exterior and interior faces of door.
- B. Section Ends and Intermediate Stiles: Enclose open ends of sections with channel end stiles formed from galvanized-steel sheet not less than 0.064-inch-nominal coated thickness and welded to door section. Provide intermediate stiles formed from not less than 0.064-inch-thick galvanized-steel sheet, cut to door section profile, and welded in place. Space stiles not more than 48 inches apart.
- C. Reinforce bottom section with a continuous channel or angle conforming to bottom-section profile.
- D. Reinforce sections with continuous horizontal and diagonal reinforcement, as required to stiffen door and for wind loading. Provide galvanized-steel bars, struts, trusses, or strip steel, formed to depth and bolted or welded in place. Ensure that reinforcement does not obstruct vision lites.
- E. Provide reinforcement for hardware attachment.
- F. Foamed-in-Place Thermal Insulation: Insulate interior of steel sections with door manufacturer's standard CFC-free polyurethane insulation, foamed in place to completely fill interior of section and pressure bonded to face sheets to prevent delamination under wind load, and with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, according to ASTM E 84. Enclose insulation completely within steel sections and the interior facing material, with no exposed insulation.
- G. Interior Facing Material: Zinc-coated (galvanized), cold-rolled, commercial steel (CS) sheet, complying with ASTM A 653/A 653M, with indicated thickness.
- H. Fabricate sections so finished door assembly is rigid and aligned, with tight hairline joints and free of warp, twist, and deformation.

**2.6 HARDWARE**

- A. General: Heavy-duty, corrosion-resistant hardware, with hot-dip galvanized, stainless-steel, or other corrosion-resistant fasteners, to suit door type.
- B. Hinges: Heavy-duty, galvanized-steel hinges of not less than 0.079-inch-nominal coated thickness at each end stile and at each intermediate stile, according to manufacturer's written recommendations for door size. Attach hinges to door sections through stiles and rails with bolts

and lock nuts or lock washers and nuts. Use rivets or self-tapping fasteners where access to nuts is impossible. Provide double-end hinges where required, for doors more than 16 feet wide unless otherwise recommended by door manufacturer.

- C. Rollers: Heavy-duty rollers with steel ball-bearings in case-hardened steel races, mounted with varying projections to suit slope of track. Extend roller shaft through both hinges where double hinges are required. Provide 3-inch-diameter roller tires for 3-inch-wide track and 2-inch-diameter roller tires for 2-inch-wide track.

## **2.7 LOCKING DEVICES**

- A. Slide Bolt: Fabricate with side-locking bolts to engage through slots in tracks for locking by padlock, located on single-jamb side, operable from inside only.
- B. Safety Interlock Switch: Equip power-operated doors with safety interlock switch to disengage power supply when door is locked.

## **2.8 COUNTERBALANCE MECHANISM**

- A. Weight Counterbalance: Counterbalance mechanism consisting of filled pipe weights that move vertically in a galvanized-steel weight pipe. Connect pipe weights with cable to weight-cable drums mounted on torsion shaft made of steel tube or solid steel.
- B. Cable Drums and Shaft for Doors: Cast-aluminum or gray-iron casting cable drums mounted on torsion shaft and grooved to receive door-lifting cables as door is raised. Mount counterbalance mechanism with manufacturer's standard ball-bearing brackets at each end of torsion shaft. Provide one additional midpoint bracket for shafts up to 16 feet long and two additional brackets at one-third points to support shafts more than 16 feet long unless closer spacing is recommended by door manufacturer.
- C. Cables: Galvanized-steel, multistrand, lifting cables with cable safety factor of at least 7 to 1.
- D. Cable Safety Device: Include a spring-loaded steel or spring-loaded bronze cam mounted to bottom door roller assembly on each side and designed to automatically stop door if either lifting cable breaks.
- E. Bracket: Provide anchor support bracket as required to connect stationary end of spring to the wall and to level the shaft and prevent sag.
- F. Bumper: Provide spring bumper at each horizontal track to cushion door at end of opening operation.

## **2.9 ELECTRIC DOOR OPERATORS**

- A. General: Electric door operator assembly of size and capacity recommended and provided by door manufacturer for door and "operation cycles" requirement specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, control stations, control devices, integral gearing for locking door, and accessories required for proper operation.
  - 1. Comply with NFPA 70.



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2. Control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6; with NFPA 70, Class 2 control circuit, maximum 24-V ac or dc.
- B. Usage Classification: Electric operator and components capable of operating for not less than number of cycles per hour indicated for each door.
- C. Door-Operator Type: Unit consisting of electric motor, gears, pulleys, belts, sprockets, chains, and controls needed to operate door and meet required usage classification.
  1. Trolley: Trolley operator mounted to ceiling above and to rear of door in raised position and directly connected to door with drawbar.
  2. Jackshaft, Center Mounted: Jackshaft operator mounted on the inside front wall above door and connected to torsion shaft with an adjustable coupling or drive chain.
- D. Motors: Reversible-type motor with controller (disconnect switch) for motor exposure indicated.
  1. Electrical Characteristics Smaller Doors::
    - a. Phase: Single phase.
    - b. Volts: 115 V.
    - c. Hertz: 60.
  2. Electrical Characteristics Larger Door:
    - a. Phase: Single Phase
    - b. Volts: 230 V
    - c. Hertz: 60.
  3. Motor Size Small Doors:  $\frac{3}{4}$  horsepower – Industrial Gearhead NEMA-4 Operator.
  4. Motor Size Large Door: 1-1/2 horsepower – Industrial Gearhead NEMA-4 Operator.
  5. Minimum size as indicated. If not indicated, large enough to start, accelerate, and operate door in either direction from any position, at a speed not less than 8 in./sec. and not more than 12 in./sec, without exceeding nameplate ratings or service factor.
  6. Operating Controls, Controllers (Disconnect Switches), Wiring Devices, and Wiring: Manufacturer's standard unless otherwise indicated.
  7. Coordinate wiring requirements and electrical characteristics of motors and other electrical devices with building electrical system and each location where installed.
  8. Use adjustable motor-mounting bases for belt-driven operators.
- E. Limit Switches: Equip motorized door with adjustable switches interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.
- F. Obstruction Detection Device: External entrapment protection consisting of indicated automatic safety sensor capable of protecting full width of door opening. Activation of device immediately stops and reverses downward door travel.
  1. Electric Sensor Edge: Automatic safety sensor edge, located within astragal or weather stripping mounted to bottom section. Contact with sensor activates device. Connect to control circuit using manufacturer's standard take-up reel or self-coiling cable.
    - a. Monitored NEMA-4 (wet rated) photo eyes.
- G. Control Station: Three-button control station in fixed location with momentary-contact push-button controls labeled "Open" and "Stop" and sustained- or constant-pressure, push-button control labeled "Close."
  1. Interior-Mounted Units: Full-guarded, surface-mounted, heavy-duty type, with general-purpose NEMA ICS 6, Type 1 enclosure.

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- H. Emergency Manual Operation: Equip electrically powered door with capability for emergency manual operation. Design manual mechanism so required force for door operation does not exceed 25 lbf.
- I. Emergency Operation Disconnect Device: Equip operator with hand-operated disconnect mechanism for automatically engaging manual operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Mount mechanism so it is accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.
- J. Motor Removal: Design operator so motor may be removed without disturbing limit-switch adjustment and without affecting emergency manual operation.
- K. Audible and Visual Signals: Audible alarm and visual indicator lights in compliance with regulatory requirements for accessibility.

### **2.10 GENERAL FINISH REQUIREMENTS**

- A. Comply with NAAMM/NOMMA's "Metal Finishes Manual for Architectural and Metal Products (AMP 500-06)" for recommendations for applying and designating finishes.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

### **2.11 ALUMINUM FINISHES**

- A. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.

### **2.12 STEEL AND GALVANIZED-STEEL FINISHES**

- A. Baked-on Two Coat Paint System Finish: Manufacturer's standard baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.
- B. Examine locations of electrical connections.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

**3.2 INSTALLATION**

- A. Install sectional doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.
- B. Tracks:
  - 1. Fasten vertical track assembly to opening jambs and framing, spaced not more than 24 inches apart.
  - 2. Hang horizontal track assembly from structural overhead framing with angles or channel hangers attached to framing by welding or bolting, or both. Provide sway bracing, diagonal bracing, and reinforcement as required for rigid installation of track and door-operating equipment.
- C. Accessibility: Install sectional doors, switches, and controls along accessible routes in compliance with regulatory requirements for accessibility.
- D. Power-Operated Doors: Install automatic garage doors openers according to UL 325.

**3.3 STARTUP SERVICES**

- A. Engage a factory-authorized service representative to perform startup service.
  - 1. Complete installation and startup checks according to manufacturer's written instructions.
  - 2. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

**3.4 ADJUSTING**

- A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.
- B. Lubricate bearings and sliding parts as recommended by manufacturer.
- C. Adjust doors and seals to provide weather-resistant fit around entire perimeter.
- D. Touch-up Painting: Immediately after welding galvanized materials, clean welds and abraded galvanized surfaces and repair galvanizing to comply with ASTM A 780/A 780M.

**3.5 DEMONSTRATION**

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain sectional doors.

**END OF SECTION 08 36 13**

## **SECTION 08 53 13 - VINYL WINDOWS**

### **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 vinyl-framed windows.
- B. Related Requirements:
  - 1. Section 07 41 13 "Formed Metal Roof and Wall Panels" for formed metal panel walls to receive vinyl windows.
  - 2. Section 07 62 00 "Sheet Metal Flashing and Trim" for flashing installed in conjunction with vinyl window.
  - 3. Section 07 92 19 "Joint Sealants" for sealant installed in conjunction with vinyl windows.

#### **1.3 PREINSTALLATION MEETINGS**

- A. Preinstallation Conference: Conduct conference at Project site.
  - 1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
  - 2. Review, discuss, and coordinate the interrelationship of vinyl windows with other exterior wall components. Include provisions for anchoring, flashing, weeping, sealing perimeters, and protecting finishes.
  - 3. Review and discuss the sequence of work required to construct a watertight and weathertight exterior building envelope.
  - 4. Inspect and discuss the condition of substrate and other preparatory work performed by other trades.

#### **1.4 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, glazing and fabrication methods, dimensions of individual components and profiles, hardware, and finishes for vinyl windows.
- B. Shop Drawings: For vinyl windows.
  - 1. Include plans, elevations, sections, hardware, accessories, insect screens, operational clearances, and details of installation, including anchor, flashing, and sealant installation.
- C. Samples: For each exposed product and for each color specified, 2 by 4 inches in size.

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- D. Product Schedule: For vinyl windows. Use same designations indicated on Drawings.

### **1.5 INFORMATIONAL SUBMITTALS**

- A. Qualification Data: For manufacturer and Installer.
- B. Product Test Reports: For each type of vinyl window, for tests performed by a qualified testing agency.
- C. Field quality-control reports.
- D. Sample Warranties: For manufacturer's warranties.

### **1.6 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: A manufacturer capable of fabricating vinyl windows that meet or exceed performance requirements indicated and of documenting this performance by test reports and calculations.
- B. Installer Qualifications: An installer acceptable to vinyl window manufacturer for installation of units required for this Project.

### **1.7 WARRANTY**

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace vinyl windows that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Failure to meet performance requirements.
    - b. Structural failures including excessive deflection, water leakage, and air infiltration.
    - c. Deterioration of materials and finishes beyond normal weathering.
    - d. Failure of insulating glass.
  - 2. Warranty Period:
    - a. Window: 10 years from date of Substantial Completion.
    - b. Glazing Units: 10 years from date of Substantial Completion.

## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURERS, GENERAL**

- A. Source Limitations: Obtain vinyl windows from a single manufacturer.
  - 1. Obtain operators and controls from sectional door manufacturer.
- B. Acceptable Manufacturers:
  - 1. Milgard® (basis of design).
  - 2. PGT Industries Harvey Building Products
  - 3. Gilkey Window Commercial Division
  - 4. CGI Windows and Doors

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5. Alside
6. GEntek Building Product, Inc.
7. Weather Shield Mfg. Inc.
8. Okna
9. Sunrise
10. Soft-Lite
11. Pella
12. Amerimax
13. Jeld Wen

### **2.2 PRODUCTS**

- A. Source Limitations: Obtain vinyl windows from single source from single manufacturer.
- B. Products: Provide Milgard Tuscany® fixed awning triple glazed window units Series 8420T with 1-3/8 – inch Nail Fin Setback or approved equal.
  1. Frame: 3-1/4” minimum depth. Multi-chambered vinyl profile.
  2. Structural Class: 59-1/2” x 95-1/2” and smaller: AP-C40.

### **2.3 WINDOW PERFORMANCE REQUIREMENTS**

- A. Product Standard: Comply with AAMA/WDMA/NWWDA-101/I.S.2 for definitions and minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.
  1. Window Certification: WDMA certified with label attached to each window.
  2. Minimum Performance Class: CW.

### **2.4 VINYL WINDOWS**

- A. Operating Types: Provide the following operating types in locations indicated on Drawings:
  1. Fixed.
  2. Integral color PVC compound containing impact-resistant solid plasticizer, titanium dioxide UV inhibitor, and surface and color stabilizers.
- B. Frames and Sashes: Impact-resistant, UV-stabilized PVC complying with AAMA/WDMA/CSA 101/I.S.2/A440.
  1. Integral color PVC compound containing impact-resistant solid plasticizer, titanium dioxide UV inhibitor, and surface and color stabilizers.
  2. Finish: Integral color, white.
  3. Weatherstripping: Vinyl compression bulb seal
- C. Glazing System: Manufacturer's standard factory installed insulated glazing system complying with ASTM E 774, Class A.
  1. Glazing Type: Triple glaze.
    - a. Glass: 1/8” Mylgard SunCoat® Low-E over 1/8” 4<sup>th</sup> surface HP Coating Center Lite Clear over SunCoat® Low-E or approved equals.
    - b. Insulating Glass Units: ASTM-E-774, Class A, Triple glaze

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- c. Spacer Type: Stainless steel spacer.
  - d. Gas Filled: Argon
  - e. Glass thickness: Not greater than required to fit frame.
- D. Fasteners: Noncorrosive and compatible with window members, trim, hardware, anchors, and other components.
  - 1. Exposed Fasteners: Do not use exposed fasteners to greatest extent possible. For application of hardware, use fasteners that match finish hardware being fastened.

### **2.5 FABRICATION**

- A. Fabricate vinyl windows in sizes indicated. Include a complete system for installing and anchoring windows.
- B. Fabricate frames and sash with mitered and fusion welded corners and joints.
- C. Trim and finish corners and welds to match adjacent surfaces.
- D. Provide concealed metal reinforcements in sash frame for attachment of lock mechanism.
- E. Factory interior glaze (except Double Hung and Double Slider) with snap-on mitered PVC glazing stops matching bevels on the sash and frame. Insulated glass units shall be re-glazable without dismantling sash framing.
- F. Glaze vinyl windows in the factory.
- G. Complete fabrication, assembly, finishing, hardware application, and other work in the factory to greatest extent possible. Disassemble components only as necessary for shipment and installation. Allow for scribing, trimming, and fitting at Project site.

### **2.6 Source Quality Control:**

- A. Inspect windows in accordance with Manufacturer's Quality Control Program as required by AAMA Gold Label Certification.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Verify rough opening dimensions, levelness of sill plate, and operational clearances.
- C. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure weathertight window installation.

- D. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 INSTALLATION**

- A. Comply with manufacturer's written instructions for installing windows, hardware, accessories, and other components. For installation procedures and requirements not addressed in manufacturer's written instructions, comply with installation requirements in ASTM E 2112.
- B. Install windows level, plumb, square, true to line, without distortion, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction to produce weathertight construction.
- C. Do not remove temporary labels.

### **3.3 ADJUSTING, CLEANING, AND PROTECTION**

- A. Clean exposed surfaces immediately after installing windows. Remove excess sealants, glazing materials, dirt, and other substances.
  - 1. Keep protective films and coverings in place until final cleaning.
  - 2. Remove temporary labels.
- B. Remove and replace sashes if glass has been broken, chipped, cracked, abraded, or damaged during construction period.
- C. Protect window surfaces from contact with contaminating substances resulting from construction operations. If contaminating substances do contact window surfaces, remove contaminants immediately according to manufacturer's written instructions.

**END OF SECTION 08 53 13**



**SECTION 08 71 00 – DOOR HARDWARE**

**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. Mechanical door hardware for:
    - a. Swinging doors.
  - 2. The intent of the hardware specification is to specify the hardware for interior and exterior doors, and to establish a type, continuity, and standard of quality. However, it is the door hardware supplier's responsibility to thoroughly review existing conditions, schedules, specifications, drawings, and other Contract Documents to verify the suitability of the hardware specified.
- B. Exclusions: Unless specifically listed in hardware sets, hardware is not specified in this section for:
  - 1. Windows
  - 2. Signage
  - 3. Overhead doors

**1.3 REFERENCES**

- A. UL - Underwriters Laboratories
  - 1. UL 10B - Fire Test of Door Assemblies
  - 2. UL 10C - Positive Pressure Test of Fire Door Assemblies
  - 3. UL 1784 - Air Leakage Tests of Door Assemblies
  - 4. UL 305 - Panic Hardware
- B. DHI - Door and Hardware Institute
  - 1. Sequence and Format for the Hardware Schedule
  - 2. Recommended Locations for Builders Hardware
  - 3. Key Systems and Nomenclature

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### **C. ANSI - American National Standards Institute**

1. ANSI/BHMA A156.1 - A156.29, and ANSI/BHMA A156.31 - Standards for Hardware and Specialties

## **1.4 SUBMITTALS**

### **A. General:**

1. Submit in accordance with Conditions of Contract and Division 01 requirements.
2. Highlight, encircle, or otherwise specifically identify on submittals deviations from Contract Documents, issues of incompatibility or other issues which may detrimentally affect the Work.
3. Prior to forwarding submittal, comply with procedures for verifying existing door and frame compatibility for new hardware, as specified in PART 3, "EXAMINATION" article, herein.

### **B. Action Submittals:**

1. Product Data: Technical product data for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements.
2. Samples for Verification: If requested by Architect, submit production sample or sample installations of each type of exposed hardware unit in finish indicated, and tagged with full description for coordination with schedule.
  - a. Samples will be returned to supplier. Units that are acceptable to Architect may, after final check of operations, be incorporated into Work, within limitations of key coordination requirements.
3. Door Hardware Schedule: Submit schedule with hardware sets in vertical format as illustrated by Sequence of Format for the Hardware Schedule as published by the Door and Hardware Institute. Indicate complete designations of each item required for each door or opening, include:
  - a. Door Index; include door number, heading number, and Architects hardware set number.
  - b. Opening Lock Function Spreadsheet: List locking device and function for each opening.
  - c. Quantity, type, style, function, size, and finish of each hardware item.
  - d. Name and manufacturer of each item.
  - e. Fastenings and other pertinent information.
  - f. Location of each hardware set cross-referenced to indications on Drawings.
  - g. Explanation of all abbreviations, symbols, and codes contained in schedule.
  - h. Mounting locations for hardware.
  - i. Door and frame sizes and materials.
  - j. Name and phone number for local manufacturer's representative for each product.
    - 1) Submittal Sequence: Submit door hardware schedule concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of

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other work to facilitate fabrication of other work that is critical in Project construction schedule.

4. Key Schedule:
  - a. After Keying Conference, provide keying schedule listing levels of keying as well as explanation of key system's function, key symbols used and door numbers controlled.
  - b. Use ANSI/BHMA A156.28 "Recommended Practices for Keying Systems" as guideline for nomenclature, definitions, and approach for selecting optimal keying system.
  - c. Provide 3 copies of keying schedule for review prepared and detailed in accordance with referenced DHI publication. Include schematic keying diagram and index each key to unique door designations.
  - d. Index keying schedule by door number, keyset, hardware heading number, cross keying instructions, and special key stamping instructions.
  - e. Provide one complete bitting list of key cuts and one key system schematic illustrating system usage and expansion.
    - 1) Forward bitting list, key cuts and key system schematic directly to Owner, by means as directed by Owner.
  - f. Prepare key schedule by or under supervision of supplier, detailing Owner's final keying instructions for locks.
5. Templates: After final approval of hardware schedule, provide templates for doors, frames and other work specified to be factory or shop prepared for door hardware installation.

### **C. Informational Submittals:**

1. Qualification Data: For Supplier, Installer and Architectural Hardware Consultant.
2. Certificates of Compliance:
  - a. UL listings for fire-rated hardware and installation instructions if requested by Architect or Authority Having Jurisdiction.
  - b. Installer Training Meeting Certification: Letter of compliance, signed by Contractor, attesting to completion of installer training meeting specified in "QUALITY ASSURANCE" article, herein.
3. Warranty: Special warranty specified in this Section.

### **D. Closeout Submittals:**

1. Operations and Maintenance Data: Provide in accordance with Division 01 and include:
  - a. Complete information on care, maintenance, and adjustment; data on repair and replacement parts, and information on preservation of finishes.
  - b. Catalog pages for each product.
  - c. Factory order acknowledgement numbers (for warranty and service)
  - d. Name, address, and phone number of local representative for each manufacturer.
  - e. Parts list for each product.
  - f. Final approved hardware schedule, edited to reflect conditions as-installed.
  - g. Final keying schedule
  - h. Copies of floor plans with keying nomenclature
  - i. Copy of warranties including appropriate reference numbers for manufacturers to identify project.

**1.5 QUALITY ASSURANCE**

- A. Supplier Qualifications and Responsibilities: Recognized architectural hardware supplier with record of successful in-service performance for supplying door hardware similar in quantity, type, and quality to that indicated for this Project and that provides certified Architectural Hardware Consultant (AHC) available to Owner, Architect, and Contractor, at reasonable times during the Work for consultation.
  - 1. Warehousing Facilities: In Project's vicinity.
  - 2. Scheduling Responsibility: Preparation of door hardware and keying schedules.
- B. Architectural Hardware Consultant Qualifications: Person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and meets these requirements:
  - 1. For door hardware, DHI-certified, Architectural Hardware Consultant (AHC).
  - 2. Can provide installation and technical data to Architect and other related subcontractors.
  - 3. Can inspect and verify components are in working order upon completion of installation.
- C. Single Source Responsibility: Obtain each type of door hardware from single manufacturer.
- D. Fire-Rated Door Openings: Provide door hardware for fire-rated openings that complies with NFPA 80 and requirements of authorities having jurisdiction. Provide only items of door hardware that are listed products tested by Underwriters Laboratories, Intertek Testing Services, or other testing and inspecting organizations acceptable to authorities having jurisdiction for use on types and sizes of doors indicated, based on testing at positive pressure and according to NFPA 252 or UL 10C and in compliance with requirements of fire-rated door and door frame labels.
- E. Keying Conference
  - 1. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including:
    - a. Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
    - b. Preliminary key system schematic diagram.
    - c. Requirements for key control system.
    - d. Requirements for access control.
    - e. Address for delivery of keys.
- F. Pre-installation Conference
  - 1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
  - 2. Inspect and discuss preparatory work performed by other trades.
  - 3. Review required testing, inspecting, and certifying procedures.

**1.6 DELIVERY, STORAGE, AND HANDLING**

- A. Inventory door hardware on receipt and provide secure lock-up for hardware delivered to Project site.
- B. Tag each item or package separately with identification coordinated with final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package.
  - 1. Deliver each article of hardware in manufacturer's original packaging.
- C. Project Conditions:
  - 1. Maintain manufacturer-recommended environmental conditions throughout storage and installation periods.
  - 2. Provide secure lock-up for door hardware delivered to Project. Control handling and installation of hardware items so that completion of Work will not be delayed by hardware losses both before and after installation.
- D. Protection and Damage:
  - 1. Promptly replace products damaged during shipping.
  - 2. Handle hardware in manner to avoid damage, marring, or scratching. Correct, replace or repair products damaged during Work.
  - 3. Protect products against malfunction due to paint, solvent, cleanser, or any chemical agent.
- E. Deliver keys and permanent cores to Owner by registered mail or overnight package service.

**1.7 COORDINATION**

- A. Coordinate layout and installation of floor-recessed door hardware with floor construction. Cast anchoring inserts into concrete.
- B. Installation Templates: Distribute for doors, frames, and other work specified to be factory or shop prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.
- C. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.

**1.8 WARRANTY**

- A. Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period: Beginning from date of Substantial Completion, for durations indicated.
    - a. Closers:
      - 1) Mechanical: 30 years
    - b. Locksets:
      - 1) Mechanical: 3 years
    - c. Continuous Hinges: Lifetime warranty.
    - d. Key Blanks: Lifetime
  - 2. Warranty does not cover damage or faulty operation due to improper installation, improper use or abuse.

**1.9 MAINTENANCE**

- A. Maintenance Tools: Furnish complete set of special tools required for maintenance and adjustment of hardware, including changing of cylinders.

**PART 2 - PRODUCTS**

**2.1 MANUFACTURERS**

- A. Approval of manufacturers and/or products other than those listed as "Scheduled Manufacturer" or "Acceptable Manufacturers" in the individual article for the product category shall be in accordance with QUALITY ASSURANCE article, herein.

**2.2 MATERIALS**

- A. Fasteners
  - 1. Provide hardware manufactured to conform to published templates, generally prepared for machine screw installation.
  - 2. Furnish screws for installation with each hardware item. Finish exposed (exposed under any condition) screws to match hardware finish, or, if exposed in surfaces of other work, to match finish of this other work including prepared for paint surfaces to receive painted finish.
  - 3. Provide concealed fasteners for hardware units exposed when door is closed except when no standard units of type specified are available with concealed fasteners. Do not use thru-bolts for installation where bolt head or nut on opposite face is exposed in other work unless thru-bolts are required to fasten hardware securely. Review door specification and advise Architect if thru-bolts are required.
  - 4. Install hardware with fasteners provided by hardware manufacturer.

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- B. Provide screws, bolts, expansion shields, drop plates and other devices necessary for hardware installation.
  - 1. Where fasteners are exposed to view: Finish to match adjacent door hardware material.

### **2.3 HINGES**

- A. Manufacturers and Products: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Scheduled Manufacturer and Product: Ives 5BB series.
  - 2. Acceptable Manufacturers and Products: Hager BB series, McKinney TA/T4A series
- B. Requirements:
  - 1. Provide hinges conforming to ANSI/BHMA A156.1.
  - 2. 1-3/4 inch (44 mm) thick doors, up to and including 36 inches (914 mm) wide:
    - a. Exterior: Standard weight, bronze or stainless steel, 4-1/2 inches (114 mm) high
    - b. Interior: Standard weight, steel, 4-1/2 inches (114 mm) high
  - 3. 1-3/4 inch (44 mm) thick doors over 36 inches (914 mm) wide:
    - a. Exterior: Heavy weight, bronze/stainless steel, 5 inches (127 mm) high
    - b. Interior: Heavy weight, steel, 5 inches (127 mm) high
  - 4. 2 inches or thicker doors:
    - a. Exterior: Heavy weight, bronze, or stainless steel, 5 inches (127 mm) high
    - b. Interior: Heavy weight, steel, 5 inches (127 mm) high
  - 5. Provide three hinges per door leaf for doors 90 inches (2286 mm) or less in height, and one additional hinge for each 30 inches (762 mm) of additional door height.
  - 6. Where new hinges are specified for existing doors or existing frames, provide new hinges of identical size to hinge preparation present in existing door or existing frame.
  - 7. Hinge Pins: Except as otherwise indicated, provide hinge pins as follows:
    - a. Steel Hinges: Steel pins
    - b. Non-Ferrous Hinges: Stainless steel pins
    - c. Out-Swinging Exterior Doors: Non-removable pins
    - d. Out-Swinging Interior Lockable Doors: Non-removable pins
    - e. Interior Non-lockable Doors: Non-rising pins
  - 8. Width of hinges: 4-1/2 inches (114 mm) at 1-3/4 inch (44 mm) thick doors, and 5 inches (127 mm) at 2 inches (51 mm) or thicker doors. Adjust hinge width as required for door, frame, and wall conditions to allow proper degree of opening.
  - 9. Provide hinges with electrified options as scheduled in the hardware sets. Provide with sufficient number and wire gage to accommodate electric function of specified hardware. Locate electric hinge at second hinge from bottom or nearest to electrified locking component.
  - 10. Provide mortar guard for each electrified hinge specified.
  - 11. Provide spring hinges where specified. Provide two spring hinges and one bearing hinge per door leaf for doors 90 inches (2286 mm) or less in height. Provide one additional bearing hinge for each 30 inches (762 mm) of additional door height.

## **2.4 MORTISE LOCKS**

- A. Manufacturers and Products: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Scheduled Manufacturer and Product: Schlage L9000 series.
  2. Acceptable Manufacturers and Products: Sargent 8200 series.
- B. Requirements:
1. Provide mortise locks conforming to ANSI/BHMA A156.13 Series 1000, Grade 1, and UL Listed for 3 hour fire doors.
  2. Provide locks manufactured from heavy gauge steel, containing components of steel with a zinc dichromate plating for corrosion resistance.
  3. Provide lock case that is multi-function and field reversible for handing without opening case. Cylinders: Refer to "KEYING" article, herein.
  4. Provide locks with standard 2-3/4 inches (70 mm) backset with full 3/4 inch (19 mm) throw stainless steel mechanical anti-friction latchbolt. Provide deadbolt with full 1 inch (25 mm) throw, constructed of stainless steel.
  5. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.

## **2.5 MECHANICAL PUSHBUTTON LOCKS**

- A. Manufacturers:
1. Scheduled Manufacturer: These mechanical pushbutton lock specifications are intended to provide a product which matches the mechanical pushbutton locks on the nearby ARFF Building. Coordinate with Owner to ensure that selected mechanical pushbutton locks match the Owner's existing lock system. Products of other manufacturers meeting or exceeding design and performance requirements specified herein will be considered for substitution subject to compliance with provisions of Division 01 Section "Substitution Procedures."
  2. Scheduled Manufacturer and Product: dormakaba Simplex L1000 series.
- B. Requirements:
1. Provide mechanical pushbutton locks conforming to ANSI/BHMA A156.2, Grade 1, and UL Listed for 3 hour fire doors.
  2. Lock Housing: Heavy-duty cylindrical lock, cast front housing, brass unified trim plate, fixed cast or wrought ADA compliant levers, 2 3/4" (70 mm) backset.
    - a. Latch: 3/4 inch (19mm) beveled front throw latch
    - b. Door Thickness: 1-3/4 inch (45 mm)
    - c. Door handing: Factory handed
  3. Finished to ANSI/BHMA standard for Materials and Finishes: 626 - Satin Chrome



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#### **2.6 CYLINDERS**

- A. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Scheduled Manufacturer: BEST
- B. Requirements:
  - 1. Provide interchangeable cylinders/cores to match Owner's existing key system, compliant with ANSI/BHMA A156.5; latest revision; cylinder face finished to match lockset, manufacturer's series as indicated. Refer to "KEYING" article, herein.
- C. Construction Keying:
  - 1. Replaceable Construction Cores.
    - a. Provide temporary construction cores replaceable by permanent cores, furnished in accordance with the following requirements.
      - 1) 3 construction control keys
      - 2) 12 construction change (day) keys.
    - b. Owner or Owner's Representative will replace temporary construction cores with permanent cores.

#### **2.7 KEYING**

- A. Comply with guidelines in ANSI/BHMA A156.28, incorporating decisions made at keying conference.
- B. Provide cylinders/cores keyed into Owner's existing keying system managed by Owner's locksmith, complying with guidelines in ANSI/BHMA A156.28, incorporating decisions made at keying conference.
- C. Requirements:
  - 1. Provide permanent cylinders/cores keyed by the manufacturer according to the following key system.
    - a. Master Keying system as directed by the Owner.
  - 2. Forward bitting list and keys separately from cylinders, by means as directed by Owner. Failure to comply with forwarding requirements will be cause for replacement of cylinders/cores involved at no additional cost to Owner.
  - 3. Provide keys with the following features:
    - a. Material: Nickel silver; minimum thickness of .107-inch (2.3mm)
  - 4. Identification:

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- a. Mark permanent cylinders/cores and keys with applicable blind code per DHI publication "Keying Systems and Nomenclature" for identification. Do not provide blind code marks with actual key cuts.
  - b. Identification stamping provisions must be approved by the Architect and Owner.
  - c. Stamp cylinders/cores and keys with Owner's unique key system facility code as established by the manufacturer; key symbol and embossed or stamped with "DO NOT DUPLICATE" along with the "PATENTED" or patent number to enforce the patent protection.
  - d. Failure to comply with stamping requirements will be cause for replacement of keys involved at no additional cost to Owner.
  - e. Forward permanent cylinders/cores to Owner, separately from keys, by means as directed by Owner.
5. Quantity: Furnish in the following quantities.
- a. Change (Day) Keys: 3 per cylinder/core.
  - b. Permanent Control Keys: 3.
  - c. Master Keys: 6.

## **2.8 DOOR CLOSERS**

- A. Manufacturers and Products: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Scheduled Manufacturer and Product: LCN 4040XP series.
  2. Acceptable Manufacturers and Products: Corbin-Russwin DC8000 series, Sargent 281 series.
- B. Requirements:
1. Provide door closers conforming to ANSI/BHMA A156.4 Grade 1 requirements by BHMA certified independent testing laboratory. ISO 9000 certify closers. Stamp units with date of manufacture code.
  2. Provide door closers with fully hydraulic, full rack and pinion action with high strength cast iron cylinder, and full complement bearings at shaft.
  3. Cylinder Body: 1-1/2 inch (38 mm) diameter with 3/4 inch (19 mm) diameter double heat-treated pinion journal.
  4. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.
  5. Spring Power: Continuously adjustable over full range of closer sizes, and providing reduced opening force as required by accessibility codes and standards.
  6. Hydraulic Regulation: By tamper-proof, non-critical valves, with separate adjustment for latch speed, general speed, and backcheck.
  7. Provide closers with solid forged steel main arms and factory assembled heavy-duty forged forearms for parallel arm closers.
  8. Pressure Relief Valve (PRV) Technology: Not permitted.
  9. Finish for Closer Cylinders, Arms, Adapter Plates, and Metal Covers: Powder coating finish which has been certified to exceed 100 hours salt spray testing as described in ANSI Standard A156.4 and ASTM B117, or has special rust inhibitor (SRI).
  10. Provide special templates, drop plates, mounting brackets, or adapters for arms as required for details, overhead stops, and other door hardware items interfering with closer mounting.

**2.9 DOOR TRIM**

- A. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Scheduled Manufacturer: Ives.
  2. Acceptable Manufacturers: Burns, Rockwood.
- B. Requirements:
1. Provide push plates 4 inches (102 mm) wide by 16 inches (406 mm) high by 0.050 inch (1 mm) thick and beveled 4 edges. Where width of door stile prevents use of 4 inches (102 mm) wide plate, adjust width to fit.
  2. Provide push bars of solid bar stock, diameter and length as scheduled. Provide push bars of sufficient length to span from center to center of each stile. Where required, mount back to back with pull.
  3. Provide offset pulls of solid bar stock, diameter and length as scheduled. Where required, mount back to back with push bar.
  4. Provide flush pulls as scheduled. Where required, provide back-to-back mounted model.
  5. Provide pulls of solid bar stock, diameter and length as scheduled. Where required, mount back to back with push bar.
  6. Provide pull plates 4 inches (102 mm) wide by 16 inches (406 mm) high by 0.050 inch (1 mm) thick, beveled 4 edges, and prepped for pull. Where width of door stile prevents use of 4 inches (102 mm) wide plate, adjust width to fit.
  7. Provide wire pulls of solid bar stock, diameter and length as scheduled.
  8. Provide decorative pulls as scheduled. Where required, mount back to back with pull.

**2.10 PROTECTION PLATES**

- A. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Scheduled Manufacturer: Ives.
  2. Acceptable Manufacturers: Burns, Rockwood.
- B. Requirements:
1. Provide kick plates, mop plates, and armor plates minimum of 0.050 inch (1 mm) thick, beveled four edges as scheduled. Furnish with sheet metal or wood screws, finished to match plates.
  2. Sizes of plates:
    - a. Kick Plates: 10 inches (254 mm) high by 2 inches (51 mm) less width of door on single doors, 1 inch (25 mm) less width of door on pairs
    - b. Mop Plates: 4 inches (102 mm) high by 2 inches (51 mm) less width of door on single doors, 1 inch (25 mm) less width of door on pairs
    - c. Armor Plates: 36 inches (914 mm) high by 2 inches (51 mm) less width of door on single doors, 1 inch (25 mm) less width of door on pairs

**2.11 DOOR STOPS AND HOLDERS**

- A. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Scheduled Manufacturer: Ives.
  - 2. Acceptable Manufacturers: Burns, Rockwood.
- B. Provide door stops at each door leaf:
  - 1. Provide wall stops wherever possible. Provide convex type where mortise type locks are used and concave type where cylindrical type locks are used.
  - 2. Where a wall stop cannot be used, provide universal floor stops for low or high rise options.
  - 3. Where wall or floor stop cannot be used, provide medium duty surface mounted overhead stop.

**2.12 THRESHOLDS, SEALS, DOOR SWEEPS, AUTOMATIC DOOR BOTTOMS, AND GASKETING**

- A. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Scheduled Manufacturer: Zero International.
  - 2. Acceptable Manufacturers: National Guard, Reese.
- B. Requirements:
  - 1. Provide thresholds, weather-stripping (including door sweeps, seals, and astragals) and gasketing systems (including smoke, sound, and light) as specified and per architectural details. Match finish of other items.
  - 2. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that meets requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.
  - 3. Size of thresholds:
    - a. Saddle Thresholds: 1/2 inch (13 mm) high by jamb width by door width
    - b. Bumper Seal Thresholds: 1/2 inch (13 mm) high by 5 inches (127 mm) wide by door width
  - 4. Provide door sweeps, seals, astragals, and auto door bottoms only of type where resilient or flexible seal strip is easily replaceable and readily available.

**2.13 SILENCERS**

- A. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

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1. Scheduled Manufacturer: Ives.
2. Acceptable Manufacturers: Burns, Rockwood.

**B. Requirements:**

1. Provide "push-in" type silencers for hollow metal or wood frames.
2. Provide one silencer per 30 inches (762 mm) of height on each single frame, and two for each pair frame.
3. Omit where gasketing is specified.

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. Prior to installation of hardware, examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

#### **3.2 INSTALLATION**

- A. Mount door hardware units at heights to comply with the following, unless otherwise indicated or required to comply with governing regulations.
  1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
  2. Custom Steel Doors and Frames: HMMA 831.
  3. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
- B. Install each hardware item in compliance with manufacturer's instructions and recommendations, using only fasteners provided by manufacturer.
- C. Do not install surface mounted items until finishes have been completed on substrate. Protect all installed hardware during painting.
- D. Set units level, plumb and true to line and location. Adjust and reinforce attachment substrate as necessary for proper installation and operation.
- E. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

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- F. Install operating parts so they move freely and smoothly without binding, sticking, or excessive clearance.
- G. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than quantity recommended by manufacturer for application indicated or one hinge for every 30 inches (750 mm) of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.
- H. Intermediate Offset Pivots: Where offset pivots are indicated, provide intermediate offset pivots in quantities indicated in door hardware schedule but not fewer than one intermediate offset pivot per door and one additional intermediate offset pivot for every 30 inches (750 mm) of door height greater than 90 inches (2286 mm).
- I. Lock Cylinders: Install construction cores to secure building and areas during construction period.
  - 1. Furnish permanent cores to Owner for installation.
- J. Door Closers: Mount closers on room side of corridor doors, inside of exterior doors, and stair side of stairway doors from corridors. Mount closers so they are not visible in corridors, lobbies and other public spaces unless approved by Architect.
- K. Closer/Holders: Mount closer/holders on room side of corridor doors, inside of exterior doors, and stair side of stairway doors.
- L. Thresholds: Set thresholds in full bed of sealant complying with requirements specified in Division 07 Section "Joint Sealants."
- M. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they may impede traffic or present tripping hazard.
- N. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
- O. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.
- P. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

### **3.3 FIELD QUALITY CONTROL**

- A. Engage qualified manufacturer trained representative to perform inspections and to prepare inspection reports.

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1. Representative will inspect door hardware and state in each report whether installed work complies with or deviates from requirements, including whether door hardware is properly installed and adjusted.

### **3.4 ADJUSTING**

- A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.
  1. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.
- B. Occupancy Adjustment: Approximately three to six months after date of Substantial Completion, Installer's Architectural Hardware Consultant must examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors and door hardware.

### **3.5 CLEANING AND PROTECTION**

- A. Clean adjacent surfaces soiled by door hardware installation.
- B. Clean operating items as necessary to restore proper function and finish.
- C. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of Substantial Completion.

### **3.6 DOOR HARDWARE SCHEDULE**

- A. Hardware items are referenced in the following hardware. Refer to the above-specifications for special features, options, cylinders/keying, and other requirements.
- B. Hardware Sets:

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#### Hardware Group No. 1

For use on Door #(s):

101-2

Provide each SGL door(s) with the following:







QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP SEC		630	IVE
1	EA	MECHANICAL PUSHBUTTON LOCK	L103526D41		626	KABA
1	EA	SURFACE CLOSER	4040XP CUSH SRI		689	LCN
1	EA	FLOOR STOP (LOCATE TO PREVENT TRIPPING HAZARD)	FS444		626	IVE
1	EA	GASKETING	488SBK PSA		BK	ZER
1	EA	DOOR SWEEP	8198AA		AA	ZER
1	EA	THRESHOLD	8724A		A	ZER

#### Hardware Group No. 2

For use on Door #(s):

102-1

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		626	IVE
1	EA	MORTISE CYLINDER	1E74		626	BES
1	EA	STOREROOM LOCK	L9080HD 06A		630	SCH
1	EA	SURFACE CLOSER	4040XP REG OR PA AS REQ WMS		689	LCN
1	EA	WALL STOP	WS406/407CCV		US32D	IVE
3	EA	SILENCER	SR64		GRY	IVE

#### Hardware Group No. 3

For use on Door #(s):

100-2

101-1

101-4

NOTE:

ALL HARDWARE PROVIDED BY  
DOOR MANUFACTURER



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#### Hardware Group No. 4

For use on Door #(s):

100-1                      101-3

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP SEC		630	IVE
1	EA	ENTRANCE LOCK	L9060HD 06A		630	SCH
1	EA	MORTISE CYLINDER	1E74		626	BES
1	EA	SURFACE CLOSER	4040XP CUSH SRI		689	LCN
1	EA	FLOOR STOP	FS444		626	IVE
		(LOCATE TO PREVENT TRIPPING HAZARD)				
1	EA	GASKETING	488SBK PSA		BK	ZER
1	EA	DOOR SWEEP	8198AA		AA	ZER
1	EA	THRESHOLD	8724A		A	ZER

**END OF SECTION 08 71 00**

## **SECTION 08 80 00 - GLAZING**

### **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. Glass for doors.
  - 2. Glazing sealants and accessories.
- B. Related Requirements:
  - 1. Section 08 11 13 "Hollow Metal Doors and Frames" for hollow metal doors to receive glazing.
  - 2. Section 08 53 13 "Vinyl Windows" for glazing provide with vinyl windows.
  - 3. Section 08 36 13 "Sectional Doors" for glazing in sectional doors.

#### **1.3 DEFINITIONS**

- A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.
- B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.
- C. IBC: International Building Code.
- D. Interspace: Space between lites of an insulating-glass unit.

#### **1.4 COORDINATION**

- A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

#### **1.5 PREINSTALLATION MEETINGS**

- A. Preinstallation Conference: Conduct conference at Project site.
  - 1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
  - 2. Review temporary protection requirements for glazing during and after installation.

**1.6 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
- B. Glass Samples: For each type of the following products; 12 inches square.
  - 1. Insulating glass.

**1.7 INFORMATIONAL SUBMITTALS**

- A. Qualification Data: For Installer.
- B. Product Certificates: For glass.
- C. Product Test Reports: For insulating glass, for tests performed by a qualified testing agency.
  - 1. For glazing sealants, provide test reports based on testing current sealant formulations within previous 36-month period.

**1.8 QUALITY ASSURANCE**

- A. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.

**1.9 DELIVERY, STORAGE, AND HANDLING**

- A. Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.
- B. Comply with insulating-glass manufacturer's written instructions for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

**1.10 FIELD CONDITIONS**

- A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.
  - 1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or are below 40 deg F.

**1.11 WARRANTY**

- A. Manufacturer's Special Warranty for Insulating Glass: Manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.

1. Warranty Period: 10 years from date of Substantial Completion.

## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURERS**

- A. Source Limitations for Glass: Obtain from single source from single manufacturer for each glass type.
- B. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.

### **2.2 PERFORMANCE REQUIREMENTS**

- A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.
- B. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated determined according to the IBC and ASTM E 1300.
  1. Design Wind Pressures: As indicated on Drawings and/or Section 13 34 19 "Metal Building Systems.
- C. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:
  1. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.

### **2.3 GLASS PRODUCTS, GENERAL**

- A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.
  1. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."
- B. Safety Glazing Labeling: Where safety (tempered) glazing is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction or manufacturer. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.
- C. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.
- D. Thickness: Where glass thickness is indicated, it is a minimum.
  1. Minimum Glass Thickness for Exterior Lites: 6 mm.

- E. Strength: All glass provided under this Section shall be fully tempered float glass.

## **2.4 GLASS PRODUCTS**

- A. Fully Tempered Float Glass: ASTM C 1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear), Quality-Q3.
1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.

## **2.5 INSULATING GLASS**

- A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E 2190.
1. Sealing System: Dual seal, with manufacturer's standard primary and secondary sealants.
  2. Perimeter Spacer: Manufacturer's standard spacer material and construction.
  3. Desiccant: Molecular sieve or silica gel, or a blend of both.

## **2.6 GLAZING SEALANTS**

- A. General:
1. Compatibility: Compatible with one another and with other materials they contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
  2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
  3. Colors of Exposed Glazing Sealants: Light grey.
- B. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 100/50, Use NT.

## **2.7 GLAZING TAPES**

- A. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:
1. AAMA 810.1, Type 1, for glazing applications in which tape acts as the primary sealant.
  2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

## **2.8 MISCELLANEOUS GLAZING MATERIALS**

- A. General: Provide products of material, size, and shape complying with referenced glazing standard, with requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

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- B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.
- C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.
- D. Spacers: Elastomeric blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
- E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

### **2.9 FABRICATION OF GLAZING UNITS**

- A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.
  - 1. Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.
    - a. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.
- B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites to produce square edges with slight chamfers at junctions of edges and faces.
- C. Grind smooth and polish exposed glass edges and corners.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:
  - 1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
  - 2. Presence and functioning of weep systems.
  - 3. Minimum required face and edge clearances.
  - 4. Effective sealing between joints of glass-framing members.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 PREPARATION**

- A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.
- B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that leave visible marks in the completed Work.

**3.3 GLAZING, GENERAL**

- A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.
- B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.
- C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.
- D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- F. Provide spacers for glass lites where length plus width is larger than 50 inches.
  - 1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
  - 2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.
- G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

**3.4 SEALANT GLAZING (WET)**

- A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.
- B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.
- C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

**3.5 CLEANING AND PROTECTION**

- A. Immediately after installation remove nonpermanent labels and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry

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surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.

1. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.
- C. Remove and replace glass that is damaged during construction period.
- D. Wash glass on both exposed surfaces not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

### **3.6 INSULATING GLASS SCHEDULE**

- A. Glass Type **GL-1**: Clear insulating glass.
  1. Overall Unit Thickness: 1 inch (25 mm).
  2. Minimum Thickness of Each Glass Lite: 6 mm.
  3. Outdoor Lite: Fully tempered float glass.
  4. Interspace Content: Argon.
  5. Indoor Lite: Fully tempered float glass.
  6. Safety glazing required.

**END OF SECTION 08 80 00**



## **SECTION 09 22 16 - NON-STRUCTURAL METAL FRAMING**

### **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. Non-load-bearing steel framing systems for interior partitions.

#### **1.3 ACTION SUBMITTALS**

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

#### **1.4 INFORMATIONAL SUBMITTALS**

- A. Product Certificates: For each type of code-compliance certification for studs and tracks.
- B. Evaluation Reports: For post-installed anchors and power-actuated fasteners, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

#### **1.5 QUALITY ASSURANCE**

- A. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified according to the product-certification program of the Certified Steel Stud Association, the Steel Framing Industry Association or the Steel Stud Manufacturers Association.

### **PART 2 - PRODUCTS**

#### **2.1 PERFORMANCE REQUIREMENTS**

- A. Horizontal Deflection: For wall assemblies, limited to 1/240 of the wall height based on horizontal loading of 10 lbf/sq. ft.

#### **2.2 FRAMING SYSTEMS**

- A. Framing Members, General: Comply with ASTM C 754 for conditions indicated.

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1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal unless otherwise indicated.
  2. Protective Coating: ASTM A 653/A 653M, G60, hot-dip galvanized unless otherwise indicated.
- B. Studs and Tracks: ASTM C 645.
1. Steel Studs and Tracks:
    - a. Minimum Base-Metal Thickness: As required by performance requirements for horizontal deflection.
    - b. Depth: As indicated on Drawings.
- C. Slip-Type Head Joints: Where indicated, provide one of the following:
1. Deflection Track: Steel sheet top track manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.

### **2.3 AUXILIARY MATERIALS**

- A. General: Provide auxiliary materials that comply with referenced installation standards.
1. Fasteners for Steel Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 INSTALLATION, GENERAL**

- A. Installation Standard: ASTM C 754.
1. Plywood Siding Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.
- B. Install framing and accessories plumb, square, and true to line, with connections securely fastened.
- C. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
- D. Install bracing at terminations in assemblies.

- E. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

### **3.3 INSTALLING FRAMED ASSEMBLIES**

- A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
  - 1. Single-Layer Application: 16 inches o.c. unless otherwise indicated.
- B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
- C. Install studs so flanges within framing system point in same direction.
- D. Install tracks at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts that penetrate partitions above ceiling.
  - 1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.

**END OF SECTION 09 22 16**

## **SECTION 09 29 00 GYPSUM BOARD**

### **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. Interior gypsum board.
- B. Related Requirements:
  - 1. Section 09 22 16 "Non-Structural Metal Framing" for non-structural steel framing and suspension systems that support gypsum board panels.

#### **1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
- B. Samples: For the following products:
  - 1. Trim Accessories: Full-size Sample in 12-inch-long length for each trim accessory indicated.

#### **1.4 DELIVERY, STORAGE AND HANDLING**

- A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

#### **1.5 FIELD CONDITIONS**

- A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written instructions, whichever are more stringent.
- B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.
- C. Do not install panels that are wet, moisture damaged, and mold damaged.
  - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.

2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

## **PART 2 - PRODUCTS**

### **2.1 GYPSUM BOARD, GENERAL**

- A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

### **2.2 INTERIOR GYPSUM BOARD**

- A. Gypsum Board, Type X: ASTM C 1396/C 1396M.
  1. Thickness: 5/8 inch.
  2. Long Edges: Tapered.

### **2.3 TRIM ACCESSORIES**

- A. Interior Trim: ASTM C 1047.
  1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized-steel sheet.
  2. Shapes:
    - a. Cornerbead.
    - b. LC-Bead: J-shaped; exposed long flange receives joint compound.
    - c. Expansion (control) joint.

### **2.4 JOINT TREATMENT MATERIALS**

- A. General: Comply with ASTM C 475/C 475M.
- B. Joint Tape:
  1. Interior Gypsum Board: Paper.
- C. Joint Compound for Interior Gypsum Board: For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.
  1. Prefilling: At open joints and damaged surface areas, use setting-type taping compound.
  2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping or drying-type, all-purpose compound.
    - a. Use setting-type compound for installing paper-faced metal trim accessories.
  3. Fill Coat: For second coat, use setting-type, sandable topping or drying-type, all-purpose compound.
  4. Finish Coat: For third coat, use setting-type, sandable topping or drying-type, all-purpose compound.

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- D. Steel Drill Screws: ASTM C 1002 unless otherwise indicated.
  - 1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick.

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. Examine areas and substrates including welded hollow-metal frames and support framing, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
- B. Examine panels before installation. Reject panels that are wet, moisture damaged, or mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

#### **3.2 APPLYING AND FINISHING PANELS, GENERAL**

- A. Comply with ASTM C 840.
- B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
- C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.
- D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.
- E. Form control and expansion joints with space between edges of adjoining gypsum panels.
- F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
  - 1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
  - 2. Fit gypsum panels around ducts, pipes, and conduits.
  - 3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- wide joints to install sealant.
- G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide 1/4- to 1/2-inch-wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

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- H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
- I. Wood Framing: Install gypsum panels over wood framing, with floating internal corner construction. Do not attach gypsum panels across the flat grain of wide-dimension lumber, including floor joists and headers. Float gypsum panels over these members or provide control joints to counteract wood shrinkage.

### **3.3 APPLYING INTERIOR GYPSUM BOARD**

- A. Install interior gypsum board in the following locations:
  - 1. Type X: As indicated on Drawings.
- B. Single-Layer Application:
  - 1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
  - 2. On partitions/walls, apply gypsum panels vertically (parallel to framing) or horizontally (perpendicular to framing at the Contractor's option unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
    - a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
  - 3. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

### **3.4 INSTALLING TRIM ACCESSORIES**

- A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
- B. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect for visual effect].
- C. Interior Trim: Install in the following locations:
  - 1. Cornerbead: Use at outside corners.
  - 2. LC-Bead: Use at exposed panel edges.
  - 3. U-Bead: Use at exposed panel edges where indicated.

### **3.5 FINISHING GYPSUM BOARD**

- A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
- B. Prefill open joints and damaged surface areas.
- C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.

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- D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:
  - 1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
  - 2. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated <above reinforced concrete wall (12'-0" AFF) between Sand Storage Bay and Drive Through Bay on the Drive Through Bay side.>.
    - a. Primer and its application to surfaces are specified in Section 099123 "Interior Painting."

#### **3.6 PROTECTION**

- A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.
- B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- C. Remove and replace panels that are wet, moisture damaged, and mold damaged.
  - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
  - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

**END OF SECTION 09 29 00**



## **SECTION 09 65 13 - RESILIENT BASE AND ACCESSORIES**

### **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. Resilient base.

#### **1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
- B. Samples: For each exposed product and for each color and texture specified, not less than 12 inches long.
- C. Samples for Initial Selection: For each type of product indicated.
- D. Samples for Verification: For each type of product indicated and for each color, texture, and pattern required in manufacturer's standard-size Samples, but not less than 12 inches long.

#### **1.4 MAINTENANCE MATERIAL SUBMITTALS**

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Furnish not less than 10 linear feet for every 500 linear feet or fraction thereof, of each type, color, pattern, and size of resilient product installed.

#### **1.5 DELIVERY, STORAGE, AND HANDLING**

- A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F.

#### **1.6 FIELD CONDITIONS**

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive resilient products during the following time periods:

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1. 48 hours before installation.
  2. During installation.
  3. 48 hours after installation.
- B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.
- C. Install resilient products after other finishing operations, including painting, have been completed.

### **PART 2 - PRODUCTS**

#### **2.1 VINYL BASE**

- A. Product Standard: ASTM F 1861, Type TV (vinyl, thermoplastic).
1. Group: I (solid, homogeneous) or II (layered).
  2. Style and Location:
    - a. Style B, Cove: Provide where indicated on the Drawings.
- B. Minimum Thickness: 0.125 inch.
- C. Height: 4 inches
- D. Lengths: Coils in manufacturer's standard length.
- E. Outside Corners: Job formed.
- F. Inside Corners: Job formed
- G. Colors and Patterns: Match Architect's sample.

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
1. Installation of resilient products indicates acceptance of surfaces and conditions.

### **3.2 PREPARATION**

- A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.
- B. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.
- C. Do not install resilient products until they are the same temperature as the space where they are to be installed.
  - 1. At least 48 hours in advance of installation, move resilient products and installation materials into spaces where they will be installed.
- D. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

### **3.3 RESILIENT BASE INSTALLATION**

- A. Comply with manufacturer's written instructions for installing resilient base.
- B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
- C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.
- D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
- E. Do not stretch resilient base during installation.
- F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.
- G. Job-Formed Corners:
  - 1. Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.
    - a. Form without producing discoloration (whitening) at bends.
  - 2. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.
    - a. Miter or cope corners to minimize open joints.

### **3.4 CLEANING AND PROTECTION**

- A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.
- B. Perform the following operations immediately after completing resilient-product installation:
  - 1. Remove adhesive and other blemishes from exposed surfaces.

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- C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

**END OF SECTION 09 65 13**

## **SECTION 09 91 13 - EXTERIOR PAINTING**

### **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 surface preparation and the application of paint systems on exterior substrates including the following.
  - 1. Galvanized metal.
- B. Related Requirements:
  - 1. Section 05 50 00 "Metal Fabrications" for shop priming metal fabrications.
  - 2. Section 08 11 13 "Hollow Metal Doors and Frame." For shop primed hollow metal doors.
  - 3. Section 09 91 23 "Interior Painting" for interior painting.
  - 4. Section 074113 "Formed Metal Roof and Wall Panels" for factory pre-finishing of metal roof and wall panels.

#### **1.3 DEFINITIONS**

- A. MPI Gloss Level 1: Not more than five units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.
- B. MPI Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- C. MPI Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.
- D. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.
- E. MPI Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.
- F. MPI Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

#### **1.4 ACTION SUBMITTALS**

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
  - 1. Include printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
  - 2. Indicate VOC content.

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- B. Samples for Initial Selection: For each type of topcoat product.
- C. Samples for Verification: For each type of paint system and each color and gloss of topcoat.
  - 1. Submit Samples on rigid backing, 8 inches square.
- D. Product List: Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

### **1.5 MAINTENANCE MATERIAL SUBMITTALS**

- A. Furnish extra materials, **from the same product run**, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Not less than 1/2 gal. of each material and color applied.

### **1.6 DELIVERY, STORAGE, AND HANDLING**

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
  - 1. Maintain containers in clean condition, free of foreign materials and residue.
  - 2. Remove rags and waste from storage areas daily.

### **1.7 FIELD CONDITIONS**

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.
- B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURERS**

- A. Products: Subject to compliance with requirements, provide product listed in the Exterior Painting Schedule for the paint category indicated.

### **2.2 PAINT, GENERAL**

- A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists."
- B. Material Compatibility:
  - 1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.

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2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.
- C. Colors: To match panel manufacturer's standard colors or adjacent ARFF Building as indicated on the Drawings.

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.
- C. Proceed with coating application only after unsatisfactory conditions have been corrected.
  1. Application of coating indicates acceptance of surfaces and conditions.

#### **3.2 PREPARATION**

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
  1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.
- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
  1. Remove incompatible primers and re-prime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
- D. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer but not less than the following:
  1. SSPC-SP 2.
- E. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
- F. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.
- G. Apply paints according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."

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1. Use applicators and techniques suited for paint and substrate indicated.
  2. Paint surfaces behind movable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.
  3. Paint both sides and edges of exterior doors and entire exposed surface of exterior door frames.
  4. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
- H. Tint undercoats same color as topcoat, but tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Provide sufficient difference in shade of undercoats to distinguish each separate coat.
- I. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- J. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

### **3.3 CLEANING AND PROTECTION**

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

### **3.4 EXTERIOR PAINTING SCHEDULE**

- A. Galvanized-Metal Substrates:
1. Latex System MPI EXT 5.3A:
    - a. Prime Coat: Primer, galvanized, water based, MPI #134.
    - b. Intermediate Coat: Latex, exterior, matching topcoat.
    - c. Topcoat: Latex, exterior, gloss (MPI Gloss Level 6), MPI #119.

**END OF SECTION 09 91 13**



## **SECTION 09 91 23 - INTERIOR PAINTING**

### **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 surface preparation and the application of paint systems on the following interior substrates:
  - 1. Steel and iron.
  - 2. Galvanized metal.
  - 3. Wood.
  - 4. Gypsum board.
- B. Related Requirements:
  - 1. Section 05 50 00 "Metal Fabrications" for shop priming metal fabrications.
  - 2. Section 08 11 13 "Hollow Metal Doors and Frames" for factory priming of hollow metal doors and frames to receive interior paint finish.
  - 3. Section 13 34 19 "Metal Building Systems" for priming of architecturally exposed structural steel framing for shop priming of structural steel to receive interior paint finish.

#### **1.3 DEFINITIONS**

- A. MPI Gloss Level 1: Not more than five units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.
- B. MPI Gloss Level 2: Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- C. MPI Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- D. MPI Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.
- E. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.
- F. MPI Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.
- G. MPI Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

**1.4 ACTION SUBMITTALS**

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
  - 1. Include Printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
  - 2. Indicate VOC content.
- B. Samples for Initial Selection: For each type of topcoat product.
- C. Samples for Verification: For each type of paint system and in each color and gloss of topcoat.
  - 1. Submit Samples on rigid backing, 8 inches square.
  - 2. Apply coats on Samples in steps to show each coat required for system.
  - 3. Label each coat of each Sample.
  - 4. Label each Sample for location and application area.
- D. Product List: Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

**1.5 MAINTENANCE MATERIAL SUBMITTALS**

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Paint: 5 percent, but not less than 1 gal. of each material and color applied.

**1.6 DELIVERY, STORAGE, AND HANDLING**

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
  - 1. Maintain containers in clean condition, free of foreign materials and residue.
  - 2. Remove rags and waste from storage areas daily.

**1.7 FIELD CONDITIONS**

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.
- B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

**PART 2 - PRODUCTS**

**2.1 PAINT, GENERAL**

- A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists."

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- B. Material Compatibility:
  - 1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
  - 2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.
- C. Colors: Match Architect's samples.

### **2.2 SOURCE QUALITY CONTROL**

- A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:
  - 1. Owner will engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
  - 2. Testing agency will perform tests for compliance with product requirements.
  - 3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
  - 1. Wood: 15 percent.
  - 2. Gypsum Board: 12 percent.
- C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.
- D. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.
- E. Proceed with coating application only after unsatisfactory conditions have been corrected.
  - 1. Application of coating indicates acceptance of surfaces and conditions.

### **3.2 PREPARATION**

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.

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- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
  - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
  - 1. Remove incompatible primers and re-prime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
- D. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer but not less than the following:
  - 1. SSPC-SP 2.
- E. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
- F. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.
- G. Wood Substrates:
  - 1. Scrape and clean knots, and apply coat of knot sealer before applying primer.
  - 2. Sand surfaces that will be exposed to view, and dust off.
  - 3. Prime edges, ends, faces, undersides, and backsides of wood.
  - 4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

### **3.3 APPLICATION**

- A. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."
  - 1. Use applicators and techniques suited for paint and substrate indicated.
  - 2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
  - 3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
  - 4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
  - 5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
- B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.
- C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

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- D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
  - 1. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

#### **3.4 FIELD QUALITY CONTROL**

- A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
  - 1. Contractor shall touch up and restore painted surfaces damaged by testing.
  - 2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

#### **3.5 CLEANING AND PROTECTION**

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

#### **3.6 INTERIOR PAINTING SCHEDULE**

- A. Steel Substrates:
  - 1. Latex System, Alkyd Primer MPI INT 5.1Q:
    - a. Prime Coat: Primer, alkyd, anti-corrosive, for metal, MPI #79 unless specified differently elsewhere.
    - b. Prime Coat: Shop primer specified in Section where substrate is specified.
    - c. Topcoat: Latex, interior, gloss (MPI Gloss Level 6, except minimum gloss of 65 units at 60 degrees), MPI #114.
  - 2. Latex over Shop-Applied Quick-Drying Shop Primer System MPI INT 5.1X:
    - a. Prime Coat: Primer, quick dry, for shop application, MPI #275.
    - b. Intermediate Coat: same as topcoat.
    - c. Topcoat: Latex, interior, gloss (MPI Gloss Level 6, except minimum gloss of 65 units at 60 degrees), MPI #114.
- B. Galvanized-Metal Substrates:

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1. Latex System MPI INT 5.3A:
  - a. Prime Coat: Primer, galvanized, cementitious, MPI #26.
  - b. Intermediate Coat: To match topcoat
  - c. Topcoat: Latex, interior, gloss (MPI Gloss Level 6, except minimum gloss of 65 units at 60 degrees), MPI #114.
  
- C. Wood Substrates: Plywood siding wall panels.
  1. Latex over Latex Primer System MPI INT 6.4R:
    - a. Prime Coat: Primer, latex, for interior wood, MPI #39.
    - b. Intermediate Coat: To match topcoat
    - c. Topcoat: Latex, interior, gloss (MPI Gloss Level 6, except minimum gloss of 65 units at 60 degrees), MPI #114.
  
- D. Gypsum Board Substrates:
  1. Latex over Latex Sealer System MPI INT 9.2A:
    - a. Prime Coat: Latex, interior, matching topcoat.
    - b. Intermediate Coat: To match topcoat
    - c. Topcoat: Latex, interior, gloss (MPI Gloss Level 6, except minimum gloss of 65 units at 60 degrees), MPI #114.

**END OF SECTION 09 91 23**

## **SECTION 10 42 50 - SIGNS**

### **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. Dimensional letters and numbers.

#### **1.3 ACTION SUBMITTALS**

- A. General: Submit the following according to the Conditions of the Contract and Division 1 Specification Sections.
- B. Product data for each type of sign specified, including details of construction relative to materials, dimensions of individual components, profiles, and finishes.
- C. Shop drawings showing material, fabrication and erection of signs.
  - 1. Provide message list for each sign required, including large-scale details of wording and lettering layout.
  - 2. For signs supported by or anchored to permanent construction, provide setting drawings, templates, and directions for installation of anchor bolts and other anchors to be installed as a unit of Work in other Sections.
  - 3. Templates: Furnish full-size spacing templates for individually mounted dimensional letters and numbers.
- D. Samples: Provide the following samples of each sign component for initial selection of color, pattern and surface texture as required and for verification of compliance with requirements indicated.
  - 1. Samples for initial selection of color, pattern, and texture.
    - a. Submit samples of exposed dimension letter finish material to match existing nearby ARFF building for verification and approval.

#### **1.4 QUALITY ASSURANCE**

- A. Sign Fabricator Qualifications: Firm producing signs with minimum three years of experience similar to those indicated for this Project, with a record of successful in-service performance, and sufficient production capacity to produce sign units required without causing delay in the Work.
- B. Single-Source Responsibility: For each separate sign type required, obtain signs from one source of a single manufacturer.

**1.5 DESIGN INTENT**

- A. Match Existing Signage: The intent of this Section is to provide door number signage that matches the door number signage on the nearby ARFF Building. The ARFF signage was provided under a Technical Specification very similar to this Section. If it is, for some reason, not possible to meet this intent. You are hereby directed to Notify the Owner's Representative.

**PART 2 - PRODUCTS**

**2.1 MATERIALS**

- A. Aluminum Sheet: Provide aluminum sheet of alloy and temper recommended by the sign manufacturer for the type of use and finish indicated, and with not less than the strength and durability properties specified in ASTM B 209 for 5005-H15.NFPA Compliance.
- B. Anchors and Inserts: Use nonferrous metal or hot-dipped galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use toothed steel or lead expansion bolt devices for drilled-in-place anchors. Furnish inserts, as required, to be set into concrete or masonry work.

**2.2 DIMENSIONAL LETTERS AND NUMBERS**

- A. Cutout Letters and Numbers: Cut letters and numbers from solid plate material of thickness indicated. Produce precisely cut characters with square cut, smooth edges. Comply with requirements indicated for finish, style, and size.
  - 1. Metal: Aluminum.
- B. Fabricated Letters and Numbers: Fabricate letters and numbers to required sizes and styles, using metals and thicknesses indicated. Form exposed faces and sides of characters to produce surfaces free from warp and distortion. Include internal bracing for stability and attachment of mounting accessories. Comply with requirements indicated for finish, style, and size.
  - 1. Aluminum Sheet: Not less than 0.090 inch thick. Fabricate by the heliarc welding process.
  - 2. Letter Height: As indicated on the Drawings.
  - 3. Letter Style: Times New Roman

**2.3 FINISHES**

- A. Colors and Surface Textures: For exposed sign material that requires selection of materials with integral or applied colors, surface textures or other characteristics related to appearance, provide color matches indicated, or if not indicated, as selected by the Architect from the manufacturer's standards.
- B. Metal Finishes: Comply with NAAMM "Metal Finishes Manual" for finish designations and applications recommendations.
- C. Aluminum Finishes: Finish designations prefixed by "AA" conform to the system established by the Aluminum Association for designating aluminum finishes.



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1. Class II Clear Anodized Medium Satin Finish: AA-M31C22A31 (Mechanical Finish: Fine satin directional textured; Chemical Finish: Medium matte etched finish; Anodic Coating: Class II Architectural, clear film thicker than 0.4 mil).

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION**

- A. General: Locate sign units and accessories where indicated, using mounting methods of the type de-scribed and in compliance with the manufacturer's instructions.
  1. Install signs level, plumb, and at the height indicated, with sign surfaces free from distortion or other defects in appearance.
- B. Dimensional Letters and Numbers: Mount letters and numbers using standard fastening methods recommended by the manufacturer for letter form, type of mounting, wall construction, and condition of exposure indicated. Provide heavy paper template to establish letter spacing and to locate holes for fasteners.
  1. Projected Mounting: Mount letters at the projection distance from the wall surface indicated.

#### **3.2 CLEANING AND PROTECTION**

- A. After installation, clean soiled sign surfaces according to the manufacturer's instructions. Protect units from damage until acceptance by the Owner.

#### **3.3 SIGNAGE SHEDULE**

- A. Exterior Dimensional Letters and Numbers: Sign Types 1,2, and 3 are indicated on the drawings. All signs to be a minimum of 6 inches and a maximum of 9 inches in length by the height required for the number of lines needed for the sign message. Provide exterior dimensional letters and numbers as indicated on Drawings.

**END OF SECTION 10 42 50**

## **SECTION 10 44 16 - FIRE EXTINGUISHERS**

### **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 portable, hand-carried fire extinguishers and mounting brackets for fire extinguishers.

#### **1.3 PREINSTALLATION MEETINGS**

- A. Preinstallation Conference: Conduct conference at Project site.
  - 1. Review methods and procedures related to fire extinguishers including, but not limited to, the following:
    - a. Schedules and coordination requirements.

#### **1.4 ACTION SUBMITTALS**

- A. Product Data: For each type of product. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher and mounting brackets.

#### **1.5 INFORMATIONAL SUBMITTALS**

- A. Warranty: Sample of special warranty.

#### **1.6 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.

#### **1.7 COORDINATION**

- A. Coordinate type and capacity of fire extinguishers with fire-protection cabinets to ensure fit and function.

**1.8 WARRANTY**

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Failure of hydrostatic test according to NFPA 10.
    - b. Faulty operation of valves or release levers.
  - 2. Warranty Period: Six years from date of Substantial Completion.

**PART 2 - PRODUCTS**

**2.1 PERFORMANCE REQUIREMENTS**

- A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."
- B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.
  - 1. Provide fire extinguishers approved, listed, and labeled by FM Global.

**2.2 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS**

- A. Fire Extinguishers: Type, size, and capacity for each unit indicated.
  - 1. Valves: Manufacturer's standard.
  - 2. Handles and Levers: Manufacturer's standard.
  - 3. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B, and bar coding for documenting fire-extinguisher location, inspections, maintenance, and recharging.
- B. Multipurpose Dry-Chemical Type in Steel Container UL-rated 2-A:10-B:C, 5-lb nominal capacity, with monoammonium phosphate-based dry chemical in enameled-steel container.

**2.3 MOUNTING BRACKETS**

- A. Mounting Brackets: Manufacturer's standard galvanized steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or black baked-enamel finish.
- B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location.
  - 1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.
    - a. Orientation: Vertical.

**PART 3 - EXECUTION**

**3.1 EXAMINATION**

- A. Examine fire extinguishers for proper charging and tagging.
  - 1. Remove and replace damaged, defective, or undercharged fire extinguishers.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

**3.2 INSTALLATION**

- A. General: Install fire extinguishers **and mounting brackets** in locations indicated and in compliance with requirements of authorities having jurisdiction.
  - 1. Mounting Brackets: 54 inches above finished floor to top of fire extinguisher.
- B. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

**END OF SECTION 10 44 16**

## **SECTION 13 34 19 – METAL BUILDING SYSTEMS**

### **PART 1 GENERAL**

#### **1.1 DESCRIPTION**

- A. Structural steel frame for building shell including exterior awnings over man door entries.
- B. Building shell roof and internal enclosed mezzanine with indoor roof covering systems consisting of the secondary structural roof framing, exterior roof panels, panel attachments, sealants, mastics, trim and flashings as required for a weather tight assembly.
- C. Wall accessories, including:
  - 1. Framed opening and trim for service doors.
  - 2. Framed opening and trim for windows.
  - 3. Framed opening and trim for overhead sectional doors.
  - 4. Steel sub-girt supports, framed openings and trim for louvers, mechanical openings, and electrical panels.
  - 5. Steel sub-girts supporting horizontal wall panels.
- D. Roof accessories, Including:
  - 1. Snow Guards

#### **1.2 RELATED SECTIONS**

- A. Section 03 30 00 - Cast-in-Place Concrete: Foundations and anchor bolts.
- B. Section 08 36 13 – Sectional Doors
- C. Section 08 11 13 – Hollow Metal Doors and Frames.
- D. Section 08 53 13 – Vinyl Windows
- E. Section 09 91 13 – Exterior Painting
- F. Section 09 91 23 – Interior Painting
- G. Section 07 41 13 – Metal Roof and Wall Panels
- H. Section 07 72 53 – Snow Guards

#### **1.3 REFERENCES**

- A. AAMA 101 - Voluntary Specification for Aluminum and Poly (Vinyl Chloride) (PVC) Prime Windows and Glass Doors; American Architectural Manufacturers Association.
- B. ASTM A 36/ASTM A36M - Standard Specification for Carbon Structural Steel.

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- C. ASTM A 307 - Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
- D. ASTM A 325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
- E. ASTM A 475 – Specification for Zinc-Coated Steel Wire Strand.
- F. ASTM A 500 – Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
- G. ASTM A 529/A 529M – Standard Specification for High-Strength Carbon-Manganese Steel of Structural Quality.
- H. ASTM A 536 – Specification for Ductile Iron Castings.
- I. ASTM A 572/A 572M - Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Steel.
- J. ASTM A 653/A 653M - Standard Specification for Steel Sheets, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- K. ASTM A 792/A 792M - Standard Specification for Steel Sheets, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
- L. ASTM A 1011 – Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low Alloy with Improved Formability.
- M. ASTM D 635 – Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position.
- N. ASTM D 1929 – Standard Test Method for Ignition Properties of Plastics.
- O. ASTM D 2843 – Standard Test Method for Smoke from the Burning or Decomposition of Plastics.
- P. ASTM E 84 – Standard Test Method for Surface Burning Characteristics of Building Materials.
- Q. ASTM E 774 – Standard Specification for Sealed Insulating Glass Units.
- R. ASTM E 1592 – Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure difference.
- S. SDI 100 – Recommended Specifications for Standard Steel Doors and Frames; Steel Door Institute.
- T. UL 580 – Tests for Wind Uplift Resistance of Roof Assemblies; Underwriters Laboratories, Inc.

### **1.4 DEFINITIONS**

- A. Building Width: Measured from outside to outside of sidewall girts. Typically edge to edge of concrete.
- B. Building Length: Measured from outside to outside of end wall girts. Typically edge to edge of concrete.
- C. Building Line: Outside face of horizontal steel girt.

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- D. Building Eave Height: Measured from the intersection of the top of the roof framing and the outside of the wall framing to the bottom of the sidewall column base plate.
- E. Bay Spacing: Measured from centerline to centerline of primary frames for interior bays and from centerline of the first interior frame to outside of endwall girts for end bays.
- F. Roof Pitch: The ratio of the vertical rise to the horizontal run.
- G. Maximum Building Height: Not to exceed maximum height as defined by local codes and zoning regulations.

### **1.5 SYSTEM DESCRIPTION**

#### **A. General:**

- 1. Provide metal building frame, metal wall panels, metal roof panels, accessories and miscellaneous materials for a complete enclosure including supports for building components specified in other sections.
- 2. Design structural systems according to professionally recognized methods and standards and legally adopted building codes.
- 3. Design under supervision of professional engineer licensed in the jurisdiction of the Project.

#### **B. Design Requirements:**

- 1. Design structural systems according to professionally recognized methods and standards, and legally adopted building codes.
- 2. Design under supervision of professional engineer licensed in Alaska.
- 3. Manufacturer must be certified by AISC in the Metal Building category.
- 4. Supplier must be a primary manufacturer of frames, secondary steel and trim.
- 5. Design Loads:
  - a. Applicable Building Code: IBC International Building Code 2018
  - b. Roof Snow Load: 60 psf
  - c. Wind Load: Calculate in accordance with applicable code based on following project specific values as applicable.
    - i. Basic Wind Speed: 137 MPH
    - ii. Exposure Category: C
    - iii. Wind Importance Factor: 1.0

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- d. Seismic Loads: Calculate and apply seismic loads in accordance with the requirements of applicable building code based on the following project specific values as applicable:
    - i. Seismic Importance Factor: 1.0
    - ii. Seismic I Soil Profile Coefficient ( $F_a$ ): 1.0
    - iii. Soil Profile Coefficient ( $F_v$ ): 1.5
    - iv. Mapped Spectral Acceleration for Short Period ( $S_s$ ): 1.50
    - v. Mapped Spectral Acceleration for 1 Second Period ( $S_1$ ): 0.60
    - vi. Max earthquake spectral response acceleration for short periods ( $S_{ms}$ ): 1.50
    - vii. Max earthquake spectral response acceleration for 1 second periods ( $S_{m1}$ ): 0.90
    - viii. Design spectral response acceleration at short periods ( $S_{ds}$ ): 1.00
    - ix. Design spectral response acceleration at 1 second periods ( $S_{d1}$ ): 0.60
    - x. Include 25% of the roof snow load in seismic load calculations.
  - e. Floor Live Load (Future Storage Area Above Mechanical):
    - i. Mezzanine Floor Live Load: 125 psf
    - ii. Floor Dead Load: 20 psf
    - iii. Floor Partition Load: 20psf
    - iv. Dead loads, including the weight of all indicated permanent construction.
6. Serviceability Criteria: Exterior wall and roof system to withstand imposed loads with maximum allowable deflections as follows:
- a. Maximum deflection, where L is span from center to center of supports, and where H is from top of foundation to eaves:
    - i. Primary framing, mid span: L/300
    - ii. Primary framing, eave line: L/250
    - iii. Secondary framing: L/250
    - iv. Roof and Wall panels, Live Load: L/200
    - v. Roof and Wall panels, Wind Load L/200
    - vi. Roof and Wall panels, Thermal L/200



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7. Assembly to permit movement of components without buckling, failure of joint seals, undue stress on fasteners or other detrimental effects, when subject to temperature range of 120 degrees F.
8. Size and fabricate wall and roof systems free of distortion or defects detrimental to appearance or performance.
9. Configuration and clearances. Configure structural framing member sizes as required to provide overall dimensions and minimum clearances indicated on the drawings.
10. Foundations and Anchor Bolts: Furnish building to fit foundation column layout and pilaster configuration as indicated. Provide building compatible to foundation design. Provide column reactions, anchor requirements, anchor bolt diameters and length to resist the column reactions induced by the design loads on the structure.
11. Metal building manufacturer to include vertical and lateral loads from the future storage area above the mechanical room roof framing in the design of the building superstructure.

### C. Performance Requirements:

1. Provide frame with design roof profile after vertical dead load deflection has occurred.
2. System to withstand gravity and lateral loads in compliance with contract documents.
3. Refer to contract drawings for additional concentrated loads to pre-engineered building hanger beams and support jacks.
  - a. Vertical unit heaters: 400# (136 kg) each.
  - b. Exhaust fans and louvers: 1000# (454 kg) vertical and 250# (113 kg) horizontal each unit.
  - c. Heavy Duty Commercial Ceiling Fans: 25# each
4. Allowable Deflections
  - a. Vertical: Clear span/240 for total load; clear span/360 for live load.
  - b. Lateral frame movement: Height/200 for wind load.
  - c. Design wall and roof panel system to withstand specified loads with deflection of  $L/180$  of span, maximum.
  - d. Wall Girt deflection for support of panels  $L/180$ .
  - e. Roof Purlin deflection for support of panels  $L/180$ .

Metal wall panels (interior and exterior) shall not to be used as shear elements.

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5. Construct assembly to permit movement of components without buckling, failure of joint seals, undue stress on fasteners or other detrimental effects, when subject to temperature range of 100 degrees F (37 degrees C) in a 24-hour period.
6. Design and fabricate wall and roof systems free of distortion or defects detrimental to appearance or performance. Some oil canning in rolled panels especially in the flats of the panel is normal and is not cause for rejection.

### **D. Serviceability Data:**

1. Deflection limits for major components based on IBC 2018 unless otherwise noted. Deflection of door support frames shall be within the allowable limits set by the door manufacturer. These max deflections may differ from the building due to the specific door requirements and should be supplied in the submittal process for review and approval to eliminate future deflection issues.

## **1.6 SUBMITTALS**

- A. Submit under provisions of Section 01 34 00 Shop Drawings, Product Data, and Samples.
- B. Design Data: Provide design criteria and structural calculations.
- C. Certification: Manufacturer certification that the building conforms to the contract documents and manufacturer's standard design procedures.
- D. Shop Drawings: Show building layout coordinated with structural foundation plan drawing and details, primary and secondary framing member sizes and locations, cross-sections, and product and connection details.
- E. Product Data: Information on manufactured products to be incorporated into the project.
- F. Color Charts: For selection of colors of panels, trim and accessories.
- G. Anchor Bolt Drawings: Layouts with bolt diameters.
- H. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.
- I. Verification Samples: For each finish product specified, two samples, minimum size 6 inches (150 mm) square, representing actual product, color, and patterns.
- J. Specimen Warranties.

## **1.7 QUALITY ASSURANCE**

- A. Manufacturer Qualifications:
  1. Not less than 5 years' experience in actual production of specified products.
  2. Member of the Metal Building Manufacturer's Association (MBMA).
  3. Primary manufacturer of frames, secondary steel, roof and wall sheeting, and trim.

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4. IAS AC472 certified to satisfy the International Building Code section 1704.2.5.1
- B. Installer Qualifications: Firm experienced in application or installation of systems similar in complexity to those required for this project, plus the following:
  1. Acceptable to or licensed by manufacturer.
  2. 3 years' experience with systems.
  3. Successfully completed not less than 5 comparable scale projects using this system.
- C. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
  1. Finish areas designated by Architect.
  2. Do not proceed with remaining work until workmanship, color, and sheen are approved by Architect.
  3. Refinish mock-up area as required to produce acceptable work.

### **1.8 DELIVERY, STORAGE, AND HANDLING**

- A. Store products in manufacturer's unopened packing until ready for installation.

### **1.9 PROJECT 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.

### **1.10 WARRANTY**

- A. Manufacturer shall warranty installed system for the periods described herein, starting from Date of Substantial Completion or ninety days from delivery, whichever comes first, against all the conditions indicated below. When notified in writing from Owner, manufacturer/installer shall, promptly and without inconvenience and cost to Owner, correct said deficiencies.
  1. Materials and Workmanship Warranty: 3 years at no charge, 5 years at a minimum charge.
  2. Finish Warranty:
    - a. Refer to section 01 74 00 Warranties and Bonds.
  3. Performance Warranty: Furnish written warranty, stating sheet metal roofing system and flashing (flashing under premium warranty only) under this Section will be maintained in watertight condition and defects resulting from the following items will be corrected without cost to Owner for a period of 10 or 20 years.
    - a. Faulty workmanship.
    - b. Defective materials including sealants and fasteners.

## **PART 2 PRODUCTS**

### **2.1 METAL MATERIALS**

Select material and material yield strengths based on building design requirements; use the following unless required otherwise:

- A. Structural Steel Plate, Bar, Sheet, and Strip for Use in Bolted and Welded Constructions: ASTM A 572/A 572M, A 529/A 529M, A 1011 or A 36/A 36M Modified 50, with minimum yield strength of 55,000 psi (380 MPa).
- B. Galvanized Structural Steel Material for Use in Roll Formed or Press Broken Secondary Structural Members: ASTM A 563, with minimum yield strength of 60,000 psi (410 MPa).
- C. Galvanized Steel Sheet for Roll Formed or Press Broken Roof and Wall Coverings, Trim and Flashing: ASTM A 653/A 653M, with minimum yield strength of 50,000 psi (345 MPa).
- D. Galvalume Steel Sheet Used in Roll Formed or Press Broken Roof Covering.
- E. Hot Rolled Steel Shapes: W, M and S shapes, angles, rods, channels and other shapes; ASTM A 500, ASTM A 572/A 572M or ASTM A 36/A 36M as applicable; with minimum yield strengths required for the design.
- F. Structural Bolts and Nuts Used with Primary Framing: High strength, ASTM A 325 bolts and ASTM A563 Grade C nuts.
- G. Bolts and Nuts Used with Secondary Framing Members: High Strength ASTM A 325 Bolts and ASTM A563 Grade C nuts.

### **2.2 FRAMING COMPONENTS**

- A. Primary Framing: Rigid Frame solid web framing consisting of tapered or uniform depth rafters rigidly connected to tapered or uniform depth columns. Provide a clear span that supports the loads at bay spacings indicated.
- B. Hybrid: Standard pre-engineered framing used in conjunction with structural steel.
- C. Endwall Framing: Corner posts, end posts and rake beams.
- D. Purlins: Zee-shaped; depth as required; with minimum yield strength of 55,000 psi; G60 galvanized sheet, cold formed, simple span or continuous span as required for design. Welded members are to be coated with manufacturer's standard primer.
- E. Girts: Zee- or Cee-shaped; depth as required, with minimum yield strength of 55,000 psi; G60 galvanized sheet, cold formed, simple span or continuous span as required for design. Welded members are to be coated with manufacturer's standard primer.
- F. Transbay Members: Open web, parallel chord, secondary joists or three plate built up girders; simple span, utilizing materials, sizes and yield strength as required.
- G. Wind Bracing: Portal, torsional, diaphragm or diagonal bracing in accordance with manufacturer's standard design practices; utilizing rods, cables, angles, and other members, with minimum yield strengths as required for design.

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- H. Primary Frame Flange Bracing: Attached from purlins or girts to the primary framing, minimum yield strength as required for design. Omit all flange braces on inside face of columns, and design columns to support defined loads without braces.
- I. Base Angles: 2" x 3" x 0.059" steel angles, with minimum yield strength of 55,000 psi , anchored to the floor slab or grade beam with power driven fasteners or equivalent at a maximum spacing of 2' on center and not more than 6" from the end of any angle member.
- J. Framed Opening Headers and Jambs: Zee- or Cee-shaped; depth as required; with minimum yield strength of 60 ksi.
- K. Sag Angles and Bridging: Steel angles, with minimum yield strength of 36,000 psi.
- L. Fabrication: Fabricate according to manufacturer's standard practice.
  - 1. Fabricate structural members made of welded plate sections by joining the flanges and webs by continuous automatic submerged arc welding process.
  - 2. All welding operators and processes shall be qualified in accordance with the American Welding Society "Structural Welding Code", AWS D1.1.
  - 3. Field connections. Prepare members for bolted field connections by making punched, drilled, or reamed holes in the shop.
- M. Component Identification: Mark all fabricated parts, either individually or by lot or group, using an identification marking corresponding to the marking shown on the shop drawings, using a method that remains visible after shop coating.
- N. Shop Coating: Finish all structural steel members using one coat of manufacturer's standard shop coat, after cleaning of oil, dirt, loose scale and foreign matter.
- O. Package building components for shipping by common carrier.
- P. Flashing and Trim: Match material and color of adjacent components. Provide trim at rakes, including peak and corner assemblies, high and low eaves, corners, bases, framed openings and as required or specified to provide weather tightness and a finished appearance suitable for northern climates heavy snow and ice conditions.
- Q. Plastic Parts: Glass fiber reinforced resin or thermoformed ABS (Acrylonitrile-Butidene-Styrene).
  - 1. ABS: Minimum 1/8" (3 mm) thick.
  - 2. Color: Manufacturer's standard color.
- R. Sealants, Mastics and Closures: Manufacturer's standard type.
  - 1. Provide at roof panel endlaps, sidelaps, rake, eave, transitions and accessories as required to provide a weather tight roof system; use tape mastic or gunnable sealant at sidelaps and endlaps.
  - 2. Provide at wall panel rakes, eaves, transitions and accessories.

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3. Closures: Formed to match panel profiles; closed cell elastic material, manufacturer's standard color.
  4. Tape Mastic: Pre-formed butyl rubber-based, non-hardening, non-corrosive to metal; white or light gray.
  5. Gunnable Sealant: Non-skinning synthetic elastomer based material; gray or bronze.
- S. Thermal Blocks: High density, 3/4" (19 mm) thick expanded polystyrene, for installation over the purlin.
- T. Superblock: 1" x 3-1/2" (25 x 89 mm) extruded polystyrene thermal spacer strips capped by 22 ga. (0.76 mm) galvanized channels, with swaged end for interconnection along the purlin run, metal tabs at 2' (610 mm) on center at SSR clip locations, and pre-punched fastener holes.

### **2.3 FABRICATION**

- A. Fabrication: Fabricate according to manufacturer's standard practice.
1. Fabricate structural members made of welded plate sections by jointing the flanges and webs by continuous automatic submerged arc welding process.
  2. Welding operators and processes: Qualified in accordance with AWS D1.1.
  3. Field connections: Prepare members for bolted field connection by making punched, drilled, or reamed holes in the shop.
- B. Component Identification: Mark all fabricated parts, either individually or by lot or group, using an identification marking corresponding to the marking shown on the shop drawings, using a method that remains visible after shop painting.

### **2.4 ROOF COVERING SYSTEM**

- A. Roof Panels per Section 07 41 13 – Metal Roof and Wall Systems

### **2.5 WALL COVERING SYSTEM**

- A. Wall Panels per Section 07 41 13 – Metal Roof and Wall Systems

### **2.6 WALL ACCESSORIES**

- A. Framed Openings: Cold-formed sheet metal framing concealed with manufacturer's standard trim, color to match wall panels.

### **2.7 ROOF ACCESSORIES**

- A. Snow Guards per Section 07 72 53

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

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- A. Verification of Conditions: Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper and or timely completion. Verify foundations are properly installed, to correct dimensions and within acceptable tolerances.
- B. Verify location of covered or built-in work.
- C. Do not proceed until unsatisfactory conditions have been corrected.

### **3.2 PREPARATION**

- A. Framing Erection: Erect framing in compliance with AIS Specification & the latest edition of the MBMA metal building systems manual.
- B. Provide for erection and wind loads. Provide temporary bracing to maintain structure plumb and in alignment until completion of erection and installation of permanent bracing. Locate braced bays as required by manufacturer.

### **3.3 ERECTION OF FRAME**

- A. Install in accordance with manufacturer's instructions.
- B. Do not erect frames without complete installation of tie beams and anchorages.
- C. Set column base plates with non-shrink grout to full plate bearing.
- D. Do not field cut or alter structural members without written approval.
- E. After erection, prime bolts, welds, abrasions, and surfaces not primed with primer used in shop painting.

### **3.4 INSTALLATION OF WALL AND ROOF SYSTEM**

- A. Install in compliance with manufacturer's instructions.
- B. Exercise care when cutting prefinished material to ensure cuttings do not remain on finish surface.
- C. Fasten cladding system to structural supports, aligned level and plumb.
- D. Locate end laps over supports. End lap panels according to manufacturer's recommendations. Place sidelaps over adjacent panel and mechanically seam or stitch fastener per erection guidelines.
- E. Provide expansion joints where indicated.
- F. Use concealed fasteners.
- G. Install sealant and gaskets to prevent weather penetration.
- H. Install system free of rattles, noise due to thermal movement, and wind whistles.
- I. Install door frames, service doors, overhead doors, window and glass, and gutter system in compliance with manufacturer's instructions.

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- J. Seal wall and roof accessories watertight and weathertight with sealant in compliance with building manufacturer's standard procedures.
- K. Rigidly support and secure gutters and downspouts. Joint lengths with formed seams sealed watertight. Flash and seal gutters to downspouts.
- L. Tolerances:
  - 1. Framing Members: 1/4 inch (6 mm) from level; 1/8 inch (3 mm) from plumb.
  - 2. Racking: 1/8 inch (3 mm) from true position. Provide shoring to maintain position prior to cladding installation.

### **3.5 FIELD QUALITY CONTROL**

- A. Testing by Contractor:
  - 1. Roof installation inspection by roof manufacturer's representative; as required as part of warranty provision.
- B. Testing by Owner:
  - 1. High Strength Bolted Connections: Specification for Structural Joints Using ASTM A325 or A490 Bolts, with minimum testing of bolted connections per the arbitration inspection procedure. Visual inspection of snug-tight bolts. Twist off type bolts or direct tension indicator washers for slip critical connections.
  - 2. Field Welded Connections: AWS. Visual inspection of 100 percent of welds. Ultrasonic inspection of 50 percent of full and partial penetration welds. A rejection rate greater than 5 percent will increase the inspection to 100 percent.
  - 3. General Testing: For materials and installed tolerances.

**END OF SECTION 13 34 19**



## **SECTION 22 05 00 - COMMON WORK RESULTS FOR PLUMBING**

### **PART 1 GENERAL**

#### **1.1 SCOPE**

- A. All provisions of the Contract including the General and Supplementary Conditions and the General Requirements apply to this work.

#### **1.2 WORK INCLUDED**

- A. The work to be included in these and all other plumbing subsections shall consist of providing, installing, adjusting and setting into proper operation complete and workable systems for all items shown on the drawings, described in the specifications or reasonably implied. This shall include the planning and supervision to coordinate the work with other crafts and to maintain a proper time schedule for delivery of materials and installation of the work.
- B. Division 01 of the specifications is to be specifically included as well as all related drawings.

#### **1.3 RELATED WORK**

- A. Related Work Specified Elsewhere:
  - 1. Heating, Ventilating and Air Conditioning (HVAC) Specifications: Division 23.
  - 2. Electrical Specifications: Division 26.
  - 3. Motors and Connections: Division 26.
  - 4. Starters and Disconnects: Division 26.
- B. Unless otherwise indicated on the electrical drawings or the electrical schedules, provide all plumbing equipment motors, motor starters, thermal overload switches, control relays, time clocks, thermostats, motor operated valves, float controls, damper motors, electric switches, electrical components, wiring and any other miscellaneous Division 22 controls. Disconnect switches are included in the electrical work, unless specifically called out on mechanical plans.
- C. Carefully coordinate all work with the electrical work shown and specified elsewhere.

#### **1.4 REFERENCED CODES - LATEST ADOPTED EDITION**

- A. NFPA 70                      National Electrical Code (NEC).
- B. IMC                              International Mechanical Code.
- C. UPC                              Uniform Plumbing Code.
- D. IFC                              International Fire Code.
- E. IFGC                            International Fuel Gas Code.
- F. IBC                              International Building Code.

#### **1.5 PROJECT RECORD DRAWINGS**

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- A. In addition to other requirements of Division 01, mark up a clean set of drawings as the work progresses to show the dimensioned location and routing of all mechanical work which will become permanently concealed. Show routing of work in concealed blind spaces within the building. Show exact dimensions of buried piping off of columns or exterior walls.
- B. Maintain record documents at job site in a clean, dry and legible condition. Keep record documents available for inspection by the Project Manager.
- C. Show the location of all valves and their appropriate tag identification.
- D. At completion of project, deliver these drawings to the Architect and obtain a written receipt.

### **1.6 SUBMITTALS**

- A. See General Conditions and the General Requirements in Division 01 regarding submittals.
- B. Submit by specification section complete and all at one time; partial submittals will not be considered. Submittals shall be provided in electronic PDF Format. The data in the electronic file shall be arranged and indexed under basic categories in order of the Specification Sections. An index shall be included with bookmarks and identifying tabs between sections and references to sections of specifications.
- C. Catalog sheets shall be complete and the item or model to be used shall be clearly marked, and identified as to which item in the specifications or on the drawings is being submitted and with drawing fixture number where applicable.
- D. Only submit on items specifically required by each specification section. If a submittal has not been requested, it will not be reviewed.

### **1.7 OPERATING AND MAINTENANCE MANUALS**

- A. See General Conditions and the General Requirements in Division 01 regarding Operating and Maintenance Manuals.
- B. Submit maintenance manuals to the Engineer covering all equipment, fixtures, devices, etc. installed by the Contractor.
- C. The operation and maintenance manuals shall be submitted by specification section complete and all at one time; partial operations and maintenance manual submittals will not be considered. The Operation and maintenance manuals shall be provided in electronic PDF Format. The data in the electronic file shall be arranged and indexed under basic categories. An index shall be included with bookmarks and identifying tabs between sections and references to sections of specifications. The manual shall contain, but not limited to, the following types of information:
  - 1. Cover sheet with name, address, telephone number of Contractor, General Contractor and major equipment suppliers.
  - 2. Catalog cuts of all equipment, fixtures, etc. installed (Marked to identify the specific items used).
  - 3. Manufacturer's maintenance and overhaul instruction booklets including exploded views.
  - 4. Identification numbers of all parts and nearest sources for obtaining parts and services.
  - 5. A copy of valve schedule and reduced scale drawings showing valve locations.

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6. Written summary of instructions to Owner.
  7. All manufacturers' warranties and guarantees.
  8. Contractors Warranty Letter.
- D. A periodic maintenance form that includes all of the equipment shall be provided with the maintenance manual. The form shall list each piece of equipment and how often maintenance is required (daily, weekly, monthly, annually). Opposite each task shall be squares for check-off for a full year (initials) to verify that the tasks are being done.

### **1.8 HANDLING**

- A. See General Conditions and the General Requirements in Division 01 regarding material handling.
- B. Deliver packaged materials to job site in unbroken packages with manufacturer's label, and store to facilitate inspection and installation sequence. All items must be labeled and identified as to make, size and quality.

### **1.9 SUBSTITUTIONS**

- A. See General Conditions and the General Requirements in Division 01 for substitution request procedures.
- B. In accordance with the General Conditions and the General Requirements in Division 01, Substitution and Product Options, all substitute items must fit in the available space, and be of equal or better quality including efficiency performance, size, and weight, and must be compatible with existing equipment. The Architect/Engineer shall be the final authority regarding acceptability of substitutes.

### **1.10 DIMENSIONS**

- A. Before ordering any material or doing any work, the Contractor shall verify all dimensions, including elevations, and shall be responsible for the correctness of the same. No extra charge or compensation will be allowed on account of differences between actual dimensions and measurements indicated on the drawings.
- B. Any differences, which may be found, shall be submitted to the Architect/Engineer for consideration before proceeding with the work.

### **1.11 MANUFACTURER'S DIRECTIONS**

- A. All manufactured articles shall be applied, installed and handled as recommended by the manufacturer, unless specifically called out otherwise. Advise the Architect/Engineer of any such conflicts before installation.

### **1.12 PERMITS, FEES, ETC.**

- A. The Contractor under each Division of these specifications shall arrange for a permit from the local authority. The Contractor shall pay for any inspection fees or other fees and charges required by ordinance, law, codes and these specifications.

### **1.13 TESTING**

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- A. The Contractor under each section shall perform the various tests as specified and required by the Architect, Engineer and as required by applicable code, the State and local authorities. The Contractor shall furnish all labor, fuel and materials necessary for making tests.

### **1.14 TERMINOLOGY**

- A. Whenever the words "furnish", "provide", "furnish and install", "provide and install", and/or similar phrases occur, it is the intent that the materials and equipment described be furnished, installed and connected under this Division of the Specifications, complete for operation unless specifically noted to the contrary.
- B. Where a material is described in detail, listed by catalogue number or otherwise called for, it shall be the Contractor's responsibility to furnish and install the material.
- C. The use of the word "shall" conveys a mandatory condition to the contract.
- D. "This section" refers to the section in which the statement occurs.
- E. "The project" includes all work in progress during the construction period.
- F. In describing the various items of equipment, in general, each item will be described singularly, even though there may be a multiplicity of identical or similar items.

### **1.15 SCHEDULE OF WORK**

- A. The work under the various sections must be expedited and close coordination will be required in executing the work. The various trades shall perform their portion of the work at such times as directed so as to meeting scheduled completion dates, and to avoid delaying any other trade. The Architect will set up completion dates. Each contractor shall cooperate in establishing these times and locations and shall process work so as to ensure the proper execution of it.

### **1.16 COOPERATION AND CLEANING UP**

- A. The Contractor for the work under each section of the specifications shall coordinate the Contractors work with the work described in all other sections of the specifications to the end that, as a whole, the job shall be a finished one of its kind, and shall carry on the work in such a manner that none of the work under any section of these specifications shall be handicapped, hindered or delayed at any time.
- B. At all times during the progress of the work, the Contractor shall keep the premises clean and free of unnecessary materials and debris. The Contractor shall, on direction at any time from the Architect, clear any designated areas or area of materials and debris. On completion of any portion of the work, the Contractor shall remove from the premises all tools and machinery and all debris occasioned by the work, leaving the premises free of all obstructions and hindrances.

### **1.17 WARRANTY**

- A. Unless a longer warranty is hereinafter called for, all work, materials and equipment items shall be warrantied for a period of one year after acceptance by the Owner. All defects in labor and materials occurring during this period, as determined by the Architect/Engineer, shall be repaired and/or replaced to the complete satisfaction of the Architect/Engineer. Guarantee shall be in accordance with Division 01.

### **1.18 COMPLETION REQUIREMENTS**

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- A. In accordance with the General Conditions and the General Requirements in Division 01, Project Closeout; before acceptance and final payment, the Contractor shall furnish:
  - 1. Accurate project record drawings, shown in red ink on prints, showing all changes from the original plans made during installation of the work.
  - 2. Contractors One Year Warranty.
  - 3. All Manufacturers' Guarantees.
  - 4. Test and Balance Reports.
  - 5. Operation and Maintenance Manuals.

## **PART 2 PRODUCTS**

### **2.1 MATERIALS**

- A. All equipment shall be regularly cataloged items of the manufacturer and shall be supplied as a complete unit in accordance with the manufacturer's standard specifications along with any optional items required for proper installation unless otherwise noted. Maintain manufacturer's identification, model number, etc. on all equipment at all times.
- B. Where more than one of an item is to be provided, all of the items shall be identical manufacture, make, model, color, etc.

### **2.2 RESTRICTED MATERIALS**

- A. No materials containing asbestos in any form shall be allowed.
- B. No solder or flux containing lead shall be used on this project.
- C. Any pipe or plumbing fitting or fixture, any solder, or any flux utilized on this project shall be "lead free" in accordance with the Safe Drinking Water Act, Section 1417. "Lead free" materials utilized in domestic water system shall not contain more than 0.2 percent lead when used with respect to solder and flux; and not more than a weighted average of 0.25 percent lead when used with respect to the wetted surfaces of pipes, pipe fittings, plumbing fittings, and fixtures. All materials utilized in domestic water system shall be certified by an ANSI accredited organization to conform to ANSI/NSF Standard 61.
- D. Where materials or equipment provided by this Contractor are found to contain restricted materials, such items shall be removed and replaced with non-restricted materials items. Entire cost of restricted materials removal and disposal and cost of installing new items shall be the responsibility of the Contractor for those restricted materials containing items installed by the Contractor.

### **2.3 IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT**

- A. Plastic Nameplates: Laminated plastic with engraved letters.
- B. Plastic Tags: Laminated plastic with engraved letters, minimum 1-1/2 inches diameter.
- C. Plastic Pipe Markers: Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering.

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- D. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.
- E. Plastic Underground Pipe Markers: Bright colored continuously printed plastic ribbon tape, for direct burial service.

### **2.4 PIPE HANGERS AND SUPPORTS**

#### **A. Acceptable Manufacturers:**

- 1. Anvil.
- 2. B-Line Systems, Inc.
- 3. Erico.
- 4. PHD Manufacturing, Inc.
- 5. Tolco.

#### **B. Plumbing Piping - DWV:**

- 1. Conform to ANSI/MSS SP58.
- 2. Hangers for Pipe Sizes ½ to 1-½ Inch: Malleable iron or carbon steel, adjustable swivel, split ring.
- 3. Hangers for Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.
- 4. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
- 5. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.
- 6. Vertical Support: Steel riser clamp.
- 7. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
- 8. Copper Pipe Support: Carbon steel ring, adjustable, copper plated with neoprene isolation pad.

#### **C. Plumbing Piping - Water:**

- 1. Conform to ANSI/MSS SP58.
- 2. Hangers for Pipe Sizes ½ to 1-½ Inch: Malleable iron or carbon steel, adjustable swivel, split ring.
- 3. Hangers for Cold Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.
- 4. Hangers for Hot Pipe Sizes 2 to 4 Inches: Carbon steel, adjustable, clevis.
- 5. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
- 6. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.

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7. Vertical Support: Steel riser clamp.
  8. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
  9. Floor Support for Hot Pipe Sizes to 4 Inches: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
  10. Copper Pipe Support: Carbon steel ring, adjustable, copper plated with neoprene isolation pad.
  11. Design hangers to allow installation without disengagement of supported pipe.
  12. Copper Plating: All hanger elements in metal-to-metal contact with copper pipe, except hanger rings with factory-applied 1/16 inch minimum thick plastic or tape cushion strip over all contact surfaces.
  13. Strut Type Pipe Hanging System: Unistrut P-1000 series; framing members shall be No. 12 gage formed steel channels, 1-5/8 inch square, conforming to ASTM A 570 GR33, one side of channel shall have a continuous slot with inturned lips; framing nut with grooves and spring 1/2 inch size, conforming to ASTM 675 GR60; screws conforming to ASTM A 307; fittings conforming to ASTM A 575; all parts enamel painted or electro-galvanized.
- D. Shield for Insulated Piping 1-½ Inches and Smaller: 18 gauge galvanized steel shield over insulation in 180° segments, minimum 12 inches long at pipe support.
- E. Shield for Insulated Piping 2 Inches and Larger: Hard block, calcium silicate insert, 180° segment, 12 inch minimum length, block thickness same as insulation thickness, flame resistant vapor barrier covering and 18 gauge galvanized shield.
- F. Shields for Vertical Copper Pipe Risers: Galvanized steel pipe.

### 2.5 HANGER RODS

- A. Steel Hanger Rods: Mild steel, threaded both ends, threaded one end, or continuous threaded. Minimum Hanger Rod Sizes:

PIPE AND TUBE SIZE (INCHES)	ROD SIZE (INCHES)
¼-4	3/8

### 2.6 INSERTS

- A. Inserts: Malleable iron case of steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

### 2.7 ANCHOR BOLTS

- A. Anchor (Expansion) Bolts: Shall be carbon steel to ASTM A 307; nut shall conform to ASTM A194; shall be drilled-in type. Design values for shear and tension shall be not more than 80 percent of the allowable load.

### 2.8 FLASHING

- A. Metal Flashing: 26-gauge minimum galvanized steel.
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- B. Metal Counter Flashing: 22 gauge minimum galvanized steel.
- C. Flexible Flashing: 47-mil thick sheet butyl, compatible with roofing.
- D. Caps: Steel, 22-gauge minimum; 16 gauge at fire resistant elements.

### **2.9 SLEEVES**

- A. Sleeves for Pipes Through Non-fire Rated Floors: Form with 18 gauge galvanized steel for 4 inch diameter and larger, 22 gauge up to 3" diameter.
- B. Sleeves for Pipes Through Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Form with steel pipe or 18 gauge galvanized steel for 4 inch diameter and larger, 22 gauge up to 3" diameter.
- C. Fire Stopping Insulation: Mineral fiber type, non- combustible.
- D. Caulk: Fire stop sealant in compliance with ASTM E814, UL 1479 and Division 07.
- E. Mechanical Sleeve Seals: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between object and sleeve, connected with bolts and pressure plates causing rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

### **2.10 ACCEPTABLE MANUFACTURERS: VIBRATION ISOLATORS AND SEISMIC RESTRAINT**

- A. Vibration isolators and Seismic Restraint shall be manufactured by:
  - 1. Amber/Booth.
  - 2. Cooper Industries.
  - 3. International Seismic Application Technology.
  - 4. Kinetics Noise Control.
  - 5. Mason Industries.
  - 6. Vibro-Acoustics.
  - 7. Substitutions: Items of same function and performance are acceptable in conformance with Division 01.

### **2.11 SEISMIC BRACING AND SUPPORT OF SYSTEMS AND COMPONENTS**

- A. General:
  - 1. Seismic restraint designer shall coordinate all attachments with the structural engineer of record.
  - 2. Design analysis shall include calculated dead loads, static seismic loads, and capacity of materials utilized for the connection of the equipment or system to the structure.
  - 3. Analysis shall detail anchoring methods, bolt diameter, and embedment depth.



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4. All seismic restraint devices shall be designed to accept without failure the forces calculated per the applicable building code and as summarized in installation requirements.
  5. The total height of the structure (h) and the height of the system to be restrained within the structure (z) shall be determined in coordination with architectural plans and the General Contractor.
- B. Friction from gravity loads shall not be considered resistance to seismic forces.

### **2.12 SEISMIC BRACING COMPONENTS**

- A. Steel strut shall be 1-5/8 inch wide in varying heights and mig-welded combinations as required to meet load capacities and designs indicated. A material heat code, part number, and manufacturer's name shall be stamped on all strut and fittings to maintain traceability to material test reports.
1. Material for epoxy painted strut: ASTM A1011, SS, Grade 33.
  2. Material for pre-galvanized strut: ASTM A653, SS, Gr. 33.
  3. Material for Hot-Dip Galvanized strut: ASTM A1011, SS, Grade 33 and hot-dip galvanized after fabrication in accordance with ASTM A123.
  4. Material for fittings and accessories: ASTM A907 Gr. 33, Structural Quality or ASTM A1011, SS, Gr.33.
  5. Fittings and accessories: Products shall be of the same manufacturer as strut and designed for use with that product.

## **PART 3 EXECUTION**

### **3.1 DRAWINGS**

- A. The drawings are partly diagrammatic, not necessarily showing all offsets or exact locations of piping and ducts, unless specifically dimensioned. The contractor shall provide all materials and labor necessary for a complete and operable system. Complete details of the building which affect the mechanical installation may not be shown. For additional details, see Architectural, Structural, Civil and Electrical Drawings. Coordinate work under this section with that of all related trades.

### **3.2 INSTALLATION**

- A. All work shall comply with the latest adopted applicable codes and ordinances including, but not limited to, the IMC, UPC, IBC, NEC, NFPA, IFGC and IFC Standards; all local and state amendments to all codes and standards.
- B. Obtain and pay for all inspection fees, connection charges and permits as a part of the Contract.
- C. Compliance with codes and ordinances shall be at the Contractor's expense.

### **3.3 MEASUREMENTS**

- A. Verify all measurements on the job site.
- B. Locate all equipment and fixtures on the centers of walls, openings, spaces, etc., unless specified otherwise.

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- C. Check all piping, equipment, etc. to clear openings.
- D. Rough-in dimensions shall be per manufacturer's recommendations and in compliance with current ADA and ANSI 117.1 standards.

### **3.4 OPERATING INSTRUCTIONS**

- A. Before the facility is turned over to the Owner, instruct the Owner or Owner's personnel in the operation, care and maintenance of all systems and equipment under the jurisdiction of the Plumbing Division. These instructions shall also be included in a written summary in the Operating Maintenance Manuals.
- B. The Operation and Maintenance Manuals shall be utilized for the basis of the instruction. Provide a minimum of four hours of onsite instruction to the owner designated personnel.
- C. When required by individual specification sections provide additional training on plumbing systems and equipment as indicated in the respective specification section.
- D. Provide schedule for training activities for review prior to start of training.

### **3.5 SYSTEM ADJUSTING**

- A. Each part of each system shall be adjusted and readjusted as necessary to ensure proper functioning of all plumbing systems. Test all plumbing equipment, fixtures and piping for proper water distribution, drainage, pressure and flow, adjust systems as required to eliminate splashing, noise and vibration.

### **3.6 CUTTING, FITTING, REPAIRING, PATCHING AND FINISHING**

- A. Arrange and pay for all cutting, fitting, repairing, patching and finishing of work by other trades where it is necessary to disturb such work to permit installation of mechanical work. Perform work only with craftsmen skilled in their respective trades.
- B. Avoid cutting, insofar as possible, by setting sleeves, frames, etc. and by requesting openings in advance. Assist other trades in securing correct location and placement of rough-frames, sleeves, openings, etc. for piping.
- C. Cut all holes neatly and as small as possible to admit work. Include cutting where sleeves or openings have been omitted. Perform cutting in a manner so as not to weaken walls, partitions or floors. Drill holes required to be cut in floors without breaking out around holes.

### **3.7 PAINTING**

- A. Perform all of the following painting in accordance with provisions of Division 09 with colors as selected by the Architect. Provide the following items as a part of plumbing work:
  - 1. Factory applied prime and finish coats on plumbing equipment.
  - 2. Factory applied prime coat on access doors.
  - 3. Pipe identification where specified.
- B. If factory finish on any equipment furnished is damaged in shipment or during construction, refinish to equal original factory finish.

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#### **3.8 IDENTIFICATION**

- A. Tag all valves with heat resistant laminated plastic labels or brass tags engraved with readily legible letters. Securely fasten to the valve stem or bonnet with beaded chain. Provide a framed, typewritten directory under glass, and installed where directed. Provide complete record drawings that show all valves with their appropriate label. Seton 250-BL-G, or 2961.20-G, 2" round or equal.
- B. Label all equipment with heat resistant laminated plastic labels having engraved lettering ½" high. If items are not specifically listed on the schedules, consult the Engineer concerning designation to use. Seton engraved Seton-Ply nameplates or equal.
- C. Identify piping to indicate contents and flow direction of each pipe exposed to view by a labeled sleeve in letters readable from floor at least once in each room and at intervals of not more than 20' apart and on each side of partition penetrations. Coloring scheme in accordance with ANSI A13.1-1981, Seton Opti-Code or equal.

#### **3.9 PIPE HANGERS AND SUPPORTS**

- A. Support plumbing piping in accordance with the latest adopted edition of the UPC.
- B. Install hangers to provide minimum ½ inch space between finished covering and adjacent work.
- C. Place a hanger within 12 inches of each horizontal elbow.
- D. Use hangers with 1-½ inch minimum vertical adjustment.
- E. Support horizontal cast iron pipe adjacent to each hub, with 5 feet maximum spacing between hangers.
- F. Support vertical piping at every floor. Support vertical cast iron pipe at each floor at hub.
- G. Where several pipes can be installed in parallel and at the same elevation, provide multiple or trapeze hangers.
- H. Support riser piping independently of connected horizontal piping.
- I. Provide transverse seismic support for all piping systems.

#### **3.10 INSERTS**

- A. Provide inserts for placement in concrete formwork.
- B. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
- C. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
- D. Where concrete slabs form finished ceiling, provide inserts to be flush with slab surface.
- E. Where inserts are omitted, drill through concrete slab from below and provide thru-bolt with recessed square steel plate and nut recessed into and grouted flush with slab.

#### **3.11 FLASHING**

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- A. Provide flexible flashing and metal counter-flashing where piping penetrates weather or waterproofed walls, floors, and roofs. For pipes through outside walls, turn flanges back into wall and caulk, metal counter-flash and seal.
- B. Seal floor drains watertight to adjacent materials.
- C. Flash vent pipes projecting 3 inches minimum above finished roof surface with pre-manufactured butyl boot.

### **3.12 SLEEVES**

- A. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.
- B. Set sleeves in position in construction. Provide reinforcing around sleeves.
- C. Extend sleeves through floors one inch above finished floor level. Caulk sleeves full depth and provide floor plate.
- D. Where piping penetrates floor, ceiling, or wall, install sleeve, close off space between pipe and adjacent work with fire stopping insulation and caulk seal. Use fire rated caulking where fire rated walls are penetrated. Provide close fitting metal collar or escutcheon covers at both sides of penetration.
- E. Install chrome plated steel escutcheons at finished surfaces.

### **3.13 SEISMIC RESTRAINT**

- A. General:
  - 1. All piping and equipment shall be restrained to resist seismic/wind forces per the applicable building code(s) as a minimum. Restraint attachments shall be made by bolts, welds or a positive fastening method. Friction shall not be considered. All attachments shall be proven capable of accepting the required wind load by calculations. Additional requirements specified herein are included specifically for this project.
  - 2. Install seismic and wind restraint devices per the manufacturer's submittals. Any deviation from the manufacturer's instructions shall be reviewed and approved by the manufacturer.
  - 3. Attachment to structure for suspended pipe and equipment: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.
  - 4. Wall penetrations may be used as bracing locations provided the wall can provide adequate resistance without significant damage.
  - 5. Coordinate sizes and locations of cast-in-place inserts for post-tensioned slabs with seismic restraint manufacturer.
  - 6. Provide hanger rod stiffeners where indicated or as required to prevent buckling of rods due to seismic forces.
  - 7. Where rigid restraints are used on equipment or piping, support rods for the equipment or piping at restraint locations must be supported by anchors rated for seismic use. Post-installed concrete anchors must be in accordance with ACI 355.2.

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8. Ensure housekeeping pads have adequate space to mount equipment and seismic restraint devices and shall also be large enough to ensure adequate edge distance for restraint anchor bolts to avoid housekeeping pad breakout failure.

### **B. Concrete Anchor Bolts:**

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid pre- or post-tensioned tendons, electrical and telecommunications conduit, and gas lines.
2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
3. Mechanical Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
5. Set anchors to manufacturer's recommended torque, using a torque wrench.

### **C. Piping Systems:**

1. For projects with a Seismic Design Category of C, provide seismic cable restraints on the following:
  - a. All piping systems assigned a component importance factor,  $I_p$ , of 1.5 with a nominal pipe diameter greater than 2" (50 mm) or trapeze-supported piping with combined operating weight over 10 lbs/ft (15 kg/m).
2. For projects with a Seismic Design Category of D, E or F, provide seismic cable restraints on the following:
  - a. All piping greater than 3" (75 mm) nominal diameter.
  - b. All piping systems assigned a component importance factor,  $I_p$ , of 1.5 with a nominal pipe diameter greater than 1" (25 mm) or trapeze-supported piping with combined operating weight over 10 lbs/ft (15 kg/m).
3. "12-inch rule", where pipe can be exempted from seismic restraint based on the length of the support rods, is accepted if one of the following conditions are met:
  - a. Hangers are detailed to avoid bending of the hangers and their attachment; and provisions are made for piping to accommodate expected deflections. The maximum stress due to combined loading including bending in the hangers must be less than 21.6 ksi.
  - b. Isolation hangers are added to hanger rod to provide swivel joint and to prevent bending moment in hanger.

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4. Restraint spacing:
    - a. For ductile piping, space lateral supports a maximum of 40' (12 m) o.c., and longitudinal supports a maximum of 80' (24 m) o.c.
    - b. For non-ductile piping (e.g., cast iron, PVC) space lateral supports a maximum of 20' (6 m) o.c., and longitudinal supports a maximum of 40' (12 m) o.c.
    - c. For piping with hazardous material inside (e.g., natural gas, medical gas) space lateral supports a maximum of 20' (6 m) o.c., and longitudinal supports a maximum of 40' (12 m) o.c.
    - d. For pipe risers, restrain the piping at floor penetrations using the same spacing requirements as above.
  5. Brace a change of direction longer than 12' (3.7 m).
  6. Longitudinal restraints for single pipe supports shall be attached directly to the pipe, not to the pipe hanger.
  7. For supports with multiple pipes (trapezes), secure pipes to trapeze member with clamps approved for application.
  8. Piping on roller supports shall include a second roller support located on top of the pipe at each restraint location to provide vertical restraint.
- D. Install restraint cables so they do not bend across edges of adjacent equipment or building structure.
- E. Install flexible metal hose loops in piping which crosses building seismic joints, sized for the anticipated amount of movement.
- F. Install flexible piping connectors where adjacent sections or branches are supported by different structural elements, and where the connections terminate with connection to equipment that is anchored to a different structural element from the one supporting the connections as they approach equipment.
- G. Coordinate seismic restraints with thermal expansion compensators, guides and anchor points. Thermal expansion anchor points shall be designed to accommodate seismic forces.

### **3.14 INSTALLATION OF EQUIPMENT**

- A. Unless otherwise indicated, mount all equipment and install in accordance with manufacturer's recommendations and approved submittals.
- B. Maintain manufacture recommended minimum clearances for access and maintenance.
- C. Where equipment is to be anchored to structure, furnish and locate necessary anchoring and vibration isolation devices.
- D. Furnish all structural steel, such as angles, channels, beams, etc. required to support all piping, equipment and accessories installed under this Division. Use structural supports suitable for equipment specified or as indicated. In all cases, support design will be based upon data contained in manufacturer's catalog.

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- E. Openings: Arrange for necessary openings in buildings to allow for admittance and reasonable maintenance or replacement of all equipment furnished under this Contract.
- F. Access Doors: Provide as necessary for reasonable maintenance of all equipment valves, controls, etc.

**END OF SECTION 22 05 00**

## **SECTION 22 05 19 – METERS AND GAUGES FOR PLUMBING PIPING**

### **PART 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- A. Water Meters.
- B. Pressure Gauges and Pressure Gauge Taps.

#### **1.2 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION**

- A. Section 22 10 00 - Plumbing Piping: Installation of thermometer wells, pressure gauge tappings.

#### **1.3 REFERENCES**

- A. ASTM E1 - Specification for ASTM Thermometers.
- B. ASTM E77 - Verification and Calibration of Liquid-in-Glass Thermometers.
- C. AWWA C700 - Cold Water Meters - Displacement Type.
- D. AWWA C706 - Direct Reading Remote Registration Systems for Cold Water Meters.

#### **1.4 SUBMITTALS**

- A. Submit under provisions of Division 01.
- B. Product Data: Include list which indicates use, operating range, total range and location for manufactured components.
- C. Submit manufacturer's installation instructions under provisions of Division 01.

#### **1.5 PROJECT RECORD DOCUMENTS**

- A. Submit documents under provisions of Division 01.
- B. Accurately record actual locations of instrumentation.

#### **1.6 ENVIRONMENTAL REQUIREMENTS**

- A. Do not install instrumentation when areas are under construction, except for required rough-in, taps, supports and test plugs.

### **PART 2 PRODUCTS**

#### **2.1 MANUFACTURERS**

- A. Trerice.
- B. Marsh.
- C. Ashcroft.



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- D. Enerpac.
- E. Sisco.
- F. Petersen.
- G. Weiss.
- H. Winters.
- I. Substitutions: In accordance with Division 01.

### **2.2 PRESSURE GAUGES**

- A. 3-1/2 inch diameter cast aluminum case, phosphor bronze bourdon tube, rotary bronze movement, brass socket, with silicone fluid dampening black figures on white background, one percent mid-scale accuracy, scale calibrated in psi. Model 600CB as manufactured by Terice.

### **2.3 PRESSURE GAUGE TAPS**

- A. Gauge Isolation Valve: Lever handle ball valve, forged brass body, chrome plated brass ball, viton o-rings for maximum 150 psig. Model Mini T-82-M as manufactured by Jomar or approved equal.
- B. Needle Valve: Brass for maximum 150 psig. Model 735 as manufactured by Terice or approved equal.
- C. Pulsation Damper: Pressure snubber, brass with 1/4 inch connections. Series 870 as manufactured by Terice or approved equal.

### **2.4 WATER METERS (LIQUID)**

- A. Provide water meter in accordance with the City of Kenai Water and Sewer Public Works requirements.
- B. Manufacturers:
  - 1. Neptune.
  - 2. Badger Meters.
  - 3. Hersey.
  - 4. Substitutions: Under provisions of Division 01.
- C. Positive Displacement Meter, service size up to 2" - Nutating disc positive displacement type suitable for fluid with hermetically sealed register. All components of lead-free bronze alloy. Permanently sealed register or encoder with magnetic drive register coupling. Conforming to AWWA Standard C700 with remote reading register conforming to AWWA C706.
- D. compound meter or approved equal.

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#### PART 3 EXECUTION

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##### 3.1 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install water meters with strainer upstream and isolating valves on inlet and outlet. Provide pressure gauge downstream of check valve. Provide full line size valved bypass for liquid service meters.
- C. Provide instruments with scale ranges selected according to service with largest appropriate scale.
- D. Install gauges and thermometers in locations where they are easily read from normal operating level.

##### 3.2 PRESSURE GAUGE SCHEDULE

LOCATION	SCALE RANGE
Domestic Water System	0 - 100 PSIG
Others	As applicable

##### 3.3 POSITIVE DISPLACEMENT METER SCHEDULE

LOCATION	SCALE RANGE
Domestic cold water	0 - 50 GPM

**END OF SECTION 22 05 19**

## **SECTION 22 07 00 – PLUMBING INSULATION**

### **PART 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- A. Piping Insulation.
- B. Jackets and Accessories.

#### **1.2 RELATED WORK**

- A. Division 09 - Painting: Painting Insulation Jacket.
- B. Section 22 05 00 - Common Work Results for Plumbing.
- C. Section 22 40 00 - Plumbing Fixtures.
- D. Section 22 45 00 - Emergency Plumbing Fixtures.

#### **1.3 REFERENCES**

- A. ASTM B209 - Aluminum and Aluminum-alloy Sheet and Plate.
- B. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
- C. ANSI/ASTM C533 - Calcium Silicate Block and Pipe Thermal Insulation.
- D. ANSI/ASTM C534 - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
- E. ASTM C450 - Standard Practice for Fabrication of Thermal Insulating Fitting Covers for NPS Piping, and Vessel Lagging.
- F. ANSI/ASTM C547 - Mineral Fiber Preformed Pipe Insulation.
- G. ANSI/ASTM C552 - Cellular Glass Block and Pipe Thermal Insulation.
- H. ANSI/ASTM C553 - Mineral Fiber Blanket and Felt Insulation.
- I. ANSI/ASTM C578 - Preformed, Block Type Cellular Polystyrene Thermal Insulation.
- J. ASTM C585 - Standard Practice for Inner and Outer Diameters of Rigid Thermal Insulation for Nominal Sizes of Pipe and Tubing (NPS System).
- K. ANSI/ASTM C612 - Mineral Fiber Block and Board Thermal Insulation.
- L. ASTM C1136 - Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation.
- M. ASTM C1427 - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.

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- N. ASTM D635 – Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position.
- O. ASTM E84 - Surface Burning Characteristics of Building Materials.
- P. ASTM E96 – Standard Test Methods for Water Vapor Transmission of Materials.
- Q. NFPA 255 - Surface Burning Characteristics of Building Materials.
- R. UL 723 - Surface Burning Characteristics of Building Materials.

### **1.4 SUBMITTALS**

- A. Submit product data under provisions of Division 01.
- B. Include product description, thickness for each service, and locations.
- C. Submit manufacturer's installation instructions.

### **1.5 QUALITY ASSURANCE**

- A. Applicator: Company specializing in piping insulation application with three years minimum experience.
- B. Pipe insulation manufactured in accordance with ASTM C585 for inner and outer diameters.
- C. Materials: Flame spread/smoke developed rating of 25/50 in accordance with UL 723, ASTM E84, or NFPA 255.
- D. Factory fabricated fitting covers manufactured in accordance with ASTM C450.

### **1.6 DELIVERY STORAGE AND HANDLING**

- A. Division 01 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.
- C. Shipment of materials from manufacturer to installation location shall be in weather tight transportation.
- D. Protect insulation from weather and construction traffic, dirt, water, chemical, and damage, by storing in original wrapping.

### **1.7 ENVIRONMENTAL REQUIREMENTS**

- A. Install insulation only when ambient temperature and humidity conditions are within range recommended by manufacturer.

### **1.8 FIELD MEASUREMENTS**

- A. Verify field measurements prior to fabrication.

### **1.9 WARRANTY**

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- A. Division 01- Execution and Closeout Requirements: Product warranties and product bonds.

### **PART 2 PRODUCTS**

#### **2.1 ACCEPTABLE MANUFACTURERS**

- A. Armacell.
- B. Certain-Teed.
- C. IMCOA.
- D. Johns Manville.
- E. Knauf.
- F. Owens-Corning.
- G. Manson.
- H. Nomaco.
- I. Pittsburgh - Corning.
- J. K-Flex USA.
- K. Armstrong.
- L. TRUEBRO.
- M. Substitutions: Under provisions of Division 01.

#### **2.2 INSULATION - PIPING**

- A. Type A: Glass fiber, rigid, molded, non-combustible insulation; ANSI/ASTM C547; 'k' value of 0.23 at 75° F, rated from 0° F to 850° F, vapor retarder jacket of Kraft paper bonded to aluminum foil, self-sealing lap and butt strips; Johns Manville "Micro-Lok" or approved equal.
- B. Type B: Cellular glass; ANSI/ASTM C552; 'k' value of 0.29 at 75° F; 7.3 lbs./cu. ft. density; Pittsburgh Corning "Foamglass ONE" or approved equal.
- C. Type C: Expanded polystyrene; ANSI/ASTM C578; rigid closed cell; maximum water vapor transmission rating of 0.1 perms; 'k' value of 0.23 at 75° F.
- D. Type D: Flexible unicellular polyolefin; ASTM C1427; 'k' value of 0.25 at 75° F ASTM C518; moisture vapor transmission of zero perm-inch ASTM E96; rated to 210° F; IMCOA "Imcolock" or approved equal.
- E. Type E: Elastomeric foam; EPDM-based closed-cell flexible foam, ASTM C534; flexible cellular elastomeric in sheet or pre-formed tube, 'k' value of 0.26 at 75° F, max. service temp - 300° F, ASTM C534; max. flame spread = 50, max. smoke developed = 50, ASTM E84; UV-resistant coating/jacketing if exposed to sunlight; K-FLEX USA "Insul-Tube", "Insul-Sheet", or approved equal.

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- F. Type F: ADA insulation; preformed cellular foam, preformed for P-trap and hot water angle stop and supply tube at handicap sinks and lavatories; in compliance with the Americans with Disability Act (ADA); burning characteristics per ASTM D635; TRUEBRO "Lav Guard 2" or approved equal.

### **2.3 FIELD APPLIED JACKET**

- A. Vapor Barrier Jackets: Kraft reinforced foil vapor barrier with self-sealing adhesive joints.
- B. PVC Jackets and solvent welding adhesive: One piece, pre-molded type, Johns Manville "Zeston 2000", fitting covers and jacketing material. Johns Manville "Perma-Weld" solvent welding adhesive.
- C. Aluminum Jackets: ASTM B209; 0.016 inch thick; corrugated or textured finish, longitudinal slip joints.
- D. Stainless Steel Jackets: Type 304 stainless steel; 0.010 inch thick; corrugated finish.
- E. Re-Wettable Canvas Jacketing: , Fiberglass cloth made from texturized yarns, impregnated throughout with an inorganic fire retardant asbestos free adhesive; 20x14 thread count, 14.5 oz./sq.yd, 0.04 inch thickness, 1,000° F upper temperature limit; GLT Products "Style 1989" or approved equal.

### **2.4 INSULATION ACCESSORIES**

- A. Adhesives: Waterproof and fire-retardant type.
- B. Canvas Lagging Adhesive: Fire resistive to NFPA 255.
- C. Impale Anchors: Galvanized steel, 12 gauge, self-adhesive pad.
- D. Joint Tape: Glass fiber cloth, open mesh.
- E. FSK Joint Tape; ASTM C1136 Foil-Scrim-Kraft (FSK) lamination coated with solvent acrylic pressure sensitive adhesive; capable of adhering to fibrous and sheet metal surfaces; tri-directionally reinforced 2x3 squares per inch fiberglass scrim; 9.5 mils thick, -40 to 240° F service temperatures; Venture Tape "1525CW" or approved equal.
- F. Tie Wire: Annealed steel, 16 gauge.
- G. Insulated pipe supports: Calcium silicate with galvanized steel jacket (min. 24 gauge); ANSI/ASTM C533; rigid white; 'k' value of 0.37 at 100° F, rated to 1,200° F; Thermal Pipe Shields "T-1000 Calsil" or equal.

## **PART 3 EXECUTION**

### **3.1 PREPARATION**

- A. Install materials after piping and equipment has been tested and approved.
- B. Clean surfaces for adhesives.
- C. Prepare surfaces in accordance with manufacturer's recommendations.

### **3.2 INSTALLATION - PIPING**

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- A. Install materials in accordance with manufacturer's recommendations, building codes and industry standards.
- B. Continue insulation vapor barrier through penetrations except where prohibited by code.
- C. Locate insulation and cover seams in least visible locations.
- D. Neatly finish insulation at supports, protrusions, and interruptions.
- E. Provide insulated cold pipes conveying fluids below ambient temperature with vapor retardant jackets with self-sealing laps. Insulate complete system, including under fitting jackets.
- F. For insulated pipes conveying fluids above ambient temperature, secure jackets with self-sealing lap or outward clinched, expanded staples. Bevel and seal ends of insulation at equipment, flanges, and unions. Insulate complete system, including under fitting jackets.
- G. For exterior applications, provide weather protection jacket or coating. Insulated pipe, fittings, joints, and valves shall be covered with PVC or metal jacket. Jacket seams shall be located on bottom side of horizontal piping.
- H. Fully insulate all piping including all spaces under jacketing.
- I. Jackets:
  - 1. Indoor, Concealed Applications: Insulated pipes shall have vapor barrier jackets, factory-applied. Vapor barrier PVC fittings may also be used provided joints are sealed with solvent welding adhesive approved by the jacket manufacturer.
  - 2. For pipe exposed in mechanical equipment rooms or in finished spaces below 10 feet above finished floor, finish with PVC jacket and fitting covers or metal jacket.
  - 3. Insulate all exposed trap arms, drains, and hot water supplies for handicap protection on handicap accessible fixtures.

### 3.3 SCHEDULE – PIPING

PIPING	TYPE	PIPE SIZE Inch	MINIMUM INSULATION THICKNESS Inch
Domestic Cold Water	A, C, D , E	All Sizes	½"

**END OF SECTION 22 07 00**

## **SECTION 22 10 00 - PLUMBING PIPING**

### **PART 1 GENERAL**

#### **1.1 WORK INCLUDED**

- A. Sanitary Sewer and Vent Piping.
- B. Water Piping.
- C. Valves.
- D. Cleanouts.

#### **1.2 RELATED WORK**

- A. Division 02 - Excavating, Backfilling, Trenching.
- B. Section 22 05 00 – Common Work Results for Plumbing.
- C. Section 22 05 16 - Expansion Fittings and Loops for Plumbing Piping.
- D. Section 22 05 19 – Meters and Gages for Plumbing Piping.
- E. Section 22 05 29 – Hangers and Supports for Plumbing Piping and Equipment.
- F. Section 22 05 53 – Identification for Plumbing Piping and Equipment.
- G. Section 22 07 00 - Plumbing Insulation.
- H. Section 22 15 00 - General Service Compressed Air.
- I. Section 22 30 00 - Plumbing Equipment.
- J. Section 22 40 00 - Plumbing Fixtures.
- K. Section 22 45 00 - Emergency Plumbing Fixtures.

#### **1.3 QUALITY ASSURANCE**

- A. Valves: Manufacturer's name and pressure rating marked on valve body.
- B. Any pipe or plumbing fitting or fixture, any solder, or any flux utilized on this project shall be "lead free" in accordance with the Safe Drinking Water Act, Section 1417. "Lead free" materials utilized in domestic water system shall not contain more than 0.2 percent lead when used with respect to solder and flux; and not more than a weighted average of 0.25 percent lead when used with respect to the wetted surfaces of pipes, pipe fittings, plumbing fittings, and fixtures. All materials utilized in domestic water system shall be certified by an ANSI accredited organization to conform to ANSI/NSF Standard 61.



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**1.4 SUBMITTALS**

- A. Submit product data under provisions of Division 01.
- B. Include data on pipe materials, pipe fittings, valves and accessories.

**1.5 WARRANTY**

- A. Polypropylene pipe and fittings shall be covered by a factory warranty for 30 years to be free of defects in materials or manufacturing.

**1.6 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver products to site under provisions of Division 01.
- B. Store and protect products under provisions of Division 01.
- C. Deliver and store valves in shipping containers with labeling in place.

**PART 2 PRODUCTS**

**2.1 SANITARY SEWER PIPING, BURIED WITHIN 5 FEET OF BUILDING**

- A. Cast Iron Pipe: CISPI 301, hubless, service weight. Fittings: Cast iron. Joints: Neoprene gaskets and stainless steel clamp-and-shield assemblies, Husky Series 4000 or approved equal.
- B. Copper Tubing: ASTM B306, DWV. Fittings: ASME B16.3, cast bronze, or ASME B16.29, wrought copper. Joints: ASTM B32, solder, Grade 95TA; Flux: ASTM B813.
- C. ABS Schedule 40 Cellular Core (Foam Core) Pipe: Pipe and fittings shall be manufactured from ABS compound with a cell class of 42222 for pipe and 32222 for fittings as per ASTM D 3965 and conform with National Sanitation Foundation (NSF) standard 14. ASTM D 2661 Fittings. Joints: ASTM D 2235 solvent welded.

**2.2 SANITARY VENT PIPING**

- A. Cast Iron Pipe: CISPI 301, hubless, service weight. Fittings: Cast iron. Joints: Neoprene gaskets and stainless steel clamp-and-shield assemblies, Husky Series 4000 or approved equal.
- B. Copper Tubing: ASTM B306, DWV. Fittings: ASME B16.3, cast bronze, or ASME B16.29, wrought copper. Joints: ASTM B32, solder, Grade 95TA; Flux: ASTM B813.
- C. ABS Schedule 40 Cellular Core (Foam Core) Pipe: Pipe and fittings shall be manufactured from ABS compound with a cell class of 42222 for pipe and 32222 for fittings as per ASTM D 3965 and conform with National Sanitation Foundation (NSF) standard 14. ASTM D 2661 Fittings. Joints: ASTM D 2235 solvent welded.

**2.3 DOMESTIC WATER PIPING, ABOVE GRADE**

- A. Copper Tubing: ASTM B88, Type L, hard drawn. Fittings: ASME B16.18, cast copper alloy, or ASME B16.22, wrought copper. Joints: ANSI/ASTM B32, solder, Grade 95TA; Flux: ASTM B813 or Press-Fit.

**2.4 FLANGES, UNIONS, AND COUPLINGS**

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- A. Pipe Size 2 Inches and Under: 150 psig malleable iron unions for threaded ferrous piping; bronze unions for copper pipe, soldered joints.

### **2.5 ACCEPTABLE MANUFACTURERS - ALL VALVE TYPES**

- A. Apollo.
- B. FNW.
- C. Hammond.
- D. Milwaukee.
- E. NIBCO.
- F. Red-White Valve Corp.
- G. Substitutions: Under provisions of Division 01.

### **2.6 GATE VALVES**

- A. Not permitted. Use ball or butterfly valves for isolation service.

### **2.7 GLOBE VALVES**

- A. Not permitted. Use ball or butterfly valves for throttling service.

### **2.8 BALL VALVES**

- A. Up to 2 Inches: 600 PSI CWP Lead free bronze two piece body, full port, forged lead free brass ball, Teflon seats and adjustable packing, lever handle, solder, threaded or press-fit ends.

### **2.9 SWING CHECK VALVES**

- A. Up to 2 Inches: 200 PSI CWP lead free bronze swing with PTFE disc, solder, screwed or press-fit ends.
- B. Over 2 Inches: 285 PSI CWP ductile iron body, stainless steel trim, swing disc, renewable disc and seat, flanged ends.

### **2.10 DRAIN VALVES**

- A. Bronze body, chrome plated brass ball, RPTFE seals and stuffing box ring, stainless steel handle with vinyl cover. 3/4" NPT x 3/4" Hose thread, with duct cover and chain, sweat ends. Apollo 78-100 Series or approved equal.

### **2.11 ACCEPTABLE MANUFACTURERS - CLEANOUTS**

- A. J.R. Smith.
- B. Zurn.
- C. Mifab.
- D. Substitutions: Under provisions of Division 01.

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#### **2.12 CLEANOUTS**

- A. Exterior Surfaced Areas: Round cast iron access frame and non-skid cover, bronze plug, vandal resistant screws. J.R. Smith Model 4251 or approved equal.
- B. Interior Finished Floor Areas: Enamel paint coated cast iron, two piece body with double drainage flange, weep holes, reversible clamping collar, bronze plug, and adjustable round nickel bronze scoriated cover in service areas and round with depressed cover to accept floor finish in finished floor areas. J.R. Smith Model 4021 or approved equal.
- C. Interior Finished Wall Areas: Line type with lacquered cast iron body and round epoxy coated gasketed cover, bronze plug, and round stainless steel access cover secured with machine screw. J.R. Smith Model 4022 or approved equal.
- D. Interior Unfinished Accessible Areas: Caulked or threaded type. Provide bolted stack cleanouts on vertical rainwater leaders.

### **PART 3 EXECUTION**

#### **3.1 PREPARATION**

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- B. Remove scale and dirt, on inside and outside, before assembly.
- C. Prepare piping connections to equipment with flanges or unions.

#### **3.2 INSTALLATION**

- A. Provide non-conducting dielectric connections wherever jointing dissimilar metals.
- B. Route piping in orderly manner and maintain gradient.
- C. Install piping to conserve building space and not interfere with use of space.
- D. Group piping whenever practical at common elevations.
- E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- F. Provide clearance for installation of insulation and access to valves and fittings.
- G. Provide access where valves and fittings are not exposed. Coordinate size and location of access doors.
- H. Slope water piping and arrange to drain at low points.
- I. Establish elevations of buried piping outside the building to ensure not less than 10 ft. of cover.
- J. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.
- K. Prepare pipe, fittings, supports, and accessories not prefinished, ready for finish painting. Refer to Division 09.

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- L. Establish invert elevations, slopes for drainage to 1/4" per foot, 1/8" per foot if 4" or over, minimum. Maintain gradients.
- M. Install valves with stems upright or horizontal, not inverted.
- N. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with Teflon™ based thread lubricate. Ensure clearance at cleanout for rodding of drainage system.
- O. Encase exterior cleanouts in concrete flush with grade.
- P. Install water hammer arrestors complete with accessible isolation valve.
- Q. Support all piping in accordance with Uniform Plumbing Code and Manufacturer installation instructions. Where there is a conflict between requirements of the Uniform Plumbing Code and Manufacturer installation instructions, the more restrictive requirement shall apply.

### **3.3 APPLICATION**

- A. Install unions downstream of valves and at equipment connections.
- B. Install ball or butterfly valves for shut-off and to isolate equipment, part of systems, or vertical risers.
- C. Install ball or balance valve valves for throttling, bypass, or manual flow control services. (No globe valves permitted.)

### **3.4 TESTING**

- A. Test all water piping in accordance with Section 609 of the UPC. Submit a signed statement to the Engineer stating testing dates, procedure and initials of tester. The test pressure for a hydrostatic test shall be 1.5 times the design pressure or 150 psi, whichever is greater, and for an air test shall be 1.1 times the design pressure or 150 psi, whichever is greater.
- B. Test all sanitary sewer and vent piping in accordance with Section 712 of the UPC. Submit a signed statement to the Engineer stating testing dates, procedure and initials of tester.

### **3.5 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM**

- A. Flush, clean and disinfect the potable water system in accordance with Section 609 of the UPC. Submit a signed statement to the Engineer stating disinfection dates, procedure and initials of tester.

### **3.6 SERVICE CONNECTIONS**

- A. Provide new water service complete with reduced pressure backflow preventor and water meter. Provide 18 gauge galvanized sheet metal sleeve around service main to 6 inch above floor. Size for minimum of 2 inches of loose batt insulation stuffing. Provide close fitting galvanized sheet metal escutcheon.

**END OF SECTION 22 10 00**

## **SECTION 22 15 00 - GENERAL SERVICE COMPRESSED-AIR SYSTEMS**

### **PART 1 GENERAL**

#### **1.1 WORK INCLUDED**

- A. Compressed Air Piping.

#### **1.2 REFERENCES**

- A. American Society of Mechanical Engineers:

- 1. ASME B16.3 - Malleable Iron Threaded Fittings.

- B. ASTM International:

- 1. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
  - 2. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
  - 3. ASTM A536 - Standard Specification for Ductile Iron Castings.

- C. Manufacturers Standardization Society of the Valve and Fittings Industry:

- 1. MSS SP 58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.
  - 2. MSS SP 70 - Cast Iron Gate Valves, Flanged and Threaded Ends.
  - 3. MSS SP 71 - Cast Iron Swing Check Valves, Flanged and Threaded Ends.
  - 4. MSS SP 80 - Bronze Gate, Globe, Angle and Check Valves.
  - 5. MSS SP 89 - Pipe Hangers and Supports - Fabrication and Installation Practices.
  - 6. MSS SP 110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

#### **1.3 RELATED SECTIONS**

- A. Division 03 - Cast-In-Place Concrete.
- B. Division 07 – Firestopping.
- C. Division 09 - Painting and Coating.
- D. Section 22 05 00 - Common Motor Requirements for Plumbing.
- E. Section 22 05 53 - Identification for Plumbing Piping and Equipment.
- F. Division 26 - Equipment Wiring Connections.

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### **1.4 SUBMITTALS**

- A. Submit product data under provisions of Division 01.
- B. Product Data:
  - 1. Piping: Submit data on pipe materials, fittings, and accessories.
  - 2. Valves: Submit manufacturers catalog information with valve data and ratings for each service.
  - 3. System Components: Submit manufacturers catalog information including capacity, component sizes, rough-in requirements, and service sizes.
  - 4. Compressors: Submit type, capacity, and performance characteristics. Include electrical characteristics and connection requirements.

### **1.5 CLOSEOUT SUBMITTALS**

- A. Division 01 - Execution and Closeout Requirements: Requirements for submittals.
- B. Project Record Documents: Record actual locations of equipment piping, valves, outlets and components.
- C. Operation and Maintenance Data: Submit assembly views, lubrication instructions, replacement part numbers and availability.

### **1.6 DELIVERY, STORAGE, AND HANDLING**

- A. Division 01 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. Accept equipment on site in factory fabricated containers with shipping skids and plastic pipe end protectors in place. Inspect for damage.
- C. Protect piping and equipment from weather and construction traffic. Maintain factory packaging and caps in place until installation.
- D. Deliver each length of piping with manufacturer's plugged or capped ends and keep sealed until installation.
- E. Deliver fittings, valves, and other components in sealed containers and keep sealed until installation.

## **PART 2 PRODUCTS**

### **2.1 COMPRESSED AIR PIPING**

- A. Steel Pipe: ASTM A53/A53M, Schedule 40 black. Fittings: ASME B16.3, malleable iron, or ASTM A234/A234M, forged steel welding type. Joints: Threaded or Viega MegaPress or Approved Equal for 2 inch and smaller, welded for 2-1/2 inch and larger.
- B. Copper Tubing: ASTM B88, Type L, hard drawn. Fittings: ASME B16.18, cast copper alloy, or ASME B16.22, wrought copper. Joints: ANSI/ASTM B32, solder, Grade 95TA; Flux: ASTM B813 or Viega ProPress or Approved Equal.

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#### **2.2 UNIONS AND FLANGES**

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A. Unions for Pipe 2 inches and Smaller:

1. Ferrous Piping: Class 150, malleable iron, threaded.

#### **2.3 GATE VALVES**

A. Not allowed.

#### **2.4 BALL VALVES**

- A. MSS SP 110, Class 150, bronze, two piece body, type 316 stainless steel ball, full port, Teflon seats, blow-out proof stem, threaded ends, lever handle.

#### **2.5 CHECK VALVES**

- A. MSS SP 80, Class 150, bronze body and cap, bronze seat, Buna-N disc, threaded ends.

#### **2.6 STRAINERS**

- A. Y pattern, ASTM B62 bronze body, threaded ends, Class 150, 1/16 inch stainless steel perforated screen.

#### **2.7 FLEXIBLE CONNECTORS**

- A. 2 inches and Smaller: Corrugated stainless steel hose with single layer of stainless steel exterior braiding, Schedule 80 black steel ends; maximum working pressure 200 psig, threaded connections.

#### **2.8 RELIEF VALVES**

- A. Relief Valves: Bronze body, Teflon seat, stainless steel stem and springs, automatic, direct pressure actuated capacities ASME certified and labeled.

#### **2.9 COMPRESSED AIR OUTLETS**

- A. Compressed Air Outlets: Quick Connector: 3/8 inch brass, snap on connector with self-closing valve.

#### **2.10 AIR PRESSURE REDUCING VALVE**

- A. Air Pressure Reducing Valve: Consisting of automatic reducing valve and bypass, and low pressure side relief valve and gage.
- B. Valve Capacity: Reduce pressure from 200 psi to 30 psi, adjustable upward from reduced pressure.

#### **2.11 PRESSURE REGULATORS**

- A. Pressure Regulators: Aluminum alloy or plastic body, diaphragm operated, direct acting, spring loaded, manual pressure setting adjustment, and rated for 250 psig inlet pressure.

#### **2.12 COMPRESSED AIR FILTERS**

- A. Coalescing Filters: Furnish with activated carbon capable of removing water and oil aerosols.

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**2.13 HOSE CONNECTORS**

- A. Hose Connectors: Corrugated stainless steel tubing with stainless steel wire braid covering and ends welded to inner tubing.
- B. Working Pressure: 250 psig minimum.
- C. End Connections:
  - 1.2 inches and Smaller: Threaded steel pipe nipple.

**2.14 ACCEPTABLE MANUFACTURERS - AIR COMPRESSORS**

- A. Ingersoll Rand.
- B. Quincy.
- C. Atlas Copco.
- D. Substitutions: Under provisions of Division 01.

**2.15 OIL-LESS RECIPROCATING AIR COMPRESSOR**

- A. Oil Less Air Compressor: Simplex tank mounted compressor unit consisting of 100 percent oil less air-cooled compressor, vertical air receiver, after cooler, and operating controls.
- B. Reciprocating Compressors:
  - 1. Type: Single stage.
  - 2. Unit: Reciprocating compressor with suction inlet screen, discharge service valves, on cast iron or welded steel base for motor and compressor with provision for V-belt adjustment.
  - 3. Motor: Constant speed 1800 rpm with electronic overheating protection in each phase with full voltage starting.
  - 4. Control Panel: Factory mounted and wired, NEMA 250 Type 1 enclosure, steel construction, with power and control wiring, factory wired for single point power connection.
    - a. Starter: Furnish with manual reset current overload protection, starter relay, control power transformer, terminal strip for connection to interface equipment.
    - b. Panel Face: Compressor run light, start-stop switch, elapsed time meter.
- C. Controls:
  - 1. Pressure Switch: Line voltage contactor to break at 100 psi with minimum differential of 20 psi.

**2.16 ACCEPTABLE MANUFACTURERS – HOSE REELS**

- A. CoxReels.
- B. Ingersoll Rand.



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- C. Substitutions: Under provisions of Division 01.

### **2.17 HOSE REELS**

- A. Auto rewind, heavy gauge 1/4" steel base & support post, factory-matched cartridge-style spring motor, brass NPT swivel inlet, 1" solid steel axle with 1" lubricated precision bearings, universal guide arm, non-corrosive stainless steel spring, pawl and zinc plated ratchet.

## **PART 3 EXECUTION**

### **3.1 PREPARATION**

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- B. Remove scale and dirt on inside and outside before assembly.
- C. Prepare piping connections to equipment with flanges or unions.
- D. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

### **3.2 INSTALLATION**

- A. Install drip connections with valves at low points of piping system.
- B. Install take-off to outlets from top of main, with shut off valve after take-off. Slope take-off piping to outlets.
- C. Install compressed air couplings, female quick connectors where outlets are indicated.
- D. Install tees instead of elbows at changes in direction of piping. Fit open end of each tee with plug.
- E. Cut piping accurately and install without springing or forcing.
- F. Install pipe sleeves where pipes pass through walls, floors, roofs, and partitions.
- G. Install firestopping at fire rated construction penetrations and openings.
- H. Install pipe identification in accordance with Section 22 05 05.
- I. Except where indicated, install ball valves with stem vertical and accessible for operation and maintenance.
- J. Install strainers on inlet side of pressure regulators.

### **3.3 INSTALLATION - EQUIPMENT**

- A. Install air compressor and air dryer on concrete housekeeping pad.
- B. Install air compressor unit on vibration isolators. Level and bolt in place.
- C. Install line size shut-off valve and check valve on compressor discharge.
- D. Install condensate drain piping to floor drain.

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#### **3.4 FIELD QUALITY CONTROL**

- A. Compressed Air Piping Leak Test: Prior to initial operation, clean and test compressed air piping in accordance with ASME B31.1.
- B. Test system with dry compressed air or dry nitrogen with test pressure in piping system at 1.5 times the operating system pressure in psi.

#### **3.5 CLEANING**

- A. Blow systems clear of free moisture and foreign matter.

**END OF SECTION 22 15 00**

## **SECTION 22 45 00 – EMERGENCY PLUMBING FIXTURES**

### **PART 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- A. Eye / Face Washes.
- B. Eye Washes.

#### **1.2 RELATED WORK**

- A. Section 22 05 00 - Common Work Results for Plumbing.
- B. Section 22 10 00 – Plumbing Piping.
- C. Section 22 30 00 – Plumbing Equipment.

#### **1.3 REFERENCES**

- A. ANSI Z358.1 – 2009 Emergency Eyewash and Shower Equipment.
- B. ANSI 117.1-2009 Accessible and Usable Buildings and Facilities.
- C. OSHA Act 1910-151.C.

#### **1.4 SUBMITTAL**

- A. Submit under provisions of Division 01.
- B. Product Data: Provide catalog illustrations of fixtures, sizes, rough in dimensions, utility sizes, capacities, materials, trim, and finishes.
- C. Manufacturer's installation instructions and performance limitations.

#### **1.5 OPERATION AND MAINTENANCE DATA**

- A. Submit under provisions of Division 01.
- B. Maintenance Data: include fixture trim exploded view and replacement parts lists.

#### **1.6 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver, store, protect and handle products to site under provisions of Division 01.
- B. Accept fixtures on site in factory packaging. Inspect for damage.
- C. Protect installed fixtures and equipment from damage by securing areas and by leaving factory packaging in place to protect fixtures and equipment from damage.

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#### **1.7 FIELD MEASUREMENTS**

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- A. Verify all rough-in and finishing measurements in the field.

#### **PART 2 PRODUCTS**

##### **2.1 ACCEPTABLE MANUFACTURERS: EMERGENCY SHOWER & EYE WASH EQUIPMENT**

- A. Bradley.
- B. Guardian.
- C. Haws.
- D. Speakman.
- E. Substitutions: Under provisions of Division 01.

##### **2.2 EYE WASHES (ONLY)**

- A. Gravity-Flow Portable Eyewash
  - 1. Self-contained 16 gallon gravity flow eyewash unit uses gravity to deliver water through dual spray heads. Unit delivers over eight gallons (30 liters) of water for fifteen minutes, thus complying with the provisions of ANSI Z358.1-2009 for eyewashes. Unit has a rugged plastic tank that can be installed in a wide variety of locations. Unit is ideal for use where a continuous supply of potable water is not available, especially in remote plant areas, low traffic and/or low hazard areas..
  - 2. Performance: Unit shall be fully factory assembled and hydrostatically tested before delivery to meet or exceed ANSI Z358.1 – 1998, and come with a full 2-year warranty.
  - 3. Fixture: Guardian Equipment G1540.

#### **PART 3 EXECUTION**

##### **3.1 EXAMINATION**

- A. Verify that mounting pads are prepared and ready for fixtures and equipment.

##### **3.2 PREPARATION**

- A. Rough-in emergency fixtures in accordance with code requirements and manufacturers recommendations.

##### **3.3 INSTALLATION**

- A. Test emergency shower equipment to demonstrate proper operation. Replace malfunctioning units or components. Adjust controls, and valves for intended water flow rate to emergency fixtures.
- B. Protect fixtures and equipment during construction. At completion, thoroughly clean emergency showers and equipment.

**END OF SECTION 22 45 00**

## **SECTION 23 05 00 - COMMON WORK RESULTS FOR HVAC**

### **PART 1 GENERAL**

#### **1.1 SCOPE**

- A. All provisions of the Contract including the General and Supplementary Conditions and the General Requirements apply to this work.

#### **1.2 WORK INCLUDED**

- A. The work to be included in these and all other mechanical subsections shall consist of providing, installing, adjusting and setting into proper operation complete and workable systems for all items shown on the drawings, described in the specifications or reasonably implied. This shall include the planning and supervision to coordinate the work with other crafts and to maintain a proper time schedule for delivery of materials and installation of the work.
- B. Division 01 of the specifications is to be specifically included as well as all related drawings.

#### **1.3 RELATED WORK**

- A. Related Work Specified Elsewhere:
  - 1. Fire Suppression Specifications: Division 21.
  - 2. Plumbing Specifications: Division 22.
  - 3. Electrical Specifications: Division 26.
  - 4. Motors and Connections: Division 26.
  - 5. Starters and Disconnects: Division 26.
- B. Unless otherwise indicated on the electrical drawings or the electrical schedules, provide all mechanical equipment motors, motor starters, thermal overload switches, control relays, time clocks, thermostats, motor operated valves, float controls, damper motors, electric switches, electrical components, wiring and any other miscellaneous Division 23 controls. Disconnect switches are included in the electrical work, unless specifically called out on mechanical plans.
- C. Carefully coordinate all work with the electrical work shown and specified elsewhere.

#### **1.4 REFERENCED CODES - LATEST ADOPTED EDITION**

- A. NFPA 70                      National Electrical Code (NEC).
- B. IMC                              International Mechanical Code.
- C. UPC                              Uniform Plumbing Code.
- D. IFC                              International Fire Code.
- E. IFGC                            International Fuel Gas Code.
- F. IBC                                International Building Code.

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#### **1.5 PROJECT RECORD DRAWINGS**

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- A. In addition to other requirements of Division 01, mark up a clean set of drawings as the work progresses to show the dimensioned location and routing of all mechanical work which will become permanently concealed. Show routing of work in concealed blind spaces within the building. Show exact dimensions of buried piping off of columns or exterior walls.
- B. Maintain record documents at job site in a clean, dry and legible condition. Keep record documents available for inspection by the Project Manager.
- C. Show the location of all valves and their appropriate tag identification.
- D. At completion of project, deliver these drawings to the Architect and obtain a written receipt.

#### **1.6 SUBMITTALS**

- A. See General Conditions and the General Requirements in Division 01 regarding submittals.
- B. Submit by specification section complete and all at one time; partial submittals will not be considered. Submittals shall be provided in electronic PDF Format. The data in the electronic file shall be arranged and indexed under basic categories in order of the Specification Sections. An index shall be included with bookmarks and identifying tabs between sections and references to sections of specifications.
- C. Catalog sheets shall be complete and the item or model to be used shall be clearly marked, and identified as to which item in the specifications or on the drawings is being submitted and with drawing fixture number where applicable.
- D. Only submit on items specifically required by each specification section. If a submittal has not been requested, it will not be reviewed.

#### **1.7 OPERATING AND MAINTENANCE MANUALS**

- A. See General Conditions and the General Requirements in Division 01 regarding Operating and Maintenance Manuals.
- B. Submit maintenance manuals to the Engineer covering all equipment, devices, etc. installed by the Contractor.
- C. The operation and maintenance manuals shall be submitted by specification section complete and all at one time; partial operations and maintenance manual submittals will not be considered. The Operation and maintenance manuals shall be provided in electronic PDF Format. The data in the electronic file shall be arranged and indexed under basic categories. An index shall be included with bookmarks and identifying tabs between sections and references to sections of specifications. The manual shall contain, but not limited to, the following types of information:
  - 1. Cover sheet with name, address, telephone number of Contractor, General Contractor and major equipment suppliers.
  - 2. Catalog cuts of all equipment, etc. installed (Marked to identify the specific items used).
  - 3. Manufacturer's maintenance and overhaul instruction booklets including exploded views.
  - 4. Identification numbers of all parts and nearest sources for obtaining parts and services.

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5. Reduced scale drawings of the control system and a verbal description of how these controls operate.
  6. A copy of the final test and balance report.
  7. A copy of valve schedule and reduced scale drawings showing valve locations.
  8. Written summary of instructions to Owner.
  9. All manufacturers' warranties and guarantees.
  10. Contractors Warranty Letter.
- D. A periodic maintenance form that includes all of the equipment shall be provided with the maintenance manual. The form shall list each piece of equipment and how often maintenance is required (daily, weekly, monthly, annually). Opposite each task shall be squares for check-off for a full year (initials) to verify that the tasks are being done.

### **1.8 HANDLING**

- A. See General Conditions and the General Requirements in Division 01 regarding material handling.
- B. Deliver packaged materials to job site in unbroken packages with manufacturer's label, and store to facilitate inspection and installation sequence. All items must be labeled and identified as to make, size and quality.

### **1.9 SUBSTITUTIONS**

- A. See General Conditions and the General Requirements in Division 01 for substitution request procedures.
- B. In accordance with the General Conditions and the General Requirements in Division 01, Substitution and Product Options, all substitute items must fit in the available space, and be of equal or better quality including efficiency performance, size, and weight, and must be compatible with existing equipment. The Architect/Engineer shall be the final authority regarding acceptability of substitutes.

### **1.10 DIMENSIONS**

- A. Before ordering any material or doing any work, the Contractor shall verify all dimensions, including elevations, and shall be responsible for the correctness of the same. No extra charge or compensation will be allowed on account of differences between actual dimensions and measurements indicated on the drawings.
- B. Any differences, which may be found, shall be submitted to the Architect/Engineer for consideration before proceeding with the work.

### **1.11 MANUFACTURER'S DIRECTIONS**

- A. All manufactured articles shall be applied, installed and handled as recommended by the manufacturer, unless specifically called out otherwise. Advise the Architect/Engineer of any such conflicts before installation.

### **1.12 PERMITS, FEES, ETC.**

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- A. The Contractor under each Division of these specifications shall arrange for a permit from the local authority. The Contractor shall pay for any inspection fees or other fees and charges required by ordinance, law, codes and these specifications.

### **1.13 TESTING**

- A. The Contractor under each section shall perform the various tests as specified and required by the Architect, Engineer and as required by applicable code, the State and local authorities. The Contractor shall furnish all labor, fuel and materials necessary for making tests.

### **1.14 TERMINOLOGY**

- A. Whenever the words "furnish", "provide", "furnish and install", "provide and install", and/or similar phrases occur, it is the intent that the materials and equipment described be furnished, installed and connected under this Division of the Specifications, complete for operation unless specifically noted to the contrary.
- B. Where a material is described in detail, listed by catalogue number or otherwise called for, it shall be the Contractor's responsibility to furnish and install the material.
- C. The use of the word "shall" conveys a mandatory condition to the contract.
- D. "This section" refers to the section in which the statement occurs.
- E. "The project" includes all work in progress during the construction period.
- F. In describing the various items of equipment, in general, each item will be described singularly, even though there may be a multiplicity of identical or similar items.

### **1.15 SCHEDULE OF WORK**

- A. The work under the various sections must be expedited and close coordination will be required in executing the work. The various trades shall perform their portion of the work at such times as directed so as to meeting scheduled completion dates, and to avoid delaying any other trade. The Architect will set up completion dates. Each contractor shall cooperate in establishing these times and locations and shall process work so as to ensure the proper execution of it.

### **1.16 COOPERATION AND CLEANING UP**

- A. The Contractor for the work under each section of the specifications shall coordinate the Contractors work with the work described in all other sections of the specifications to the end that, as a whole, the job shall be a finished one of its kind, and shall carry on the work in such a manner that none of the work under any section of these specifications shall be handicapped, hindered or delayed at any time.
- B. At all times during the progress of the work, the Contractor shall keep the premises clean and free of unnecessary materials and debris. The Contractor shall, on direction at any time from the Architect, clear any designated areas or area of materials and debris. On completion of any portion of the work, the Contractor shall remove from the premises all tools and machinery and all debris occasioned by the work, leaving the premises free of all obstructions and hindrances.



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### **1.17 WARRANTY**

- A. Unless a longer warranty is hereinafter called for, all work, materials and equipment items shall be warrantied for a period of one year after acceptance by the Owner. All defects in labor and materials occurring during this period, as determined by the Architect/Engineer, shall be repaired and/or replaced to the complete satisfaction of the Architect/Engineer. Guarantee shall be in accordance with Division 01.

### **1.18 COMPLETION REQUIREMENTS**

- A. In accordance with the General Conditions and the General Requirements in Division 01, Project Closeout; before acceptance and final payment, the Contractor shall furnish:
  - 1. Accurate project record drawings, shown in red ink on prints, showing all changes from the original plans made during installation of the work.
  - 2. Contractors One Year Warranty.
  - 3. All Manufacturers' Guarantees.
  - 4. Test and Balance Reports.
  - 5. Operation and Maintenance Manuals.

## **PART 2 PRODUCTS**

### **2.1 MATERIALS**

- A. All equipment shall be regularly cataloged items of the manufacturer and shall be supplied as a complete unit in accordance with the manufacturer's standard specifications along with any optional items required for proper installation unless otherwise noted. Maintain manufacturer's identification, model number, etc. on all equipment at all times.
- B. Where more than one of an item is to be provided, all of the items shall be identical manufacture, make, model, color, etc.

### **2.2 RESTRICTED MATERIALS**

- A. No materials containing asbestos in any form shall be allowed.
- B. No solder or flux containing lead shall be used on this project.
- C. Where materials or equipment provided by this Contractor are found to contain restricted materials, such items shall be removed and replaced with non-restricted materials items. Entire cost of restricted materials removal and disposal and cost of installing new items shall be the responsibility of the Contractor for those restricted materials containing items installed by the Contractor.

### **2.3 ELECTRICAL MOTORS**

- A. Motors: Furnish electric motors designed for the specific application and duty applied, and to deliver rated horsepower without exceeding temperature ratings when operated on power systems with a combined variation in voltage and frequency not more than + 10% of rated voltage. Motors for pumps and fans shall be selected to be non-overloading.

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- B. Verify from the drawings and specifications the available electrical supply characteristics and furnish equipment that will perform satisfactorily under the conditions shown and specified.
- C. All motors for use with equipment with variable frequency drives shall be inverter ready motors. Verify compatibility and sizing of motor with variable frequency drive.
- D. Size motors for 1.15 service factor and not to exceed 40° C temperature rise above ambient.
- E. Fractional horsepower motors to have self-resetting thermal overload switch.
- F. Provide Premium Efficiency, motors for all three phase motors one horsepower and larger. Standard efficiency motors will not be acceptable.

### **2.4 IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT**

- A. Plastic Nameplates: Laminated plastic with engraved letters.
- B. Plastic Tags: Laminated plastic with engraved letters, minimum 1-1/2 inches diameter.
- C. Plastic Pipe Markers: Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering.
- D. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

### **2.5 PIPE HANGERS AND SUPPORTS**

- A. Acceptable Manufacturers:
  - 1. Anvil.
  - 2. PHD Manufacturing, Inc.
  - 3. Michigan Hanger Company.
  - 4. B-Line Systems, Inc.
- B. Hydronic Piping:
  - 1. Conform to ANSI/MSS SP58.
  - 2. Hangers for Pipe Sizes ½ to 1-½ Inch: Malleable iron, adjustable swivel, split ring for steel pipe, copper swivel for copper pipe.
  - 3. Hangers for Hot Pipe Sizes 2 to 4 Inches and Cold Pipe Sizes 2 Inches and Larger: Carbon steel, adjustable, clevis.
  - 4. Hangers for Hot Pipe Sizes 6 Inches and Over: Adjustable steel yoke, cast iron roll, double hanger.
  - 5. Multiple or Trapeze Hangers: Steel channels or strut with hanger rods. Cast iron roll and stand for hot pipe sizes 6 inches and over.
  - 6. Wall Support for Pipe Sizes to 3 Inches: Strut triangular bracket with pipe clamp and cushion insulator.

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7. Wall Support for Pipe Sizes 4 Inches and Over: Welded steel bracket and wrought steel clamp; adjustable steel yoke and cast iron roll for hot pipe sizes 6 inches and over.
  8. Vertical Support: Steel riser clamp.
  9. Floor Support for Pipe Sizes to 4 Inches and All Cold Pipe Sizes: Cast iron adjustable pipe saddle, locknut nipple, floor flange or steel support.
  10. Floor Support for Hot Pipe Sizes 6 Inches and Over: Adjustable cast iron roll and stand, steel screws, and concrete pier or steel support.
  11. Copper Pipe Support: Carbon steel ring, adjustable, copper plated with felt isolation pad or all copper ring or swivel.
- C. Shield for Insulated Piping 1-½ Inches and Smaller: 18 gauge galvanized steel shield over insulation in 180° segments, minimum 12 inches long at pipe support.
- D. Shield for Insulated Piping 2 Inches and Larger: Hard block, calcium silicate insert, 180° segment, 12 inch minimum length, block thickness same as insulation thickness, flame resistant vapor barrier covering and 18 gauge galvanized shield.
- E. Shields for Vertical Copper Pipe Risers: Galvanized steel pipe.
- F. Design hangers to allow installation without disengagement of supported pipe.
- G. Copper Plating: All hanger elements in metal-to-metal contact with copper pipe, except hanger rings with factory-applied 1/16 inch minimum thick plastic or tape cushion strip over all contact surfaces.
- H. Strut Type Pipe Hanging System: Unistrut P-1000 series; framing members shall be No. 12 gage formed steel channels, 1-5/8 inch square, conforming to ASTM A 653 GR33, one side of channel shall have a continuous slot with inturned lips; framing nut with grooves and spring 1/2 inch size, conforming to ASTM 675 GR60; screws conforming to ASTM A 307; fittings conforming to ASTM A 575; all parts enamel painted or electro-galvanized.

### **2.6 HANGER RODS**

- A. Steel Hanger Rods: Threaded both ends, or continuous threaded.

### **2.7 ANCHOR BOLTS**

- A. Anchor (Expansion) Bolts: Shall be carbon steel to ASTM A 307; nut shall conform to ASTM A194; shall be drilled-in type. Design values for shear and tension shall be not more than 80 percent of the allowable load.

### **2.8 INSERTS**

- A. Inserts: Malleable iron case of steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

### **2.9 FLASHING**

- A. Metal Flashing: 26-gauge minimum galvanized steel.
- B. Metal Counter Flashing: 22 gauge minimum galvanized steel.

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- C. Flexible Flashing: 47-mil thick sheet butyl, compatible with roofing.
- D. Caps: Steel, 22-gauge minimum; 16 gauge at fire resistant elements.

### **2.10 SLEEVES**

- A. Sleeves for Pipes Through Non-fire Rated Floors: Form with 18 gauge galvanized steel for 4 inch diameter and larger, 22 gauge up to 3" diameter.
- B. Sleeves for Pipes Through Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Form with steel pipe or 18 gauge galvanized steel for 4 inch diameter and larger, 22 gauge up to 3" diameter.

### **2.11 FORMED STEEL CHANNEL**

- A. Manufacturers:
  - 1. Allied Tube & Conduit Corp.
  - 2. B-Line Systems.
  - 3. Midland Ross Corporation, Electrical Products Division
  - 4. Unistrut Corp.
  - 5. Substitutions under provisions of Division 01.
- B. Product Description: Galvanized 12 gauge (2.8 mm) thick steel. With holes 1-1/2 inches (38 mm) on center.

### **2.12 SEISMIC BRACING AND SUPPORT OF SYSTEMS AND COMPONENTS**

- A. General:
  - 1. Seismic restraint designer shall coordinate all attachments with the structural engineer of record.
  - 2. Design analysis shall include calculated dead loads, static seismic loads, and capacity of materials utilized for the connection of the equipment or system to the structure.
  - 3. Analysis shall detail anchoring methods, bolt diameter, and embedment depth.
  - 4. All seismic restraint devices shall be designed to accept without failure the forces calculated per the applicable building code and as summarized in installation requirements.
  - 5. The total height of the structure (h) and the height of the system to be restrained within the structure (z) shall be determined in coordination with architectural plans and the General Contractor.
- B. Friction from gravity loads shall not be considered resistance to seismic forces.

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#### **2.13 SEISMIC BRACING COMPONENTS**

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- A. Steel strut shall be 1-5/8 wide in varying heights and mig-welded combinations as required to meet load capacities and designs indicated. A material heat code, part number, and manufacturer's name shall be stamped on all strut and fittings to maintain traceability to material test reports.
  - 1. Material for epoxy painted strut: ASTM A1011, SS, Grade 33.
  - 2. Material for pre-galvanized strut: ASTM A653, SS, Gr. 33.
  - 3. Material for Hot-Dip Galvanized strut: ASTM A1011, SS, Grade 33 and hot-dip galvanized after fabrication in accordance with ASTM A123.
  - 4. Material for fittings and accessories: ASTM A907 Gr. 33, Structural Quality or ASTM A1011, SS, Gr.33.
  - 5. Fittings and accessories: Products shall be of the same manufacturer as strut and designed for use with that product.

#### **PART 3 EXECUTION**

##### **3.1 DRAWINGS**

- A. The drawings are partly diagrammatic, not necessarily showing all offsets or exact locations of piping and ducts, unless specifically dimensioned. The contractor shall provide all materials and labor necessary for a complete and operable system. Complete details of the building which affect the mechanical installation may not be shown. For additional details, see Architectural, Structural, Civil and Electrical Drawings. Coordinate work under this section with that of all related trades.

##### **3.2 INSTALLATION**

- A. All work shall comply with the latest adopted applicable codes and ordinances including, but not limited to, the IMC, UPC, IBC, NEC, NFPA, IFGC and IFC Standards; all local and state amendments to all codes and standards.
- B. Obtain and pay for all inspection fees, connection charges and permits as a part of the Contract.
- C. Compliance with codes and ordinances shall be at the Contractor's expense.
- D. Install in accordance with manufacturer's instructions.

##### **3.3 MEASUREMENTS**

- A. Verify all measurements on the job site.
- B. Locate all equipment on the centers of walls, openings, spaces, etc., unless specified otherwise.
- C. Check all piping, ducts, etc. to clear openings.
- D. Rough-in dimensions shall be per manufacturer's recommendations and in compliance with current ADA and ANSI 117.1 standards.

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#### **3.4 OPERATING INSTRUCTIONS**

- A. Before the facility is turned over to the Owner, instruct the Owner or Owner's personnel in the operation, care and maintenance of all systems and equipment under the jurisdiction of the Mechanical Division. These instructions shall also be included in a written summary in the Operating Maintenance Manuals.
- B. The Operation and Maintenance Manuals shall be utilized for the basis of the instruction. Provide a minimum of four hours of on site instruction to the owner designated personnel.
- C. When required by individual specification sections provide additional training on HVAC systems and equipment as indicated in the respective specification section.
- D. Provide schedule for training activities for review prior to start of training.

#### **3.5 SYSTEM ADJUSTING**

- A. Each part of each system shall be adjusted and readjusted as necessary to ensure proper functioning of all controls, proper air distribution, elimination of drafts, noise and vibration.
- B. Balance air and water systems for volume quantities shown and as required to ensure even temperature and the elimination of drafts. Balancing shall be done by a qualified firm acceptable to the Engineer. Provide balancing log to the Engineer before substantial completion.

#### **3.6 CUTTING, FITTING, REPAIRING, PATCHING AND FINISHING**

- A. Arrange and pay for all cutting, fitting, repairing, patching and finishing of work by other trades where it is necessary to disturb such work to permit installation of mechanical work. Perform work only with craftsmen skilled in their respective trades.
- B. Avoid cutting, insofar as possible, by setting sleeves, frames, etc. and by requesting openings in advance. Assist other trades in securing correct location and placement of rough-frames, sleeves, openings, etc. for ducts and piping.
- C. Cut all holes neatly and as small as possible to admit work. Include cutting where sleeves or openings have been omitted. Perform cutting in a manner so as not to weaken walls, partitions or floors. Drill holes required to be cut in floors without breaking out around holes.

#### **3.7 PAINTING**

- A. Perform all of the following painting in accordance with provisions of Division 09 with colors as selected by the Architect. Provide the following items as a part of mechanical work:
  - 1. Factory applied prime and finish coats on mechanical equipment.
  - 2. Factory applied prime and finish coat on all air registers, grilles and diffusers, unless otherwise specified.
  - 3. Factory applied prime coat on access doors.
  - 4. Pipe identification where specified.
- B. If factory finish on any equipment furnished is damaged in shipment or during construction, refinish to equal original factory finish.

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#### 3.8 IDENTIFICATION

- A. Tag all valves with heat resistant laminated plastic labels or brass tags engraved with readily legible letters. Securely fasten to the valve stem or bonnet with beaded chain. Provide a framed, typewritten directory under glass, and installed where directed. Provide complete record drawings that show all valves with their appropriate label. Seton 250-BL-G, or 2961.20-G, 2" round or equal.
- B. Label all equipment with heat resistant laminated plastic labels having engraved lettering 1/2" high. If items are not specifically listed on the schedules, consult the Engineer concerning designation to use. Seton engraved Seton-Ply nameplates or equal.
- C. Identify piping to indicate contents and flow direction of each pipe exposed to view by a labeled sleeve in letters readable from floor at least once in each room and at intervals of not more than 20' apart and on each side of partition penetrations. Coloring scheme in accordance with ANSI A13.1-1981, Seton Opti-Code or equal.

#### 3.9 PIPE HANGERS AND SUPPORTS

- A. Support piping as follows:

Pipe Size	Max. Hanger Spacing	Hanger Diameter
1/2 to 1-1/4 inch	6'-0"	3/8"
1-1/2 to 2 inch	10'-0"	3/8"
2-1/2 to 3 inch	10'-0"	1/2"

**Notes:**

<sup>a</sup> See piping manufacturer installation instructions for additional requirements.

- B. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
- C. Place a hanger within 12 inches of each horizontal elbow.
- D. Use hangers with 1-1/2 inch minimum vertical adjustment.
- E. Support vertical piping at every floor.
- F. Where several pipes can be installed in parallel and at the same elevation, provide multiple or trapeze hangers.
- G. Support riser piping independently of connected horizontal piping.

#### 3.10 INSERTS

- A. Provide inserts for placement in concrete formwork.
- B. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
- C. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
- D. Where concrete slabs form finished ceiling, provide inserts to be flush with slab surface.
- E. Where inserts are omitted, drill through concrete slab from below and provide thru-bolt with recessed square steel plate and nut recessed into and grouted flush with slab.

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### **3.11 FLASHING**

- A. Provide flexible flashing and metal counter-flashing where piping and ductwork penetrate weather or waterproofed walls, floors, and roofs.

### **3.12 SLEEVES**

- A. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.
- B. Set sleeves in position in construction. Provide reinforcing around sleeves.
- C. Extend sleeves through floors one inch above finished floor level. Caulk sleeves full depth and provide floor plate.
- D. Where piping or ductwork penetrates floor, ceiling, or wall, install sleeve, close off space between pipe or duct and adjacent work with fire stopping insulation and caulk seal. Use fire rated caulking where fire rated walls are penetrated. Provide close fitting metal collar or escutcheon covers at both sides of penetration.
- E. Install chrome plated steel escutcheons at finished surfaces.

### **3.13 SEISMIC RESTRAINT**

- A. General:
  - 1. All equipment, piping and ductwork shall be restrained to resist seismic/wind forces per the applicable building code(s) as a minimum. Restraint attachments shall be made by bolts, welds or a positive fastening method. Friction shall not be considered. All attachments shall be proven capable of accepting the required wind load by calculations. Additional requirements specified herein are included specifically for this project.
  - 2. Install seismic and wind restraint devices per the manufacturer's submittals. Any deviation from the manufacturer's instructions shall be reviewed and approved by the manufacturer.
  - 3. Attachment to structure for suspended equipment, pipe and duct: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.
  - 4. Wall penetrations may be used as bracing locations provided the wall can provide adequate resistance without significant damage.
  - 5. Coordinate sizes and locations of cast-in-place inserts for post-tensioned slabs with seismic restraint manufacturer.
  - 6. Provide hanger rod stiffeners where indicated or as required to prevent buckling of rods due to seismic forces.
  - 7. Where rigid restraints are used on equipment, ductwork or piping, support rods for the equipment, ductwork or piping at restraint locations must be supported by anchors rated for seismic use. Post-installed concrete anchors must be in accordance with ACI 355.2.
  - 8. Ensure housekeeping pads have adequate space to mount equipment and seismic restraint devices and shall also be large enough to ensure adequate edge distance for restraint anchor bolts to avoid housekeeping pad breakout failure.



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### **B. Concrete Anchor Bolts:**

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid pre- or post-tensioned tendons, electrical and telecommunications conduit, and gas lines.
2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
3. Mechanical Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
5. Set anchors to manufacturer's recommended torque, using a torque wrench.

### **C. Equipment Restraints:**

1. Seismically restrain equipment all equipment. Install fasteners, straps and brackets as required to secure the equipment.
2. Install seismic snubbers on HVAC equipment supported by floor-mounted, non-seismic vibration isolators. Locate snubbers as close as possible to vibration isolators and attach to equipment base and supporting structure as required.
3. Install neoprene grommet washers on equipment anchor bolts where clearance between anchor and equipment support hole exceeds 1/8" (3.2 mm).
4. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.

### **D. Duct Systems:**

1. Seismically restrain all ductwork listed below, using seismic cable restraints:
  - a. All ducts with cross-sectional area equal to or greater than 6 ft<sup>2</sup> (0.55 m<sup>2</sup>).
  - b. Any ductwork which if it were to fail would result in damage to a piece of equipment or building function that has a component importance factor of 1.5.
  - c. All ductwork weighing more than 17 lbs/ft (25 kg/m).
2. "12-inch rule", where duct can be exempted from seismic restraint based on the length of the support rods, is accepted if one of the following conditions are met:
  - a. The hangers shall be detailed to avoid significant bending of the hangers and their attachments. The maximum stress due to combined loading including bending in the hangers must be less than 21.6 ksi.

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- b. Isolation hangers are added to hanger rod to provide swivel joint and to prevent bending moment in hanger.
- 3. Space lateral supports a maximum of 30' o.c. (9 m), and longitudinal supports a maximum of 60' (18 m) o.c.
- 4. Duct risers shall be restrained at floor penetrations every 30' (9 m) maximum spacing.
- 5. Fire damper locations may be used as restraint locations for all directions except away from the damper.
- 6. Brace a change of direction longer than 12' (3.7 m).
- 7. Install restraint cables so they do not bend across edges of adjacent equipment or building structure.

### **E. Piping Systems:**

- 1. For projects with a Seismic Design Category of D, E or F, provide seismic cable restraints on the following:
  - a. All piping greater than 3" (75 mm) nominal diameter.
  - b. All piping systems assigned a component importance factor,  $I_p$ , of 1.5 with a nominal pipe diameter greater than 1" (25 mm) or trapeze-supported piping with combined operating weight over 10 lbs/ft (15 kg/m).
- 2. "12-inch rule", where pipe can be exempted from seismic restraint based on the length of the support rods, is accepted if one of the following conditions are met:
  - a. Hangers are detailed to avoid bending of the hangers and their attachment; and provisions are made for piping to accommodate expected deflections. The maximum stress due to combined loading including bending in the hangers must be less than 21.6 ksi.
  - b. Isolation hangers are added to hanger rod to provide swivel joint and to prevent bending moment in hanger.
- 3. Restraint spacing:
  - a. For ductile piping, space lateral supports a maximum of 40' (12 m) o.c., and longitudinal supports a maximum of 80' (24 m) o.c.
  - b. For non-ductile piping (e.g., cast iron, PVC) space lateral supports a maximum of 20' (6 m) o.c., and longitudinal supports a maximum of 40' (12 m) o.c.
  - c. For piping with hazardous material inside (e.g., natural gas, medical gas) space lateral supports a maximum of 20' (6 m) o.c., and longitudinal supports a maximum of 40' (12 m) o.c.
  - d. For pipe risers, restrain the piping at floor penetrations using the same spacing requirements as above.
- 4. Brace a change of direction longer than 12' (3.7 m).

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5. Longitudinal restraints for single pipe supports shall be attached directly to the pipe, not to the pipe hanger.
6. For supports with multiple pipes (trapezes), secure pipes to trapeze member with clamps approved for application.
7. Piping on roller supports shall include a second roller support located on top of the pipe at each restraint location to provide vertical restraint.
8. Install restraint cables so they do not bend across edges of adjacent equipment or building structure.
9. Install flexible metal hose loops in piping which crosses building seismic joints, sized for the anticipated amount of movement.
10. Install flexible piping connectors where adjacent sections or branches are supported by different structural elements, and where the connections terminate with connection to equipment that is anchored to a different structural element from the one supporting the connections as they approach equipment.
11. Coordinate seismic restraints with thermal expansion compensators, guides and anchor points. Thermal expansion anchor points shall be designed to accommodate seismic forces.

### **3.14 INSTALLATION OF EQUIPMENT**

- A. Unless otherwise indicated, mount all equipment and install in accordance with manufacturer's recommendations and approved submittals.
- B. Maintain manufacture recommended minimum clearances for access and maintenance.
- C. Where equipment is to be anchored to structure, furnish and locate necessary anchoring and vibration isolation devices.
- D. Furnish all structural steel, such as angles, channels, beams, etc. required to support all piping, ductwork, equipment and accessories installed under this Division. Use structural supports suitable for equipment specified or as indicated. In all cases, support design will be based upon data contained in manufacturer's catalog.
- E. Openings: Arrange for necessary openings in buildings to allow for admittance and reasonable maintenance or replacement of all equipment furnished under this Contract.
- F. Access Doors: Provide as necessary for reasonable maintenance of all equipment valves, controls, etc.

**END OF SECTION 23 05 00**

## **SECTION 23 05 16 - EXPANSION FITTINGS AND LOOPS FOR HVAC PIPING**

### **PART 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- A. Flexible Pipe Connectors.
- B. Expansion Joints.
- C. Expansion Compensators.
- D. Pipe Alignment Guides.
- E. Pipe Anchors.

#### **1.2 RELATED SECTIONS**

- A. Section 23 05 00 – Common Work Results for HVAC.
- B. Section 23 21 13 - Hydronic Piping: Product and installation requirements for piping used in hydronic heating and cooling systems.

#### **1.3 REFERENCES**

- A. AMSE B31.1 - Power Piping.
- B. ASME B31.5 - Refrigeration Piping.
- C. ASME B31.9 - Building Services Piping
- D. ASME Section IX - Boiler and Pressure Vessel Code - Welding and Brazing Qualifications.
- E. AWS D1.1 - Structural Welding Code - Steel.

#### **1.4 PERFORMANCE REQUIREMENTS**

- A. Provide structural work and equipment required to control expansion and contraction of piping. Verify that anchors, guides, and expansion joints provided, adequately protect system.
- B. Expansion Calculations:
  - 1. Installation Temperature: 40° F.
  - 2. Hot Water Heating: 210° F.
  - 3. Safety Factor: 30%.

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#### **1.5 SUBMITTALS**

- A. Submit product data under provisions of Division 01.
  - 1. Flexible Pipe Connectors: Indicate maximum temperature and pressure rating, face-to-face length, live length, hose wall thickness, hose convolutions per foot and per assembly, fundamental frequency of assembly, braid structure, and total number of wires in braid.
  - 2. Expansion Joints: Indicate maximum temperature and pressure rating, and maximum expansion compensation.
- B. Manufacturer's Installation Instructions: Indicate special procedures, and external controls.
- C. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

#### **1.6 PROJECT RECORD DOCUMENTS**

- A. Submit under provisions of Division 01.
- B. Record actual locations of flexible pipe connectors, expansion joints, anchors, and guides.

#### **1.7 OPERATION AND MAINTENANCE DATA**

- A. Submit under provisions of Division 01.
- B. Maintenance Data: Include adjustment instructions.

#### **1.8 QUALITY ASSURANCE**

- A. Perform Work in accordance with ASME B31.1 code for installation of piping systems and ASME Section IX for welding materials and procedures.

#### **1.9 QUALIFICATIONS**

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

#### **1.10 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver, store, protect and handle products to site under provisions of Division 01.
- B. Accept expansion joints on site in factory packing with shipping bars and positioning devices intact. Inspect for damage.
- C. Protect equipment from exposure by leaving factory coverings, pipe end protection, and packaging in place until installation.

#### **1.11 WARRANTY**

- A. Provide five year warranty under provisions of Division 01.
- B. Warranty: Include coverage for leak free performance of packed expansion joints.

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#### **PART 2 PRODUCTS**

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##### **2.1 EXPANSION JOINTS**

###### **A. Flexible Expansion Loop (Thermal or Seismic Applications):**

1. Flexible loops shall consist of two flexible sections of hose and braid, two 90° elbows, and a 180° return assembled in such a way that the piping does not change direction, but maintains its course along a single axis.
2. Flexible loops shall have a factory supplied, center support nut located at the bottom of the 180° return, and a drain/air release plug.
3. Flexible loops shall impart no thrust loads to system support anchors or building structure. Loops shall be installed in a neutral, pre-compressed or pre-extended condition as required for the application.
4. Install and guide per manufacturer's recommendations. Materials of construction and end fitting type shall be consistent with pipe material and equipment/ pipe connection fittings.
5. For potable water service, connectors shall be UL classified in accordance with ANSI/NSF 61-1977 standards.
6. Metraflex Model Metraloop or approved equal.

##### **2.2 ACCESSORIES**

###### **A. Pipe Alignment Guides:**

1. Primary and intermediate guides shall be of the radial type employing a heavy wall guide cylinder with weld down or bolt down anchor base. A two section guide spider, having 1/8" maximum diametrical clearance with guide cylinder inside diameter, bolted or welded tight to the carrier pipe which slides through the guide cylinder I.D. Cylinder shall be of sufficient size to clear 1 inch thick pipe insulation and long enough to prevent over travel of the spider.
2. Metraflex Model PGIV or approved equal.

###### **B. Pipe Anchors:**

1. Pipe Alignment Guide (Spider Type):
  - a. Primary and intermediate guides shall be of the radial type employing a heavy wall guide cylinder with weld down or bolt down anchor base. A two section guide spider, having 1/8" maximum diametrical clearance with guide cylinder inside diameter, bolted or welded tight to the carrier pipe which slides through the guide cylinder I.D. Cylinder shall be of sufficient size to clear pipe insulation and long enough to prevent over travel of the spider.
2. Metraflex Model PGIV or approved equal.
  - a. Pipe Alignment Guide (Slide Type):
    - b. Primary and intermediate guides shall be of the sliding type. Two piece construction employing a sliding member to be welded to the carrier pipe and a weld down or

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bolt down anchor base. Sliding member shall be of sufficient height to clear pipe insulation and long enough to prevent over travel of the slide. Load bearing surfaces shall be Teflon to Teflon (T/T-standard), Teflon to Stainless (T/S), or Graphite to Graphite (G/G) as required for the application.

- c. Metraflex Model SG or approved equal.

### **PART 3 EXECUTION**

#### **3.1 INSTALLATION**

- A. Install in accordance with manufacturer's instructions.
- B. Construct spool pieces to exact size of flexible connection for future insertion.
- C. Install flexible pipe connectors on pipes connected to equipment supported by vibration isolation. Provide line size flexible connectors.
- D. Install flexible connectors at right angles to displacement. Install one end immediately adjacent to isolated equipment and anchor other end. Install in horizontal plane unless indicated otherwise.
- E. Rigidly anchor pipe to building structure where necessary. Provide pipe guides so movement is directed along axis of pipe only. Erect piping such that strain and weight is not on cast connections or apparatus.
- F. Provide support and equipment required to control expansion and contraction of piping. Provide loops, pipe offsets, and swing joints, or expansion joints where required.
- G. Provide expansion loops as indicated on drawings.

**END OF SECTION 23 05 16**

## **SECTION 23 05 19 - METERS AND GAUGES FOR HVAC PIPING**

### **PART 1 GENERAL**

#### **1.1 SUMMARY**

A. Section Includes:

1. Thermometers
2. Pressure Gauges.
3. Pressure Gauge Taps.
4. Thermometers.

B. PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THE SECTION

1. Section 23 21 13 - Hydronic Piping: Installation of thermometer wells, pressure gauge tappings.
2. Section 23 31 00 – HVAC Ducts and Casings: Installation of thermometers and static pressure gauges.

#### **1.2 RELATED WORK**

- A. Section 23 05 00 - Common Work Results for HVAC.
- B. Section 23 09 00 – Instrumentation and Control for HVAC.
- C. Section 23 21 16 - Hydronic Piping Specialties.
- D. Section 23 33 00 - Air Duct Accessories.

#### **1.3 REFERENCE STANDARDS**

- A. ASTM E1 - Specification for ASTM Thermometers.
- B. ASTM E77 - Verification and Calibration of Liquid-in-Glass Thermometers.
- C. AWWA C700 - Cold Water Meters - Displacement Type.
- D. AWWA C706 - Direct Reading Remote Registration Systems for Cold Water Meters.
- E. ASTM E1 - Standard Specification for ASTM Thermometers.

#### **1.4 SUBMITTALS**

- A. Product Data: Submit engineering data for each component, Include list which indicates use, operating range, total range and location for manufactured components.
- B. Submit manufacturer's installation instructions under provisions of Division 01.



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**1.5 CLOSEOUT SUBMITTALS**

- A. Project Record Documents: Accurately record actual location of all instrumentation and gauges.
- B. Operation and Maintenance Data.

**1.6 WARRANTY**

- A. Furnish one year manufacturer warranty for HVAC instrumentation.

**PART 2 PRODUCTS**

**2.1 INSTRUMENTATION FOR HVAC**

- A. Manufacturers:
  - 1. Dwyer
  - 2. Terice.
  - 3. Weiss.
  - 4. Marshalltown.
  - 5. Ashcroft.
  - 6. Enerpac.
  - 7. Peterson.
  - 8. Winters.
  - 9. Substitutions: In accordance with Division 01.

**2.2 PRESSURE GAUGES**

- A. 4-1/2 inch diameter cast aluminum case, phosphor bronze bourbon tube, rotary bronze movement, brass socket, with silicone fluid dampening black figures on white background, one percent mid-scale accuracy, scale calibrated in psi. Model 600CB as manufactured by Terice or approved equal.

**2.3 PRESSURE GAUGE TAPS**

- A. Gauge Isolation Valve: Lever handle ball valve, forged brass body, chrome plated brass ball, viton o-rings for maximum 150 psig. Model Mini T-82-M as manufactured by Jomar or equal.
- B. Needle Valve: Brass for maximum 150 psig. Model 735 as manufactured by Terice or equal.
- C. Pulsation Damper: Pressure snubber, brass with 1/4 inch connections. Series 870 as manufactured by Terice.
- D. Coil Siphon: Brass, 1/4", male pipe thread each end. 885 series.

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#### 2.4 STEM TYPE THERMOMETERS

- A. Analog Thermometers: 9 inch scale, universal adjustable angle, organic spirits, lens front tube, cast aluminum case with blue/black metallic finish and clear Lexan window, extended brass stem, cast aluminum adjustable joint with positive locking device, 2 percent of scale accuracy to ASTM E77, scale calibrated in both degrees F and degrees C, range per schedule. BX9 series as manufactured by Terice or approved equal.

### PART 3 EXECUTION

#### 3.1 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Provide two pressure gauges per pump, installing taps before strainers and on suction and discharge of pump. Pipe to gauge with isolation valve to each tapping.
- C. Install thermometers in piping systems in sockets in short couplings Enlarge pipes smaller than 2-1/2 inch for installation of thermometer sockets. Select bulb length to reach centerline of pipe. Coat thermometer stem with conductive compound.
- D. Install thermometer sockets and flanges adjacent to controls system thermostat, transmitter, or sensors. Refer to Section 23 09 33.
- E. Provide instruments with scale ranges selected according to service with largest appropriate scale.
- F. Install gauges and thermometers in locations where they are easily read from normal operating level.

#### 3.2 PRESSURE GAUGE SCHEDULE

LOCATION	SCALE RANGE
Pumps less than 40' TDH	0 - 30 PSIG
Heating water system	0 - 30 PSIG
Others	As applicable

#### 3.3 THERMOMETER SCHEDULE

LOCATION	SCALE RANGE
Heating water system	0 - 200° F
Others	As applicable

**END OF SECTION 23 05 19**

## **SECTION 23 05 93 - TESTING, ADJUSTING, AND BALANCING FOR HVAC**

### **PART 1 GENERAL**

#### **1.1 WORK INCLUDED**

- A. Hydronic Systems:
  - 1. Constant Flow Systems.
  - 2. Primary-secondary Systems.

#### **1.2 SCOPE**

- A. Furnish the professional services of a qualified and approved balancing and testing firm to perform the work of this specification section.
- B. The work of this section includes but is not necessarily limited to:
  - 1. Testing and balancing existing hydronic heating and ventilation systems as indicated on drawings.
  - 2. Testing and balancing fans and air handling systems.
  - 3. Testing and balancing new liquid heat transfer systems.
  - 4. Working directly with the control subcontractor to obtain proper system adjustments.
  - 5. Domestic water distribution system adjustment.
- C. The work of this section does not include:
  - 1. Adjusting burners for proper combustion operation.
  - 2. Liquid waste transfer system adjustment.
  - 3. Fire protection systems.

#### **1.3 APPLICABLE CODES AND STANDARDS**

- A. SMACNA Manual for the Balancing and Adjustment of Air Distribution Systems.
- B. AMCA Publication 203, Field Performance Measurements.
- C. American Air Balancing Council (AABC) Recommended Procedures
- D. National Environmental Balancing Bureau (NEBB) Recommended Procedures

#### **1.4 QUALIFICATION OF THE BALANCING FIRM OR COMPANY**

- A. Subcontractor minimum qualifications include:
  - 1. Demonstrate satisfactory completion of five projects of similar scope in the State of Alaska during the past five years. Provide references if requested.
  - 2. NEBB Certified in Testing, Adjusting and Balancing of Air and Hydronic Systems.

#### **1.5 TIMING OF WORK**

- A. Do not begin balancing and testing until the systems, including controls, are completed and in full working order.
- B. Schedule the testing and balancing work in cooperation with other trades.
- C. Complete the testing and balancing at least one week before the date of substantial completion and before any occupancy occurs

#### **1.6 CONTRACTOR RESPONSIBILITY TO BALANCING AGENCY**

- A. Award the test and balance contract to an approved firm or company upon receipt of contract to allow the Balance and Testing Agency to schedule this work in cooperation with other trades involved and comply with completion date.
- B. Put all heating, ventilating and air conditioning systems, equipment and controls into full operation for the Balancing Agency and continue the operation of same during each working day of testing balancing.
- C. Provide scaffolding, ladders and access to each system for proper testing balancing.
- D. Ensure that the building enclosure is complete, including but not limited to, structural components, windows and doors installed, door hardware complete, ceilings complete, stair, elevator and mechanical shafts complete, roof systems complete, all plenums sealed, etc.
- E. Make any changes in pulleys, belts and dampers, or add any dampers as required for correct balance as recommended by the Balance and Testing Agency at no additional cost to the Owner.
- F. Complete installation, programming (including design parameters and graphics), calibration, and startup of all building control systems.
- G. Require that the building control system firm provide access to hardware and software, or onsite technical support required to assist the TAB effort. The hardware and software or the onsite technical support shall be provided at no cost to the TAB firm.

#### **1.7 REPORT**

- A. Certified Reports shall be included in project O & M manuals. Reports shall include: testing, adjusting, and balancing reports bearing the signature of the Test and Balance Agency Representative. The reports shall be certified proof that the systems have been tested, adjusted,

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and balanced in accordance with the referenced standards; are an accurate representation of how the systems have been installed; are a true representation of how the systems are operating at the completion of the testing, adjusting and balancing procedures; and are an accurate record of all final quantities measured, to establish normal operating values of the system. Follow the procedures and format specified below:

1. Draft Reports: Upon completion of testing, adjusting and balancing procedures, prepare draft reports on the approved forms. Draft reports may be hand written, but must be complete, factual, accurate, and legible. Organize and format draft reports in the same manner specified for the final reports.
2. Final Reports: Upon verification and approval of the draft report; prepare final reports, typewritten, organized and formatted as specified below.
3. Report Format: Report forms shall be those standard forms prepared by the referenced standard for each respective item and system to be tested, adjusted and balanced. Report shall be provided in electronic PDF Format. The data in the electronic file shall be arranged and indexed. Divide the contents into the below listed sections, with bookmarks for each section:
  - a. General Information and Summary.
  - b. Air Systems.
  - c. Hydronic Systems.
  - d. Temperature Control Systems.
  - e. Special Systems.
  - f. System Deficiency Reports and Corrective Actions.
4. Report Contents: Provide the following minimum information, forms and data:
  - a. General Information and Summary: Inside cover sheet to identify testing, adjusting, and balancing agency; contractor; owner, architect, engineer and project. Include addresses, contact names and telephone numbers. Also, include a certification sheet containing the name, address, telephone number and signature of the Certified Test and Balance Personnel. Include in this division a listing of the instrumentation used for the procedures along with the proof of calibration.
  - b. The remainder of the report shall contain the appropriate forms containing as a minimum, the information indicated on the standard report forms prepared by the AABC for each respective item and system. Prepare a schematic diagram for each item of equipment and system to accompany each respective report form.
  - c. Calibration Reports: Submit proof that all required instrumentation has been calibrated to tolerances specified in the referenced standards, within a period of six months prior to starting the project.

## **1.8 SUBMITTALS**

- A. Submit in accordance with Division 01.
- B. Submit balancing agency qualifications and sample balancing forms.
- C. Provide list of equipment to be used and date of last calibration.
- D. Submit preliminary balance report a minimum of one week prior to substantial completion inspection.

## **PART 2 PRODUCTS**

### **2.1 INSTRUMENTS**

- A. Maintain all instruments accurately calibrated and in good working order. Use instruments with the following minimum performance characteristics.
  - 1. Air Velocity Instruments: Direct reading in feet per minute, 2% accuracy.
  - 2. Static Pressure Instruments: Direct reading in inches' water gauge, 2% accuracy.
  - 3. RPM Instruments: Direct reading in revolutions per minute, .5% accuracy; or revolution counter accurate within 2 counts per 1,000.
  - 4. Pressure Readout: Direct reading in feet of water or PSI, .5% accuracy.
  - 5. Temperature Instruments - Direct reading in degrees F, +.5% accuracy.
  - 6. Water Flow Instruments: Differential pressure type; direct reading in feet of water or PSI, accuracy, suitable for readout balancing valve provided.
  - 7. Sound Measuring Instrument: Octave Band Analyzer which essentially complies to AASA Standards SI.6 1960 with a range of 24DB to 150 DB sound pressure level ref. .0002 microbar. Calibrate sound test instrument before use to a closed coupler and a driving loudspeaker that produces a know-sound pressure level at the microphone of the analyzer.

## **PART 3 EXECUTION**

### **3.1 GENERAL PROCEDURES FOR ALL SYSTEMS**

- A. Start with new, clean filters.
- B. In cooperation with the control manufacturer's representative, coordinate adjustments of automatically operated dampers and valves to operate as specified, indicated and/or noted.
- C. Use manufacturer's ratings on all equipment to make required calculations.
- D. Make final adjustments for each space per heating or cooling comfort requirement. State reason for variance from design CFM, i.e., "too noisy", "drafty", etc.

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- E. Mark equipment and balancing device settings (including damper-control positions, valve position indicators, fan-speed-controls, and similar controls and devices) with paint or other suitable permanent identification material to show final settings.

### **3.2 REQUIREMENTS FOR ALL AIR HANDLING SYSTEMS**

- A. Identify each diffuser, grille and register as to location and area.
- B. Identify and list size, type and manufacturer of diffusers, grilles, registers and all testing equipment.
- C. In readings and tests of diffusers, grilles and registers, include required FPM velocity and required CFM and test CFM after adjustments. If test apparatus is designed to read CFM directly, velocity reading may be omitted. Identify test apparatus used. Identify wide open (W.O.) runs.
- D. Check and record the following items:
  - 1. Air temperatures; mixed air, after coils, outside air, return air and supply air.
  - 2. Pressure drop at each coil, filter bank, etc.
  - 3. Operating suction and discharge pressure.
  - 4. Full nameplate data of all equipment.
  - 5. Rated and actual running amperage and voltage of all motors.
  - 6. Drive data including sheaves and belts and adjustments.
  - 7. Electrical overloads/heaters sizes and ranges of motors.

### **3.3 FLUID SYSTEM TESTING AND BALANCING**

- A. Preparation of system - Phase I:
  - 1. Complete air balance before beginning fluid balance.
  - 2. Clean all strainers.
  - 3. Examine fluid in system to determine if treated and clean.
  - 4. Check pump rotation.
  - 5. Verify expansion tanks are not air bound and system full of fluid.
  - 6. Verify all air vents at high points of fluid systems are installed properly and are operating freely. Make certain all air is removed from circuiting system.
  - 7. Open all valves to full flow position including coil and heater stop valves, close bypass valves and open return line balancing cocks. Set temperature controls so that automatic valves are open to full flow through apparatus.

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8. Check and set operating temperature of boilers and heat exchangers to design requirements when balancing by temperature drop.
9. Adjust all flows to 110% of design flows as shown.

### **B. Test and Balance Procedure - Phase II:**

1. Set pumps to proper GPM delivery and set proper GPM delivery in main piping runs from boiler room. Note flow variations for additive alternates.
2. Adjust flow of fluid through primary equipment.
3. Check leaving fluid temperatures and return fluid temperatures and pressure drop through major equipment. Reset to correct design temperatures.
4. Check fluid temperature at inlet side of coils and other heat transfer equipment. Note rise or drop of temperatures from source.
5. Balance each coil and all other heat transfer apparatus in system.
6. Upon completion of flow readings and adjustments, mark all settings and record all data.

### **C. Test and Balance Procedure - Phase III:**

1. After making adjustments to coils and apparatus, recheck settings at pumps and major equipment. Readjust if required.
2. Attach pressure gauges on each coil, then read pressure drop through coil at set flow rate on call for full flow through coil. Set pressure drop across bypass valve to match coil full flow pressure drop. This prevents unbalanced flow conditions when coils are on full bypass.
3. Check and record the following items with flows set at 100% of design.
  - a. Inlet and leaving fluid and air temperatures at coils and major equipment.
  - b. GPM flow of each coil and major equipment.
  - c. Pressure drop of each coil and major equipment.
  - d. Pressure drop across bypass valve.
  - e. Pump operating suction and discharge pressures and final total developed head.
  - f. Pump GPM.
  - g. Rated and actual running amperage and voltage of pump motor.
  - h. Full nameplate data of all pumps and equipment.
  - i. Electrical overloads/heaters sizes and ranges of motors.



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4. Permanently mark adjusted position of all balancing valves. Stamp indicator plate of circuit setters and other balancing valves without memory stop.

**END OF SECTION 23 05 93**

## **SECTION 23 07 00 - HVAC INSULATION**

### **PART 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- A. Piping Insulation.
- B. Ductwork Insulation.
- C. Jackets and Accessories.

#### **1.2 RELATED WORK**

- A. Division 09 – Painting.
- B. Section 23 05 00 – Common Work Results for HVAC Systems.
- C. Section 23 05 16 – Expansion Fittings and Loops for HVAC Piping.
- D. Section 23 05 19 – Meters and Gages for HVAC Piping.
- E. Section 23 21 13 – Hydronic Piping.
- F. Section 23 21 16 – Hydronic Specialties.
- G. Section 23 31 00 – HVAC Ducts and Casings.
- H. Section 23 33 00 – Air Duct Accessories.
- I. Section 23 82 00 – Convection Heating and Cooling Units.

#### **1.3 REFERENCES**

- A. ASTM B209 - Aluminum and Aluminum-alloy Sheet and Plate.
- B. ASTM C195 - Mineral Fiber Thermal Insulating Cement.
- C. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
- D. ANSI/ASTM C547 - Mineral Fiber Pipe Insulation (Preformed).
- E. ANSI/ASTM C552 - Cellular Glass Thermal Insulation.
- F. ANSI/ASTM C553 - Mineral Fiber Blanket Insulation.
- G. ASTM C585 - Standard Practice for Inner and Outer Diameters of Rigid Thermal Insulation for Nominal Sizes of Pipe and Tubing (NPS System).
- H. ASTM C612 - Mineral Fiber Block and Board Thermal Insulation.
- I. ASTM C449 - Mineral Fiber Hydraulic-setting Thermal Insulating and Finishing Cement.

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- J. ASTM C1071 - Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material).
- K. ASTM C1136 - Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation.
- L. ASTM C1427 - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
- M. ASTM D1000 - Standard Test Methods for Pressure-Sensitive Adhesive-Coated Tapes Used for Electrical and Electronic Applications.
- N. ASTM E84 - Surface Burning Characteristics of Building Materials.
- O. NFPA 255 - Surface Burning Characteristics of Building Materials.
- P. UL 723 - Surface Burning Characteristics of Building Materials.

### **1.4 SUBMITTALS**

- A. Submit product data under provisions of Division 01.
- B. Include product description, thickness for each service, and locations.
- C. Submit manufacturer's installation instructions.

### **1.5 QUALITY ASSURANCE**

- A. Applicator: Company specializing in piping insulation application with three years minimum experience.
- B. Pipe insulation manufactured in accordance with ASTM C585 for inner and outer diameters.
- C. Materials: Flame spread/smoke developed rating of 25/50 in accordance with UL 723, ASTM E84, or NFPA 255.
- D. Factory fabricated fitting covers manufactured in accordance with ASTM C450.

### **1.6 DELIVERY, STORAGE, AND HANDLING**

- A. Division 01 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.
- C. Shipment of materials from manufacturer to installation location shall be in weather tight transportation.
- D. Protect from weather and construction traffic, dirt, water, chemical, and damage, by storing in original packaging.

### **1.7 ENVIRONMENTAL REQUIREMENTS**

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- A. Maintain ambient temperatures and conditions required by manufacturers of adhesive, mastics, and insulation cements.

### **1.8 FIELD MEASUREMENTS**

- A. Verify field measurements prior to fabrication.

### **1.9 WARRANTY**

- A. Division 01- Execution and Closeout Requirements: Product warranties and product bonds.

## **PART 2 PRODUCTS**

### **2.1 ACCEPTABLE MANUFACTURERS**

- A. Armacell.
- B. Certain-Teed.
- C. IMCOA.
- D. Johns Manville.
- E. Knauf.
- F. Owens-Corning.
- A. Manson.
- B. Nomaco.
- C. Pittsburgh - Corning.
- D. K-Flex USA.
- E. Armstrong.
- F. Substitutions: Under provisions of Division 01.

### **2.2 INSULATION - PIPING**

- A. Type A: Glass fiber, rigid, molded, non-combustible insulation; ANSI/ASTM C547; 'k' value of 0.23 at 75° F, rated from 0° F to 850° F, vapor retarder jacket of Kraft paper bonded to aluminum foil, self-sealing lap and butt strips; Johns Manville "Micro-Lok" or approved equal.
- B. Type B: Cellular glass; ANSI/ASTM C552; 'k' value of 0.29 at 75° F; 7.3 lbs./cu. ft. density; Pittsburgh Corning "Foamglass ONE" or approved equal.
- C. Type C: Expanded polystyrene; ANSI/ASTM C578; rigid closed cell; maximum water vapor transmission rating of 0.1 perms; 'k' value of 0.23 at 75° F.
- D. Type D: Flexible unicellular polyolefin; ASTM C1427; 'k' value of 0.25 at 75° F ASTM C518; moisture vapor transmission of zero perm-inch ASTM E96; rated to 210° F; IMCOA "Imcolock" or approved equal.

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- E. Type E: Elastomeric foam; EPDM-based closed-cell flexible foam, ASTM C534; flexible cellular elastomeric in sheet or pre-formed tube, 'k' value of 0.26 at 75° F, max. service temp - 300° F, ASTM C534; max. flame spread = 50, max. smoke developed = 50, ASTM E84; UV-resistant coating/jacketing if exposed to sunlight; K-FLEX USA "Insul-Tube", "Insul-Sheet", or approved equal.

### **2.3 FIELD APPLIED PIPING JACKET**

- A. Vapor Barrier Jackets: Kraft reinforced foil vapor barrier with self-sealing adhesive joints.
- B. PVC Jackets and solvent welding adhesive: One piece, pre-molded type, Johns Manville "Zeston 2000", fitting covers and jacketing material. Johns Manville "Perma-Weld" solvent welding adhesive.
- C. Aluminum Jackets: ASTM B209; 0.016 inch thick; corrugated or textured finish, longitudinal slip joints.
- D. Stainless Steel Jackets: Type 304 stainless steel; 0.010 inch thick; corrugated finish.
- E. Re-Wettable Canvas Jacketing: , Fiberglass cloth made from texturized yarns, impregnated throughout with an inorganic fire retardant asbestos free adhesive; 20x14 thread count, 14.5 oz./sq.yd, 0.04 inch thickness, 1,000° F upper temperature limit; GLT Products "Style 1989" or approved equal.

### **2.4 INSULATION - DUCTWORK**

- A. Type K: Exterior FSK Duct Wrap: Flexible glass fiber; ASTM C553; commercial grade; 'k' value of 0.27 at 75° F, 0.6 lb./cu. ft. density. 0.00035 inch vinyl scrim facing with 2" stapling tab. Johns Manville "Microlite Standard Duct Wrap" or equal.
- B. Type L: Exterior FSK Rigid Fiber Board Duct Insulation; ASTM C612, 'k' value of 0.23 at 75° F, 3.0 lb./cu. ft. density. 0.00035 inch foil scrim facing. Johns Manville "814 Spin-Glas" or equal.
- C. Type M: Duct Liner: Rigid Fiber Board; ASTM C1071; 'k' value of 0.23 at 75° F; coated air side for maximum 6,000 ft./min. air velocity, UL listed adhesive galvanized steel pins. Johns Manville "Permacote Linacoustic R-300" or approved equal.

### **2.5 FIELD APPLIED EQUIPMENT AND DUCTWORK JACKETS**

- A. Aluminum Jackets: ASTM B209; 0.016 inch thick; corrugated or textured finish, longitudinal slip joints.
- B. Stainless Steel Jackets: Type 304 stainless steel; 0.010 inch thick; corrugated finish.
- C. Re-Wettable Canvas Jacketing: , Fiberglass cloth made from texturized yarns, impregnated throughout with an inorganic fire retardant asbestos free adhesive; 20x14 thread count, 14.5 oz./sq.yd, 0.04 inch thickness, 1,000° F upper temperature limit; GLT Products "Style 1989" or approved equal.

### **2.6 INSULATION ACCESSORIES**

- A. Adhesives: Waterproof and fire-retardant type.
- B. Lagging Adhesive: Fire resistive to NFPA 255.
- C. Impale Anchors: Galvanized steel, 12 gauge, self-adhesive pad.

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- D. Joint Tape: Glass fiber cloth, open mesh.
- E. FSK Joint Tape; ASTM C1136 Foil-Scrim-Kraft (FSK) lamination coated with solvent acrylic pressure sensitive adhesive; capable of adhering to fibrous and sheet metal surfaces; tri-directionally reinforced 2x3 squares per inch fiberglass scrim; 9.5 mils thick, -40 to 240° F service temperatures; Venture Tape "1525CW" or approved equal.
- F. Tie Wire: Annealed steel, 16 gauge.
- G. Insulated pipe supports: Calcium silicate with galvanized steel jacket (min. 24 gauge); ANSI/ASTM C533; rigid white; 'k' value of 0.37 at 100° F, rated to 1,200° F; Thermal Pipe Shields "T-1000 Calsil" or equal.

### PART 3 EXECUTION

#### 3.1 PREPARATION

- A. Install materials after piping, equipment and ductwork has been tested and approved.
- B. Clean surfaces for adhesives.
- C. Prepare surfaces in accordance with manufacturer's recommendations.

#### 3.2 INSTALLATION – PIPING INSULATION

- A. Install materials in accordance with manufacturer's recommendations, building codes and industry standards.
- B. Continue insulation vapor barrier through penetrations except where prohibited by code.
- C. Locate insulation and cover seams in least visible locations.
- D. Neatly finish insulation at supports, protrusions, and interruptions.
- E. Provide insulated cold pipes conveying fluids below ambient temperature with vapor retardant jackets with self-sealing laps. Insulate complete system, including under fitting jackets.
- F. For insulated pipes conveying fluids above ambient temperature, secure jackets with self-sealing lap or outward clinched, expanded staples. Bevel and seal ends of insulation at equipment, flanges, and unions. Insulate complete system, including under fitting jackets.
- G. Provide insulated piping supports on piping 1-½" inch or larger. Insulated piping supports shall not be less than the following lengths:

1-½" to 2-½" pipe size	10" long
3" to 6" pipe size	12" long
- H. Fully insulate all piping including all spaces under jacketing.
- I. Jackets:
  - 1. Indoor, Concealed Applications: Insulated pipes shall have vapor barrier jackets, factory-applied. Vapor barrier PVC fittings may also be used provided joints are sealed with solvent welding adhesive approved by the jacket manufacturer.

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2. For pipe exposed in mechanical equipment rooms or in finished spaces below 10 feet above finished floor, finish with PVC jacket and fitting covers or metal jacket.

**3.3 SCHEDULE – PIPING**

PIPING	TYPE	PIPE SIZE	MINIMUM INSULATION THICKNESS
Heating Glycol/Water Supply and Return	A, E	1-1/4" and Smaller	1"
Heating Glycol/Water Supply and Return	A, E	1-1/2" and Larger	1"
Boiler Feed Water	A	All Sizes	1"

**3.4 INSTALLATION – DUCTWORK INSULATION**

- A. Install materials in accordance with manufacturer's instructions.
- B. Provide insulation with vapor barrier when air conveyed may be below ambient temperature. Continue insulation with vapor barrier through penetration.
- C. Fiberglass Duct Liner (Type L) Application:
  1. Adhere insulation with approved adhesive for 100 percent coverage. Secure insulation with mechanical fasteners on 15 inch centers maximum on top and side of ductwork with dimension exceeding 20 inches. Butt joints together tightly then seal and smooth. Thoroughly coat ends of liner with adhesive. Do not use nail-type fasteners. Seal vapor barrier penetrations by mechanical fasteners with vapor barrier adhesive.
  2. Ductwork dimensions indicated are net inside dimensions required for air flow. Increase ductwork to allow for insulation thickness.
  3. Install liner as indicated on plans.
- D. Where canvas jacketing is indicated, apply mastic in sufficient thickness to completely cover the texture of the canvas material.

**3.5 SCHEDULE - DUCTWORK**

DUCTWORK	TYPE	INSULATION THICKNESS	FINISH
Exhaust & Relief Ducts Within 10 ft. of Exterior Openings	J,K	1" Rigid	CANVAS
Outside Air Intake Ducts	K	2" Rigid	CANVAS

**END OF SECTION 23 07 00**

## **SECTION 23 09 00 - INSTRUMENTATION AND CONTROL FOR HVAC**

### **PART 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- A. Electric Control System.

#### **1.2 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION**

- A. Section 23 21 13 – Hydronic Piping: Installation of Thermometer Wells, Pressure Gauge Tappings.

#### **1.3 RELATED SECTIONS**

- A. Section 23 05 00 – Common Work Results for HVAC.
- B. Section 23 05 93 – Testing, Adjusting and Balancing for HVAC.
- C. Section 23 21 13 – Hydronic Piping.
- D. Section 23 21 16 – Hydronic Specialties.
- E. Section 23 33 00 – Air Duct Accessories.
- F. Division 26 – Electrical Specifications.

#### **1.4 REFERENCES**

- A. Air Movement and Control Association International, Inc.:
  - 1. AMCA 500 - Test Methods for Louvers, Dampers, and Shutters.

#### **1.5 SUBMITTALS**

- A. Submit shop drawings under provisions of Division 01.
- B. Submit product data under provisions of Division 01.
- C. Product Data: Include list which indicates use, operating range, total range and location for manufactured components.
- D. Schematic control diagrams. Clearly indicate wiring diagrams and terminal labels, set points, and other hardware interface required to completely describe the system. Depict circuitry on schematic control diagrams to allow circuits to be traced from connection to connection.
- E. Sequence of operations. Print sequence of operations on the schematic control diagrams so that the relevant sequence is on the same diagram with the control schematic it describes.
- F. Submit manufacturer's installation instructions under provisions of 230500 and Division 01.

#### **1.6 PROJECT RECORD DOCUMENTS**

- A. Submit the following under provisions of 230500 and Division 01.



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- B. Operation and maintenance manuals for control system including actual locations of instrumentation control devices and asbuilt schematic control diagrams.

### **1.7 ENVIRONMENTAL REQUIREMENTS**

- A. Do not install instrumentation when areas are under construction, except for required rough-in, taps, supports and test plugs.

### **1.8 SYSTEMS DEMONSTRATION**

- A. The Contractor will completely check out, calibrate and test all connected hardware to insure that the system performs in accordance with the approved specifications and sequences of operation.
- B. Provide complete demonstration of system operation to the owners representative at the project substantial completion inspection. The Contractor will demonstrate to the Owner's satisfaction that all equipment and systems operate in accordance with the sequence of operation.

### **1.9 WARRANTY**

- A. Under provisions of Division 01 Standard General Provisions.
- B. All components, system software, parts and assemblies will be guaranteed against defects in materials and workmanship for one year from acceptance date.
- C. Labor to troubleshoot, repair or replace system components will be furnished by the Contractor at no charge to the owner during the warranty period.

## **PART 2 PRODUCTS**

### **2.1 ACCEPTABLE MANUFACTURERS - INSTRUMENTATION**

- A. Terice.
- B. Weiss.
- C. Dwyer.
- D. Substitutions: Under provisions of Section Division 01.

### **2.2 PRESSURE GAUGES**

- A. 4-1/2inch diameter cast aluminum case, phosphor bronze bourbon tube, rotary bronze movement, brass socket, with silicone fluid dampening black figures on white background, one percent mid-scale accuracy, scale calibrated in psi. Model 600C as manufactured by Terice.

### **2.3 PRESSURE GAUGE TAPS**

- A. Gauge Isolation Valve: Lever handle ball valve, forged brass body, chrome plated brass ball, viton o-rings for maximum 150 psig. Model Mini T-82-M as manufactured by Jomar.

### **2.4 THERMOMETER SUPPORTS**

- A. Socket: Brass separable sockets for thermometer stems with or without extensions as required, and with cap and chain.

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- B. Flange: 3 inch outside diameter reversible flange, designed to fasten to sheet metal air ducts, with brass perforated stem.

### **2.5 TEST PLUGS**

- A. Test Plug: 1/4 inch or 1/2 inch brass fitting and cap for receiving 1/8 inch outside diameter pressure or temperature probe with Nordel or Viton core for temperatures up to 350 degrees F.

### **2.6 ACCEPTABLE MANUFACTURERS – THERMOSTATS AND CONTROL VALVES**

- A. Honeywell.
- B. Siemens.
- C. Johnson.
- D. Belimo.
- E. Substitutions: Under provisions of Section Division 01.

### **2.7 LOW VOLTAGE THERMOSTATS**

- A. Digital 24 vac voltage thermostat: 7 day programming, digital display, menu-drive, precise temperature control (+/-1 degree F), battery backup, 40 F to 85 F set point range, hardwired power.

### **2.8 LINE VOLTAGE THERMOSTATS**

- A. Line voltage thermostat compatible with unit heaters and cabinet unit heaters.

### **2.9 CONTROL RELAYS**

- A. General: Provide relays rated for current and voltage requirements of controlled equipment.
- B. Field Mounted Relays:
- C. Solid state packaged relay including relay, LED indicator, provisions for mounting, transient protection and housing.
- D. Provide with a Hand-Off-Auto switch.
- E. Provide internal separation between class 1 and class 2 wiring including separate wire ways or nipples.
- F. UL listed.

### **2.10 COUNTDOWN WALL TIMERS**

- A. In wall, auto shut-off timer with ranges from 30 minutes to 4 hours with hold feature.
- B. Provide with DC transformer or low voltage relays as required for controls interface. Coordinate with requirements of sequences of operation for manual enable function. Intermatic FF34HH or approved equal.

### **2.11 DAMPER AND VALVE ACTUATORS**

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- A. Provide spring return to normal position type.
- B. Two Position Electric Actuator. Direct mounting actuator to open or close depending on contact closure state. Belimo or equal.

### **2.12 EMERGENCY BOILER SHUT OFF**

- A. Momentary contact pushbutton with 60 mm diameter red mushroom head, mounted on stainless steel 1-gang plate in recessed box. Mount a red engraved nameplate with white letters that reads "Boiler Emergency Stop" on faceplate or wall above button. Provide NO or NC contact blocks as required to perform the specified sequence of operation..
- B. Kele ST120, Safety Technology International SS2 2201PO-EN or approved equal.

### **2.13 WIRING AND RACEWAYS**

- A. Provide wiring and raceway complying with the National Electrical Code, Division 26 05 33, and State and Local Codes and Ordinances, with the following exception:
- B. The minimum size of conduit shall be 1/2". This shall apply to conduit and cabling operating at voltages less than 48V

## **PART 3 EXECUTION**

### **3.1 INSTALLATION**

- A. Provide control system to accomplish the sequence of operations. Provide all controllers, temperature sensors, thermostats, control valves, control dampers, electric actuators, transformers, wiring and associated components. Test all systems, verify all systems operate as specified in sequence of operations, and record initial settings and operating setpoints in O&M manuals.
- B. Work must comply with industry standards except when more restrictive tolerances or specified requirements indicate more rigid standards. Perform work by persons qualified to produce workmanship of specified quality. If required by the State of Alaska workers shall be licensed. If requested provide copy of license.
- C. Schematics and diagrams show approximate functional relationships and sequences only. All required devices are not shown. Contractor is responsible for providing all components required for a complete functioning system selected to meet the specific functional requirements of each application and the sequences of operations.
- D. Do not install control devices in locations where they are subject to damage or malfunction due to normally encountered ambient temperatures.
- E. Provide dust proof protective guards for all control components installed in vehicle or sand storage bays below 10' AFF.
- F. Provide electric power to control devices from transformer power circuit or from device or equipment being controlled
- G. Mount damper operators and other control devices secured to insulated ductwork on brackets such that the device is external of the insulation.
- H. Install in accordance with manufacturer's instructions.

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- I. Provide proper grounding of all control wiring.

### **3.2 IDENTIFICATION**

- A. All controllers, transmitters, switches, thermostats, gauges, and devices with adjustable setpoints shall be permanently tagged for identification.
- B. The tagging scheme shall be reflected on the control drawings. Also, include plain language label.

### **3.3 POWER AND INTERFACE CONNECTIONS**

- A. Coordinate fully with other Divisions of this specification to provide all necessary power connections and interface connections for a complete and fully operable control system.
- B. Electric wiring and wiring connection required for the installation of the control system as herein specified shall be provided by the Controls Contractor.
- C. Line voltage wiring shall be installed in raceways. .
- D. Low voltage wiring shall be physically protected and installed in raceways.
- E. All wiring shall comply with the requirements of local and national electrical codes and with Division 26.
- F. All wiring and conduit shall be installed by qualified personnel with electrical certificate of fitness.

### **3.4 INSTRUCTION AND ADJUSTMENT**

- A. Upon completion of the project, the controls contractor shall adjust and validate all thermostats, controllers, damper operators, relays, etc. provided under this section, or where sequence is listed, he shall validate and calibrate controls provided by others.
- B. Instruction manuals shall be provided by the controls contractor and approved by the Engineer. Such manuals shall cover the function and operation of the control system on the project for use by the Owner's operating personnel. Such manuals shall be used in conjunction with two (2) hours of on-site instruction to familiarize operating personnel with the control system. The required instruction shall consist of a "classroom" period and a "field" period.
  1. The classroom portion shall cover:
    - a. Preventive maintenance procedures.
    - b. A brief description of the controls' sequence of operation.
    - c. A discussion and explanation of all alarms, switches, and gauges.
    - d. A summary and brief explanation of steps to be taken for specific alarm or control malfunctions.
  2. The field portion shall consist of a building walk- through to physically locate and examine all control devices, and demonstrations on control setpoint adjustment procedures. Adjusting procedures should emphasize methods for continual building "fine-tuning." Also, demonstrate all controls sequences to the Owner and Engineer on final acceptance.

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- C. The controls contractor shall provide a complete controls maintenance section for inclusion in the mechanical maintenance manuals. This shall include as-built control diagrams, Sequence of Operation, control parts list, equipment data sheets, preventive maintenance requirements and schedules, and the above-mentioned instruction manual.
- D. At the instruction period, a one (1) year "In Warranty" maintenance agreement shall be presented to Owner's Representative.

**3.5 WARRANTY**

- A. Upon completion of the project, as defined either by acceptance of the building by the Owner or use of the equipment by the Owner for its intended purposes - whichever occurs first, a warranty period of one (1) year shall commence. The warranty shall consist of a commitment by the controls contractor to provide, at no cost to the Owner, parts and labor as required to repair or replace such parts of the control system that prove inoperative due to defective materials or installation practices. This warranty expressly excludes routine service, such as instrument calibration.

**END OF SECTION 23 09 00**

## **SECTION 23 11 23 – FACILITY NATURAL-GAS PIPING**

### **PART 1 GENERAL**

#### **1.1 WORK INCLUDED**

- A. Pipe and pipe fittings.
- B. Valves.

#### **1.2 RELATED WORK**

- A. Section 23 05 00 - Common Work Results for HVAC
- B. Section 23 05 16 - Expansion Fittings and Loops for HVAC Piping.
- C. Section 23 05 19 – Meters and Gages for HVAC Piping.

#### **1.3 QUALITY ASSURANCE**

- A. Valves: Manufacturer's name and pressure rating marked on valve body.

#### **1.4 SUBMITTALS**

- A. Submit product data under provisions of Division 01.
- B. Include data on pipe materials, pipe fittings, valves and accessories.

#### **1.5 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver products to site under provisions of Division 01.
- B. Store and protect products under provisions of Division 01.
- C. Deliver and store valves in shipping containers with labeling in place.

### **PART 2 PRODUCTS**

#### **2.1 NATURAL GAS PIPING, ABOVE GRADE**

- A. Piping: Steel Pipe ASTM A53, Schedule 40 black. Fittings: ASME B16.3, malleable iron, or ASTM A234/A234M, forged steel welding type.
- B. Joints:
  - 1. Low pressure, 2" and under: Screwed or Viega MegaPressG Cold Press Mechanical Joint. Press fittings are acceptable to last tee for connection to the appliance. Utilize threaded piping at the last tee.
  - 2. Medium pressure or larger than 2": ANSI/AWS D1.1, welded.

#### **2.2 FLANGES, UNIONS, AND COUPLINGS**

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- A. Pipe Size 2 Inches and Under: 150 psig malleable iron unions for threaded ferrous piping; bronze unions for copper pipe, soldered joints.
- B. Pipe Size Over 2 Inches: 150 psig forged steel slip-on flanges for ferrous piping; bronze flanges for copper piping: 1/16 inch thick preformed neoprene bonded to fiber.
- C. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

### **2.3 ACCEPTABLE MANUFACTURERS – GAS COCKS AND BALL VALVES**

- A. Apollo.
- B. Hammond.
- C. Milwaukee.
- D. Nibco.
- E. Substitutions: Under provisions of Division 01

### **2.4 GAS COCKS**

- A. Up to 2 Inches: Bronze body, bronze tapered plug. non-lubricated, Teflon packing, threaded ends.
- B. Over 2 Inches: Cast iron body and plug, non- lubricated, Teflon packing, flanged ends.

### **2.5 BALL VALVES**

- A. Up to 2 Inches: Bronze two piece body, full port, forged brass, chrome plated ball, Teflon seats and stuffing box ring, lever handle, solder, threaded or press-fit ends.
- B. Over 2 Inches: Cast steel, two piece body, full port chrome plated steel ball, Teflon seat and stuffing box seals, lever handle, flanged, solder, threaded or press-fit ends.

## **PART 3 EXECUTION**

### **3.1 PREPARATION**

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- B. Remove scale and dirt, on inside and outside, before assembly.
- C. Prepare piping connections to equipment with flanges or unions.
- D. Verify that excavations are to required grade, dry, and not over excavated.

### **3.2 INSTALLATION**

- A. Install in accordance with manufacturer's instructions.
- B. Provide non-conducting dielectric connections wherever jointing dissimilar metals.
- C. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

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- D. Install piping to maintain headroom to conserve building space and not interfere with use of space.
- E. Group piping whenever practical at common elevations.
- F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- G. Provide clearance for installation of insulation and access to valves and fittings.
- H. Provide access where valves and fittings are not exposed. Coordinate size and location of access doors.
- I. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.
- J. Install valves with stems upright or horizontal, not inverted.

### **3.3 APPLICATION**

- A. Install unions downstream of valves and at equipment or apparatus connections.
- B. Install ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.

### **3.4 TESTING**

- A. Test all piping in accordance with IFGC and UPC requirements. The test pressure used shall be no less than 10 times the proposed maximum working pressure, but not less than 10 psig for low pressure gas systems (7 inch WC) or 60 psig for medium pressures gas systems (2 psig or 5 psig). All welded pipe shall be tested with not less than 60 psig test pressures.

**END OF SECTION 23 11 23**



## **SECTION 23 21 13 - HYDRONIC PIPING**

### **PART 1 GENERAL**

#### **1.1 WORK INCLUDED**

- A. Pipe and Pipe Fittings.
- B. Valves.
- C. Heating Water Piping System.

#### **1.2 RELATED WORK**

- A. Section 23 05 00 - Common Work Results for HVAC.
- B. Section 23 05 16 - Expansion Fittings and Loops for HVAC Piping.
- C. Section 23 05 19 – Meters and Gages for HVAC Piping.
- D. Section 23 07 00 - HVAC Insulation.
- E. Section 23 21 16 - Hydronic Piping Specialties.
- F. Section 23 21 23 - Hydronic Pumps.
- G. Section 23 52 16 - Condensing Boilers.

#### **1.3 REGULATORY REQUIREMENTS**

- A. Conform to ANSI/ASME B31.9.

#### **1.4 QUALITY ASSURANCE**

- A. Valves: Manufacturer's name and pressure rating marked on valve body.

#### **1.5 SUBMITTALS**

- A. Submit product data under provisions of Division 01.

#### **1.6 WARRANTY**

- A. Polypropylene pipe and fittings shall be covered by a factory warranty for 30 years to be free of defects in materials or manufacturing.

#### **1.7 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver products to site under provisions of Division 01.
- B. Store and protect products under provisions of Division 01.
- C. Deliver and store valves in shipping containers with labeling in place.

### **PART 2 PRODUCTS**

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#### **2.1 HEATING WATER PIPING, ABOVE GROUND**

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A. Copper Tubing: ASTM B88, Type L, hard drawn.

1. Fittings: ANSI/ASME B16.18 Cast Copper Alloy Solder Joint Pressure Fittings or ANSI/ASME B16.22 Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
2. Joints: ASTM B32, solder, Grade 95TA or ANSI/AWS A5.8, BCuP silver braze; Flux: ASTM B813.
3. Press Fittings: Viega ProPress Fittings are allowed. Sealing elements for press fittings shall be EPDM. Sealing elements shall be factory installed or an alternative supplied by fitting manufacturer. Press end shall have Smart Connect feature design leakage path. Smart Connect™ (SC Feature) In ProPress ½" to 4" dimensions the Smart Connect Feature assures leakage of liquids and/or gases from inside the system past the sealing element of an un-pressed connection. The function of this feature is to provide the installer quick and easy identification of connections which have not been pressed prior to putting the system into operation.

B. Polypropylene Pipe:

1. Polypropylene (PP-RCT) piping in SDR 7.3 (Piping ¾" and less) SDR 11 (Piping 1" and larger in accordance with ASTM F2389.
2. Pipe and fittings shall be manufactured from a beta crystalline PP-RCT resin meeting the short-term properties and long-term strength requirements of ASTM F 2389 and CSA B137.11. The piping shall be extruded with a middle layer that has glass fiber content to restrict thermal expansion.
3. Fittings shall be manufactured from a PP-RCT resin meeting the short-term properties and long-term strength requirements of ASTM F 2389. All fittings shall comply with NSF 14, ASTM F 2389 and CSA B137.11. Fittings may be either socket fusion through nominal 5 inch, electrofusion through 8 inch or butt fusion in nominal 2 inch through 24 inch sizes. Electrofusion may also be performed in nominal sizes 10 inch through 24 inch by means of the use of electrofusion couplings as applied on butt fusion fittings and pipe.

C. PEX Tubing (allowed for inslab radiant floor application only): Tubing shall be cross-linked high-density polyethylene. Tubing shall be produced using silane method of cross-linking and shall meet the dimension and performance specifications of ASTM F876/F877 and CSA B137.5. Tubing shall also comply with ANSI/NSF 61 as suitable for use with potable water. Temperature and pressure ratings shall be 160 psi at 73 degrees F, 100 psi at 180 degrees F, and 80 psi at 200 degrees F.

D. Grooved piping systems are not allowed.

#### **2.2 EQUIPMENT DRAINS AND OVERFLOWS**

A. Steel Pipe: ASTM A53, Schedule 40 galvanized.

1. Fittings: Galvanized cast iron, or ANSI/ASTM B16.3 malleable iron.
2. Joints: Screwed, or grooved mechanical couplings.

B. Copper Tubing: ASTM B88, Type L, hard drawn.

1. Fittings: ANSI/ASME B16.18 cast bronze, or ANSI/ASME B16.29 solder wrought copper.

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2. Joints: ASTM B32, solder, Grade 95TA or ANSI/AWS A5.8, BCuP silver braze; Flux: ASTM B813.
- C. PVC Pipe: ASTM D1785, Schedule 40, and Schedule 80 for sizes 8 inch and larger, or ASTM D2241, SDR 21 or 26.
  1. Fittings: ASTM D2466 or D2467, PVC.
  2. Joints: ASTM D2855, solvent weld.

### **2.3 FLANGES, UNIONS, AND COUPLINGS**

- A. Pipe Size 2 Inches and Under: 150 psig malleable iron unions for threaded ferrous piping; bronze unions for copper pipe, soldered joints.

### **2.4 GATE VALVES**

- A. Gate valves will not be permitted. Use ball or butterfly valves for isolation.

### **2.5 GLOBE VALVES**

- A. Globe valves will not be permitted. Use ball or butterfly valves for throttling.

### **2.6 ACCEPTABLE MANUFACTURERS - ALL VALVE TYPES**

- A. Apollo.
- B. Crane.
- C. FNW.
- D. Hammond.
- E. Milwaukee.
- F. NIBCO.
- G. Red-White Valve Corp.
- H. Substitutions: Under provisions of Division 01.

### **2.7 BALL VALVES**

- A. Up to 2 Inches: 600 PSI CWP Bronze two piece body, full port, forged brass, chrome plated ball, Teflon seats and stuffing box ring, lever handle, solder or threaded ends. Seat material to be compatible with fluid handled.

### **2.8 PLUG COCKS**

- A. Up to 2 Inches: Bronze body, bronze tapered plug, non-lubricated, Teflon packing, threaded ends, with one wrench operator for every ten plug cocks.

### **2.9 SWING CHECK VALVES**

- A. Up to 2 Inches: Bronze 45° swing disc, solder ends.

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- B. Over 2 Inches: Iron body, bronze trim, 45° swing disc, renewable disc and seat, flanged ends.

### **2.10 SPRING LOADED CHECK VALVES**

- A. Iron body, bronze trim, stainless steel spring, renewable composition disc, screwed, wafer or flanged ends.

### **2.11 RELIEF VALVES**

- A. Bronze body, Teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, capacities ASME certified and labeled.

### **2.12 HYDRONIC SYSTEM CLEANER**

- A. Acceptable Products:
  - 1. CH<sub>2</sub>O Boil Out Liquid
  - 2. Oatey Hercules Boiler and Heating System Cleaner.

## **PART 3 EXECUTION**

### **3.1 PREPARATION**

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- B. Remove scale and dirt on inside and outside before assembly.
- C. Prepare piping connections to equipment with flanges or unions.
- D. After completion, fill, clean, and treat systems.

### **3.2 INSTALLATION**

- A. Route piping in orderly manner, plumb and parallel to building structure, and maintain gradient.
- B. Install piping to conserve building space, and not interfere with use of space and other work.
- C. Group piping whenever practical at common elevations.
- D. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Refer to Section 23 05 16.
- E. Provide clearance for installation of insulation, and access to valves and fittings.
- F. Provide access where valves and fittings are not exposed.
- G. Slope piping and arrange systems to drain at low points. Use eccentric reducers to maintain top of pipe level.
- H. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.
- I. Prepare pipe, fittings, supports, and accessories for finish painting. Refer to Division 09.

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- J. Install valves with stems upright or horizontal, not inverted.
- K. Support all piping in accordance with International Mechanical Code and Manufacturer installation instructions. Where there is a conflict between requirements of the Mechanical Code and Manufacturer installation instructions, the more restrictive requirement shall apply.
- L. Polypropylene piping shall not be installed in any locations used as a return air plenums.

### **3.3 APPLICATION**

- A. Use grooved mechanical couplings and fasteners only in accessible locations.
- B. Install unions downstream of valves and at equipment or apparatus connections.
- C. Install brass male adapters each side of valves in copper piped system. Sweat solder adapters to pipe.
- D. Install ball or butterfly valves for shut-off and to isolate equipment, part of systems, or vertical risers.
- E. Install ball or butterfly valves for throttling, bypass, or manual flow control services.
- F. Provide spring loaded check valves on discharge of condenser water pumps.
- G. Provide ¾ inch ball drain valves at main shut-off valves, low points of piping, bases of vertical risers, and at equipment. Pipe to nearest drain.

### **3.4 CLEANING OF THE HYDRONIC SYSTEM**

- A. Prior to starting work, verify system is complete. Thoroughly flush and drain the system. Clean all strainer baskets and start-up screens on pump suction diffusers. Re-install strainer baskets and start-up screens and refill system.
- B. Fill the hydronic piping systems with the system cleaner in accordance with cleaning compound directions for use.
- C. Boil out system for a minimum period of four (4) hours or as recommended by system cleaner, boiler, chiller start-up instructions at a system design operating temperature.
- D. Upon completion of boil out, completely flush system and drain all low points. Remove and clean and re-install all strainer baskets. Remove start-up screens on pump suction diffusers.
- E. Fill system with water or glycol as indicated on the plans. Feed water to system through make-up line with pressure regulator, venting system high points. Set to fill at 12 psig. Pressure system cold at 5 psig, adjust when hot to 12 psig. See Specification Section 23 21 16 for glycol fill procedures.
- F. Submit a written and signed statement to the Owner that the above referenced cleaning procedures have been completed.

### **3.5 TESTING**

- A. Test all heating water piping hydrostatically at 100 psig or 150 percent of working pressure, whichever is greater, for a period of 4 hours. Observe piping during this period and repair all leaks.

**END OF SECTION 23 21 13**

## **SECTION 23 21 16 - HYDRONIC SPECIALTIES**

### **PART 1 GENERAL**

#### **1.1 WORK INCLUDED**

- A. Expansion Tanks.
- B. Air Vents.
- C. Air Separators.
- D. Strainers.
- E. Balance Valves.
- F. Relief Valves.

#### **1.2 RELATED WORK**

- A. Section 23 05 00 - Common Work Results for HVAC.
- B. Section 23 21 23 - Hydronic Pumps.
- C. Section 23 52 16 - Condensing Boilers.

#### **1.3 REFERENCES**

- A. ANSI/ASME - Boilers and Pressure Vessels Code.

#### **1.4 REGULATORY REQUIREMENTS**

- A. Conform to ANSI/ASME Boilers and Pressure Vessels Code Section 8D for manufacture of tanks.

#### **1.5 QUALITY ASSURANCE**

- A. Manufacturer: For each product specified, provide components by same manufacturer throughout.

#### **1.6 SUBMITTALS**

- A. Submit product data under provisions of Division 01 and Section 23 05 00.

#### **1.7 OPERATION AND MAINTENANCE DATA**

- A. Submit operation and maintenance data under provisions of Division 01.
- B. Include installation instruction, assembly views, lubrication instructions, and replacement parts list.

#### **1.8 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver products to site under provisions of Division 01.
- B. Store and protect products under provisions of Division 01.

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#### **PART 2 PRODUCTS**

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##### **2.1 ACCEPTABLE MANUFACTURERS - DIAPHRAGM-TYPE COMPRESSION TANKS**

- A. Amtrol.
- B. Taco.
- C. Bell & Gossett.
- D. Substitutions: Under provisions of Division 01.

##### **2.2 DIAPHRAGM-TYPE COMPRESSION TANKS**

- A. Construction: Welded steel, tested and stamped in accordance with Section 8D of ANSI/ASME Code; supplied with National Board Form U-1, rated for working pressure of 125 psig, with flexible EPDM diaphragm sealed into tank, and steel legs or saddles.
- B. Accessories: Pressure gauge and air-charging fitting, tank drain; precharge to 12 psig.

##### **2.3 ACCEPTABLE MANUFACTURERS - AIR VENTS**

- A. Taco.
- B. Amtrol.
- C. Bell & Gossett.
- D. Substitutions: Under provisions of Division 01.

##### **2.4 AIR VENTS**

- A. Manual Type: Disk type vent with built-in check valve for manual or automatic operation, discs replaceable without draining system, 1/8 inch shank, rated at 50 psi; Hoffman No. 508 or equal.
- B. Float Type: Maintenance free solid brass construction, continuous air venting, 150 psig standard working pressure, 240° F maximum temperature, 1/2 inch male thread at vent point for pressure testing or remote venting, 1/2 or 3/4 inch female threaded connections. Provide with mini ball valve for isolation. Taco 409 , Spirotherm Spirotop VTP or approved equal.

##### **2.5 ACCEPTABLE MANUFACTURERS - AIR SEPARATORS**

- A. Spirotherm.
- B. Caleffi.
- C. Bell & Gossett.
- D. Taco.
- E. Substitutions: Under provisions of Division 01.

##### **2.6 AIR SEPARATORS**

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- A. Coalescing type combination air eliminator and dirt separator fabricated of steel, rated for 150 psig working pressure, stamped and registered in accordance with ASME Section VIII, Division 01 for unfired pressure vessels, and include two equal chambers above and below the inlet / outlet nozzles. Unit shall include internal elements filling the entire vessel to suppress turbulence and provide air elimination efficiency of 100% free air, 100% entrained air, and 99.6% dissolved air at the installed location. Dirt separation efficiency shall be a minimum of 80% of all particles 30 micron and larger within 100 passes. The elements must consist of a copper core tube with continuous wound copper wire medium permanently attached and followed by a separate continuous wound copper wire permanently affixed. Each unit shall have a separate venting chamber to prevent system contaminants from harming the float and venting valve operation. At the top of the venting chamber shall be an integral full port float actuated brass venting mechanism. Units shall include a valved side tap to flush floating dirt or liquids and for quick bleeding of large amounts of air during system fill or refill.
- B. Air Elimination Valve: Bronze, float operated, for 125 psig operating pressure.

### **2.7 ACCEPTABLE MANUFACTURERS - STRAINERS**

- A. Bell & Gossett.
- B. Taco.
- C. Armstrong.
- D. Substitutions: Under provisions of Division 01.

### **2.8 STRAINERS**

- A. Size 2 inch and Under: Screwed brass or iron body for 175 psig working pressure, Y pattern with 1/32 inch stainless steel perforated screen.
- B. Size 2-½ inch to 4 inch: Flanged iron body for 175 psig working pressure, Y pattern with 3/64 inch stainless steel perforated screen.

### **2.9 ACCEPTABLE MANUFACTURERS - BALANCE VALVES**

- A. Armstrong.
- B. Taco.
- C. Bell & Gossett.
- D. Substitutions: Under provisions of Division 01.

### **2.10 BALANCE VALVES**

- A. Angle or straight pattern, inside screw globe valve for 125 psig working pressure, with bronze body and integral union for screwed connections, renewable composition disc, plastic wheel handle for shut-off service, and lockshield key cap for balancing service.

### **2.11 ACCEPTABLE MANUFACTURERS - RELIEF VALVES**

- A. Watts.



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- B. Taco.
- C. Bell & Gossett.
- D. Substitutions: Under provisions of Division 01.

### **2.12 RELIEF VALVES**

- A. Bronze body, Teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, capacities ASME certified and labeled.

## **PART 3 EXECUTION**

### **3.1 INSTALLATION AND APPLICATION**

- A. Install specialties in accordance with manufacturer's instructions to permit intended performance.
- B. Support tanks inside building from building structure.
- C. Where large air quantities can accumulate, provide enlarged air collection standpipes.
- D. Provide manual air vents at system high points and as indicated.
- E. For automatic air vents, provide vent tubing to nearest drain or back to glycol tank if in mechanical room. Where a drain is not available run discharge to a 12"x12"x6" high galvanized, water tight pan located in an accessible location.
- F. Provide air separator on suction side of system circulation pump and connect to expansion tank.
- G. Provide valved drain and hose connection on strainer blow down connection.
- H. Provide shutoff valves on water inlet to terminal heating units such as radiation, unit heaters, and fan coil unit.
- I. Provide balancing valves on water outlet from terminal heating units.
- J. Provide relief valves on pressure tanks, low pressure side of reducing valves, and heat exchangers.
- K. Select system relief valve capacity so that it is greater than make-up pressure reducing valve capacity. Select equipment relief valve capacity to exceed rating of connected equipment.
- L. Pipe relief valve outlet to nearest floor drain.
- M. Where one line vents several relief valves, make cross sectional area equal to sum of individual vent areas.

### **3.2 AIR VENT APPLICATION SCHEDULE**

<b>Location</b>	<b>Type</b>
Terminal heating units, mains below	Manual
Terminal heating units, mains above	None

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Heating mains, at high points in system      Automatic

Combination air separator/strainers      High capacity

Note: For terminal heating units, mains above unit, install branch piping connections at bottom of mains or 45° from bottom to allow air migration to mains.

**END OF SECTION 23 21 16**

## **SECTION 23 21 23 – HYDRONIC PUMPS**

### **PART 1 GENERAL**

#### **1.1 WORK INCLUDED**

- A. In-line Circulators.

#### **1.2 RELATED WORK**

- A. Section 23 05 00 - Common Work Results for HVAC.
- B. Section 23 05 16 - Expansion Fittings and Loops for HVAC Piping.
- C. Section 23 05 19 – Meters and Gages for HVAC Piping.
- D. Section 23 21 13 - Hydronic Piping.
- E. Section 23 21 16 - Hydronic Piping Specialties.

#### **1.3 REFERENCES**

- A. ANSI/UL 778 - Motor Operated Water Pumps.

#### **1.4 QUALITY ASSURANCE**

- A. Manufacturer: Company specializing in manufacture, assembly, and field performance of pumps with minimum three years' experience.
- B. Alignment: Base mounted pumps shall be aligned by qualified millwright and alignment certified.

#### **1.5 SUBMITTALS**

- A. Submit product data under provisions of Division 01.
- B. Submit certified pump curves showing performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable.

#### **1.6 OPERATION AND MAINTENANCE DATA**

- A. Submit operation and maintenance data under provisions of Division 01.
- B. Include installation instructions, assembly views, lubrication instructions, and replacement parts list.

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#### **1.7 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver products to site under provisions of Division 01.
- B. Store and protect products under provisions of Division 01.

#### **1.8 EXTRA PARTS**

- A. Provide one extra set of mechanical seals for pumps.

### **PART 2 PRODUCTS**

#### **2.1 ACCEPTABLE MANUFACTURERS**

- A. Grundfos.
- B. Bell & Gossett.
- C. Taco.
- D. Armstrong.
- E. Substitutions: Under provisions of Division 01.

#### **2.2 IN-LINE CIRCULATORS**

- A. Type: Maintenance free, self-lubricated, 3 speed industrial/commercial single stage, direct drive circulator.
- B. Casing: Cast iron.
- C. Impeller: Type 304 stainless steel.
- D. Bearings: Upper and lower radial bearings to be aluminum oxide ceramic, tungsten carbide shaft bearing surfaces.
- E. Shaft: Stainless steel with type 430F.

### **PART 3 EXECUTION**

#### **3.1 INSTALLATION**

- A. Install pumps in accordance with manufacturer's instructions.
- B. Provide access space around pumps for service. Provide no less than minimum as recommended by manufacturer.
- C. Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.
- D. Decrease from line size with long radius reducing elbows or reducers.

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- E. Support piping adjacent to pump such that no weight is carried on pump casings. In-line pumps are supported by adjacent piping.

**END OF SECTION 23 21 23**

## **SECTION 23 31 00 - HVAC DUCTS AND CASINGS**

### **PART 1 GENERAL**

#### **1.1 SUMMARY**

A. Section Includes:

1. Duct Materials.
2. Ductwork Fabrication.

#### **1.2 RELATED SECTIONS**

- A. Division 03 - Cast-In-Place Concrete: Product requirements for concrete for placement by this section.
- B. Division 09 - Painting and Coating: Execution requirements for Weld priming, weather resistant, paint or coating specified by this section.
- D. Section 23 07 00 – HVAC Insulation: Product requirements for duct liners for placement by this section.
- E. Section 23 33 00 - Air Duct Accessories: Product requirements for duct accessories for placement by this section.

#### **1.3 REFERENCES**

A. ASTM International:

1. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.
2. ASTM A90/A90M - Standard Test Method for Weight Mass of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings.
3. ASTM A167 - Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
4. ASTM A568/A568M - Standard Specification for Steel, Sheet, Carbon, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements for.
5. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
6. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
7. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
8. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

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9. ASTM C14 - Standard Specification for Concrete Sewer, Storm Drain, and Culvert Pipe.
  10. ASTM C443 - Standard Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.
  11. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- B. National Fire Protection Association:
1. NFPA 90A - Standard for the Installation of Air Conditioning and Ventilating Systems.
  2. NFPA 90B - Standard for the Installation of Warm Air Heating and Air Conditioning Systems.
  3. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.
- C. Sheet Metal and Air Conditioning Contractors:
1. SMACNA - Fibrous Glass Duct Construction Standards.
  2. SMACNA - HVAC Air Duct Leakage Test Manual.
  3. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.
- D. Underwriters Laboratories Inc.:
1. UL 181 - Factory-Made Air Ducts and Connectors.

### **1.4 DEFINITIONS**

- A. Duct Sizes: Inside clear dimensions. For lined ducts, maintain sizes inside lining.
- B. Low Pressure: Three pressure classifications: ½ inch WG positive or negative static pressure and velocities less than 2,000 fpm; 1 inch WG positive or negative static pressure and velocities less than 2,500 fpm and 2 inch WG positive or negative static pressure and velocities less than 2,500 fpm.
- C. Medium Pressure: Three pressure classifications: 3 inch WG positive or negative static pressure and velocities less than 4,000 fpm, 4 inch WG positive static pressure and velocities greater than 2,000 fpm, 6 inch WG positive static pressure and velocities greater than 2,000 fpm.
- D. High Pressure: 10 inch WG positive static pressure and velocities greater than 2,000 fpm.

### **1.5 PERFORMANCE REQUIREMENTS**

- A. Variation of duct configuration or sizes other than those of equivalent or lower loss coefficient is not permitted except by written permission. Size round ducts installed in place of rectangular ducts in accordance with ASHRAE table of equivalent rectangular and round ducts.

### **1.6 SUBMITTALS**

- A. See General Conditions and the General Requirements in Division 01 regarding submittals.

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- B. Product Data: Submit data for duct materials.
- C. Manufacturer's Installation Instructions: Submit special procedures for glass fiber ducts.

### **1.7 CLOSEOUT SUBMITTALS**

- A. Division 01 - Execution and Closeout Requirements: Closeout procedures.
- B. Project Record Documents: Record actual locations of ducts and duct fittings. Record changes in fitting location and type. Show additional fittings used.

### **1.8 QUALITY ASSURANCE**

- A. Perform Work in accordance with SMACNA - HVAC Duct Construction Standards - Metal and flexible.
- B. Construct ductwork to NFPA 90A standards.
- C. Maintain one copy of each document on site.

### **1.9 QUALIFICATIONS**

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
- B. Installer: Company specializing in performing Work of this section with minimum three years experience.

### **1.10 ENVIRONMENTAL REQUIREMENTS**

- A. Division 01 - Product Requirements.
- B. Do not install duct sealant when temperatures are less than those recommended by sealant manufacturers.
- C. Maintain temperatures during and after installation of duct sealant.

### **1.11 FIELD MEASUREMENTS**

- A. Verify field measurements prior to fabrication.

### **1.12 WARRANTY**

- A. Division 01 - Execution and Closeout Requirements: Product warranties and product bonds.

## **PART 2 PRODUCTS**

### **2.1 DUCT MATERIALS**

- A. Galvanized Steel Ducts: ASTM A653/A653M galvanized steel sheet, lock-forming quality, having G90 zinc coating of in conformance with ASTM A90/A90M.
- B. Fasteners: Rivets, bolts, or sheet metal screws.



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- C. Hanger Rod: ASTM A36/A36M; steel; threaded both ends, threaded one end, or continuously threaded.

### **2.2 LOW PRESSURE DUCTWORK FABRICATION**

- A. Fabricate and support rectangular ducts in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible and ASHRAE handbooks, except as indicated. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.
- B. Size round ducts installed in place of rectangular ducts in accordance with ASHRAE table of equivalent rectangular and round ducts. No variation of duct configuration or sizes permitted except by written permission.
- C. Construct T's, bends, and elbows with minimum radius 1-1/2 times centerline duct width. Where not possible and where rectangular elbows are used, provide airfoil turning vanes. Where acoustical lining is indicated, furnish turning vanes of perforated metal with glass fiber insulation.
- D. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30° divergence upstream of equipment and 45° convergence downstream.
- E. Use crimp joints with or without bead for joining round duct sizes 12" and smaller with crimp in direction of airflow.
- F. Use double nuts and lock washers on threaded rod supports.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Division 01 - Administrative Requirements: Coordination and project conditions.
- B. Verify sizes of equipment connections before fabricating transitions.

### **3.2 INSTALLATION**

- A. During construction, install temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.
- B. Use crimp joints with or without bead or beaded sleeve couplings for joining round duct sizes 12" and smaller.
- C. Install duct hangers and supports in accordance with Section 23 05 00.
- D. Use double nuts and lock washers on threaded rod supports.

### **3.3 INTERFACE WITH OTHER PRODUCTS**

- A. Install openings in ductwork where required to accommodate thermometers and controllers. Install pitot tube openings for testing of systems. Install pitot tube complete with metal can with spring device or screw to prevent air leakage. Where openings are provided in insulated ductwork, install insulation material inside metal ring.

**END OF SECTION 23 31 00**

## **SECTION 23 33 00 - AIR DUCT ACCESSORIES**

### **PART 1 GENERAL**

#### **1.1 SUMMARY**

- A. Section Includes:
  - 1. Back-draft Dampers.
  - 2. Insulated Control Dampers.

#### **1.2 RELATED SECTIONS**

- A. Section 23 31 00 - HVAC Ducts and Casings: Requirements for duct construction and pressure classifications.
- B. Division 26 - Equipment Wiring Connections: Execution requirements for connection of electrical Combination Smoke and Fire Dampers specified by this section.

#### **1.3 REFERENCES**

- A. Air Movement and Control Association International, Inc.:
  - 1. AMCA 500 - Test Methods for Louvers, Dampers, and Shutters.
- B. National Fire Protection Association:
  - 1. NFPA 90A - Standard for the Installation of Air Conditioning and Ventilating Systems.
- C. Sheet Metal and Air Conditioning Contractors:
  - 1. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.

#### **1.4 SUBMITTALS**

- A. Division 01 - Submittal Procedures: Submittal procedures.
- B. Shop Drawings: Indicate for shop fabricated assemblies including volume control dampers and duct access doors.
- C. Product Data: Submit data for shop fabricated assemblies and hardware used.
- D. Product Data: Submit for the following. Include where applicable electrical characteristics and connection requirements.
  - 1. Control dampers.

#### **1.5 CLOSEOUT SUBMITTALS**

- A. Division 01 - Execution and Closeout Requirements: Closeout procedures.

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### **1.6 QUALITY ASSURANCE**

- A. Damper pressure drop ratings based on tests and procedures performed in accordance with AMCA 500.
- B. Maintain one copy of each document on site.

### **1.7 QUALIFICATIONS**

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

### **1.8 DELIVERY, STORAGE, AND HANDLING**

- A. Division 01 - Product Requirements: Product storage and handling requirements.
- B. Protect dampers from damage to operating linkages and blades.
- C. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly indicating manufacturer and material.
- D. Storage: Store materials in a dry area indoor, protected from damage.
- E. Handling: Handle and lift dampers in accordance with manufacturer's instructions. Protect materials and finishes during handling and installation to prevent damage.

### **1.9 FIELD MEASUREMENTS**

- A. Verify field measurements prior to fabrication.

### **1.10 COORDINATION**

- A. Division 01 - Administrative Requirements: Coordination and project conditions.
- B. Coordinate Work where appropriate with building control Work.

### **1.11 WARRANTY**

- A. Division 01 - Execution and Closeout Requirements: Product warranties and product bonds.

### **1.12 COMPLETION REQUIREMENTS**

- A. In accordance with the General Conditions and the General Requirements in Division 01, Project Closeout; before acceptance and final payment, the Contractor shall furnish:
  - 1. Accurate project record drawings, shown in red ink on prints, showing all changes from the original plans made during installation of the work.
  - 2. Contractors One Year Warranty.
  - 3. All Manufacturers' Guarantees.
  - 4. Operation and Maintenance Manuals.

**2.1 BACK-DRAFT DAMPERS**

A. Manufacturers:

1. Ruskin.
2. Greenheck.
3. Penn.
4. Substitutions: Division 01 - Product Requirements.

B. Gravity backdraft dampers, size 18 x 18 inches or smaller, furnished with air moving equipment, may be air moving equipment manufacturer's standard construction.

C. Fabricate multi-blade, parallel action gravity balanced backdraft dampers of 16 gauge galvanized steel, or extruded aluminum, with center pivoted blades of maximum 6" width, with felt or flexible vinyl sealed edges, linked together in rattle-free manner with 90 degree stop, steel ball bearings, and plated steel pivot pin; adjustment device to permit setting for varying differential static pressure.

**2.2 CONTROL DAMPERS – ACCEPTABLE MANUFACTURERS**

A. Manufacturers:

1. Ruskin.
2. Greenheck.
3. Tamco.
4. Substitutions: Division 01 – Product Requirements.

**2.3 CONTROL DAMPERS**

A. Multi-blade, opposed blade action, control dampers of extruded aluminum, with airfoil type blades of maximum six inch width, blades positioned across short air opening dimension, field replaceable extruded vinyl sealed edges, linked together in rattle-free manner, non-corrosive molded synthetic bearings, square or hexagonal axles for positive locking connection to blades and linkage, with documented leakage rate not to exceed 6 CFM/sq. ft. at 4" W.G.

B. Thermally Broken Control Dampers:

1. Extruded aluminum damper frame shall not be less than .080" in thickness. Damper frame shall be insulated with polystyrofoam on three sides if "Installed in Duct" type and on four sides if "Flanged to Duct" type.
2. Blades to be extruded aluminum profiles, internally insulated with expanded polyurethane foam and shall be thermally broken. Complete blade shall have an insulating factor of R-2.29 and a temperature index of 55.

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3. Blade seals shall be of extruded EPDM. Frame seals shall be of extruded silicone. Seals to be secured in an integral slot within the aluminum extrusions.
4. Linkage hardware shall be installed in the frame side and constructed of aluminum and corrosion-resistant, zinc-plated steel, complete with cup-point trunnion screws for a slip-proof grip.
5. Dampers are to be designed for operation in temperatures ranging between -40°F and 185°F.
6. Dampers shall be available with either opposed blade action or parallel blade action. Provide opposed blade dampers for modulating damper applications and parallel blade damper action for open/closed damper applications.
7. Leakage shall not exceed 3 cfm/ft<sup>2</sup> against 1" w.g. differential static pressure.
8. Pressure drop of a fully open 48" x 48" damper shall not exceed .03" w.g. at 1000.
9. Dampers shall be made to size required without blanking off free area.
10. Dampers shall be available in two mounting types: i.e., "Installed in Duct" or "Flanged to Duct".

### **PART 3 EXECUTION**

#### **3.1 EXAMINATION**

- A. Division 01 - Administrative Requirements: Coordination and project conditions.
- B. Verify ducts and equipment installations are ready for accessories.
- C. Check location of air outlets and inlets and make necessary adjustments in position to conform to architectural features, symmetry, and lighting arrangement.

#### **3.2 INSTALLATION.**

- A. Install in accordance with NFPA 90A, and follow SMACNA HVAC Duct Construction Standards - Metal and Flexible. Refer to Section 23 31 00 for duct construction and pressure class.
- B. Install back-draft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.

**END OF SECTION 23 33 00**

## **SECTION 23 34 00 - HVAC FANS**

### **PART 1 GENERAL**

#### **1.1 SUMMARY**

A. Section Includes:

1. Wall mounted exhaust fans.
2. Ceiling propeller fans.

B. Related Sections:

1. Section 23 05 00 - Common Work Results for HVAC.
2. Section 23 05 93 – Testing, Adjusting and Balancing.
3. Section 23 07 00 - HVAC Insulation.
4. Section 23 09 00 - Instrumentation and Control for HVAC.
5. Section 23 09 93 – Sequence of Operations for HVAC Controls.
6. Section 23 33 00 - Air Duct Accessories.
7. Division 26 - Equipment Wiring Connections: Execution and product requirements for connecting equipment specified by this section.

#### **1.2 REFERENCES**

A. American Bearing Manufacturers Association:

1. ABMA 9 - Load Ratings and Fatigue Life for Ball Bearings.
2. ABMA 11 - Load Ratings and Fatigue Life for Roller Bearings.

B. Air Movement and Control Association International, Inc.:

1. AMCA 99 - Standards Handbook.
2. AMCA 204 - Balance Quality and Vibration Levels for Fans.
3. AMCA 210 - Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.
4. AMCA 300 - Reverberant Room Method for Sound Testing of Fans.
5. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data.

C. National Electrical Manufacturers Association:

1. NEMA MG 1 - Motors and Generators.
2. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

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### **1.3 SUBMITTALS**

- A. Submit shop drawings and product data under provisions of 23 05 00 Common Work Results for HVAC.
- B. Shop Drawings: Indicate size and configuration of fan assembly, mountings, weights, ductwork and accessory connections.
- C. Product Data: Submit data on each type of fan and include accessories, fan curves with specified operating point plotted, power, RPM, sound power levels for both fan inlet and outlet at rated capacity, electrical characteristics and connection requirements.
- D. Manufacturer's Installation Instructions: Submit fan manufacturer's instructions.
- E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

### **1.4 CLOSEOUT SUBMITTALS**

- A. Submit shop drawings and product data under provisions of 23 05 00 Common Work Results for HVAC.
- B. Operation and Maintenance Data: Submit instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams.

### **1.5 QUALITY ASSURANCE**

- A. Performance Ratings: Conform to AMCA 210.
- B. Sound Ratings: AMCA 301, tested to AMCA 300.
- C. UL Compliance: UL listed and labeled, designed, manufactured, and tested in accordance with UL 705.
- D. Balance Quality: Conform to AMCA 204.
- E. Energy Recovery Unit Wheel Energy Transfer Rating: Meet ARI 1060.

### **1.6 QUALIFICATIONS**

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.
- B. Installer: Company specializing in performing Work of this section with minimum three years experience.

### **1.7 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver products to site under provisions of Division 01 in factory-fabricated protective containers, with factory-installed shipping skids and lifting lugs.
- B. Protect motors, shafts, and bearings from weather and construction dust.
- C. Protect motors, shafts, and bearings from weather and construction dust.

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#### **1.8 FIELD MEASUREMENTS**

- A. Verify field measurements prior to fabrication.

#### **1.9 WARRANTY**

- A. Provide warranty under provisions of 23 05 00 Common Work Results for HVAC: Product warranties and product bonds.
- B. Furnish five year manufacturer's warranty for fans.

### **PART 2 PRODUCTS**

#### **2.1 ACCEPTABLE MANUFACTURERS**

- A. Greenheck Corp.
- B. Loren Cook Company.
- C. Twin City.
- D. Substitutions: Under provisions of Division 01

#### **2.2 GENERAL**

- A. Fans used shall not decrease motor size, increase noise level, or increase tip speed by more than 10 percent, or increase inlet air velocity by more than 20 percent, from specified criteria. Fans shall be capable of accommodating static pressure variations of plus or minus 10 percent.
- B. Base performance on sea level conditions unless otherwise noted.
- C. Statically and dynamically balance fans to eliminate vibration or noise transmission to occupied areas.

#### **2.3 WALL MOUNTED EXHAUST FANS**

- A. Construction:
  - 1. Propeller: Shaped steel or cast aluminum blade with hubs, statically and dynamically balanced, keyed and locked to shaft, directly connected to motor or furnished with V-belt drive. Statically and dynamically balanced.
  - 2. Frame: One piece, square steel with die formed venturi orifice, mounting flanges and supports, with baked enamel finish.
- B. Accessories:
  - 1. Outlet Damper: Multiple blade with offset hinge pin, blades linked, line voltage motor drive, power open, spring return.
  - 2. Safety Screens: Expanded galvanized metal over inlet, motor, and drive; to comply with OSHA regulations.



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#### **2.4 CEILING PROPELLER FANS**

- A. Controls: Wired Wall Control with fan on/off and fan speed adjustment.
- B. Universal mounting, provide extension tube as required.
- C. Color: White.

#### **PART 3 EXECUTION**

##### **3.1 EXAMINATION**

- A. Verify exhaust louvers are installed and dimensions are as instructed by manufacturer.

##### **3.2 INSTALLATION**

- A. Secure wall fans with cadmium plated steel lag screws to structure.
- B. Install motorized dampers on outlet of wall exhaust fans and intake air openings.
- C. Install safety screen where inlet or outlet is exposed.
- D. Provide sheaves required for final air balance for belt driven fans. Refer to requirements Section 23 05 93.

##### **3.3 MANUFACTURER'S FIELD SERVICES**

- A. Division 01 - Quality Requirements: Requirements for manufacturer's field services.

##### **3.4 CLEANING**

- A. Vacuum clean inside of fan cabinet.

##### **3.5 DEMONSTRATION**

- A. Demonstrate fan operation and maintenance procedures.

##### **3.6 PROTECTION OF FINISHED WORK**

- A. Do not operate fans for until ductwork is clean, filters in place, bearings lubricated, and fan has been test run under observation.

**END OF SECTION 23 34 00**

## **SECTION 23 37 00 - AIR OUTLETS AND INLETS**

### **PART 1 - GENERAL**

#### **1.1 WORK INCLUDED**

- A. Louvers.

#### **1.2 REFERENCES**

- A. ADC 1062 - Certification, Rating and Test Manual.
- B. AMCA 500 - Test Method for Louvers, Dampers and Shutters.
- C. ARI 650 - Air Outlets and Inlets.
- D. ASHRAE 70 - Method of Testing for Rating the Air Flow Performance of Outlets and Inlets.
- E. SMACNA - HVAC Duct Construction Standard.

#### **1.3 QUALITY ASSURANCE**

- A. Test and rate performance of air outlets and inlets in accordance with ADC Equipment Test Code 1062 and ASHRAE 70.
- B. Test and rate performance of louvers in accordance with AMCA 500.

#### **1.4 REGULATORY REQUIREMENTS**

- A. Conform to ANSI/NFPA 90A.

#### **1.5 SUBMITTALS**

- A. Submit product data under provisions of Division 01.
- B. Provide product data for items required for this project.
- C. Review requirements of outlets and inlets as to size, finish, and type of mounting prior to submitting product data.

### **PART 2 - PRODUCTS**

- A. ACCEPTABLE MANUFACTURERS - LOUVERS
- B. Ruskin.
- C. Penn.
- D. Carnes.
- E. Substitutions: Under provisions of Division 1.

## **2.2 LOUVERS**

- A. Provide 6 inch deep louvers with blades on 45 degree slope with center baffle and return bend, heavy channel frame, birdscreen with 1/2 inch square mesh for exhaust and 3/4 inch for intake.
- B. Fabricate of 16 gauge galvanized steel or 12 gauge extruded aluminum, welded assembly, with factory baked enamel finish.
- C. Furnish with exterior flat flange for installation.
- D. Fabricate louver penthouses with mitered corners and reinforce with structural angles.
- E. Model ELF6375DX as manufactured by Ruskin.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Install items in accordance with manufacturers' instructions.
- B. Check location of outlets and inlets and make necessary adjustments in position to conform with architectural features, symmetry, and lighting arrangement.
- C. Install diffusers to ductwork with air tight connection.
- D. Provide balancing dampers on duct take-off to diffusers, and grilles and registers, regardless of whether dampers are specified as part of the diffuser, or grille and register assembly.
- E. Paint ductwork visible behind air outlets and inlets matte black.

**END OF SECTION**

## **SECTION 23 52 16 – CONDENSING BOILERS**

### **PART 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- A. Condensing Gas Boilers.
- B. Controls and Boiler Trim.

#### **1.2 RELATED SECTIONS**

- A. Section 23 05 00 - Common Work Results for HVAC.
- B. Section 23 09 00 – Instrumentation and Controls for HVAC.
- C. Section 23 21 13 - Hydronic Piping.
- D. Section 23 21 16 - Hydronic Piping Specialties.
- E. Section 23 51 00 – Breechings Chimneys and Stacks.
- F. Section 26 05 83 - Wiring Connections.

#### **1.3 REFERENCES**

- A. American National Standards Institute:
  - 1. ANSI Z21.13 - Gas-fired Low Pressure Steam and Hot Water Boilers.
- B. American Society of Heating, Refrigerating and Air-Conditioning Engineers:
  - 1. ASHRAE 90.1 - Energy Standard for Buildings Except Low-Rise Residential Buildings.
- C. American Society of Mechanical Engineers:
  - 1. ASME Section IV - Boiler and Pressure Vessel Code - Heating Boilers.
  - 2. ASME Section VIII - Boiler and Pressure Vessel Code - Pressure Vessels.
  - 3. ASME CSD-1 (Controls and Safety Devices).
- D. Hydronics Institute:
  - 1. H.I. Heating Boiler Standard - Testing and Rating Standard for Heating Boilers.
- E. National Fire Protection Association:
  - 1. NFPA 54 - National Fuel Gas Code.

#### **1.4 SUBMITTALS**

- A. Submit product data under provisions of Division 01.
- B. Product Data: Include performance data, operating characteristics, furnished specialties and accessories.
  - 1. Prior to flue vent installation, engineered calculations and drawings must be submitted to Architect/Engineer to thoroughly demonstrate that size and configuration conform to recommended size, length and footprint for each submitted boiler.
- C. Efficiency Curves: At a minimum, submit efficiency curves for 100%, 60%, and 5% input firing rates at incoming water temperatures ranging from 60°F to 160°F
- D. Pressure Drop Curve: Submit pressure drop curve for flows ranging from 0 GPM to maximum value of boiler.
  - 1. If submitted material is different from that of the design basis, boiler manufacture shall incur all costs associated with reselection of necessary pumps. Possible differences include, but are not limited to, the pump type, pump pad size, electrical characteristics and piping changes.
- E. Shop Drawings: For boilers, boiler trim and accessories, include:
  - 1. Plans, elevations, sections, details and attachments to other work.
  - 2. Wiring Diagrams for power, signal and control wiring.
- F. Source Quality Control Test Reports: Reports shall be included in submittals.
- G. Field Quality Control Test Reports: Reports shall be included in submittals.
- H. Submit data showing boiler burner, controls and boiler control panel wiring.

#### **1.5 OPERATION AND MAINTENANCE DATA**

- A. Submit operation and maintenance data under provisions of Division 01.
- B. Include manufacturer's descriptive literature, operating instructions, cleaning procedures, replacement parts list, and maintenance and repair data.
- C. Include reports from manufacturers field service testing.

#### **1.6 QUALITY ASSURANCE**

- A. Manufacturer: Company specializing in manufacturing the products specified in this Section with minimum three years experience.
- B. The equipment shall, at a minimum, be in strict compliance with the requirements of this specification and shall be the manufacturer's standard commercial product unless specified otherwise. Additional equipment features, details, accessories, appurtenances, etc. which are not specifically identified but which are a part of the manufacturer's standard commercial product, shall be included in the equipment being furnished.

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- C. The equipment shall be of the type, design, and size that the manufacturer currently offered for sale and appears in the manufacturer's current catalogue. The equipment shall be new and fabricated from new materials and shall be free from defects in materials and workmanship.
- D. All units of the same classification shall be identical to the extent necessary to insure interchangeability of parts, assemblies, accessories, and spare parts wherever possible.
- E. In order to provide unit responsibility for the specified capacities, efficiencies, and performance, the boiler manufacturer shall certify in writing that the equipment being submitted shall perform as specified. The boiler manufacturer shall be responsible for guarantying that the boiler provides the performance as specified herein.

### **1.7 CERTIFICATIONS**

- A. Manufacturer's Certification: The boiler manufacturer shall certify the following:
  - 1. The products and systems furnished are in strict compliance with the specifications.
  - 2. The boiler, burner and other associated mechanical and electrical equipment have all been properly coordinated and integrated to provide a complete and operable boiler.
  - 3. ASME certification.
  - 4. UL certification.
  - 5. The specified factory tests have been satisfactorily performed.
  - 6. The specified field tests have been satisfactorily performed.
- B. Contractor's Certification: The contractor shall certify the following:
  - 1. The products and systems installed are in strict compliance with the specifications.
- C. Boiler Inspectors' Certification: All boiler inspections during hydrostatic testing shall be performed by an authorized boiler inspector who is certified by the National Board of Boiler and Pressure Vessel Inspectors and shall be submitted in writing prior to final acceptance by the engineer.

### **1.8 REGULATORY REQUIREMENTS**

- A. Conform to ANSI/NFPA 70 code for internal wiring of factory wired equipment.
- B. Conform to ANSI/ASME SEC4 and SEC 8D for boiler construction.
- C. Units: AGA certified. UL labeled.

### **1.9 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver, store, and protect products to site under provisions of Division 01.
- B. Accept boilers and accessories on site in factory shipping packaging. Inspect for damage.
- C. Protect boilers from damage by leaving packing in place until installation.

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- D. Protect units before, during, and after installation from damage to casing by leaving factory shipping packaging in place until immediately prior to final acceptance.

**1.10 WARRANTY**

- A. Provide one year warranty for the entire boiler under provisions of Division 01.

**PART 2 PRODUCTS**

**2.1 ACCEPTABLE MANUFACTURERS**

- A. Lochinvar.
- B. Navien.
- C. HTP.
- D. Substitutions: Under provisions of General Conditions in Division 01.

**2.2 HIGH EFFICIENCY CONDENSING BOILERS**

- A. The BOILER shall bear the ASME "H" stamp for 80 psi working pressure and shall be National Board listed. The BOILER shall have a fully welded, stainless steel, fire tube heat exchanger. There shall be no banding material, bolts, gaskets or "O" rings in the pressure vessel construction. The heat exchanger shall be designed for a single-pass water flow to limit the water side pressure drop. The condensate collection basin shall be constructed of welded stainless steel. The complete heat exchanger assembly shall carry a fifteen (15) year limited warranty
- B. The BOILER shall operate at a minimum of 94.4% THERMAL Efficiency (WHB399) as registered with AHRI. The BOILER shall be certified for indoor installation.
- C. The BOILER shall be constructed with a heavy gauge steel jacket assembly, primed and pre-painted on both sides. The combustion chamber shall be sealed and completely enclosed, independent of the outer jacket assembly. The BOILER shall be supplied with a negative pressure regulation gas valve and be equipped with a pulse width modulation blower system to precisely control the fuel/air mixture to the burner. The BOILER shall operate in a safe condition with gas supply pressures as low as 4 inches of water column. The BOILER shall utilize an integral control circuit and components. The control system shall have a factory installed display for boiler set-up, boiler status, and boiler diagnostics. All components shall be easily accessed and serviceable from the front and top of the jacket. The BOILER shall be equipped with a temperature/pressure gauge; high limit temperature control with manual reset; ASME certified pressure relief valve set for 30 psi (standard); outlet water temperature sensor with a dual thermistor to verify accuracy; system supply water temperature sensor; outdoor air sensor, flue temperature sensor with dual thermistor to verify accuracy; low water cut off with manual reset, blocked drain switch and a condensate trap for the heat exchanger condensate drain.
- D. The BOILER shall feature integral controls with outdoor air reset, pump delay with freeze protection, pump exercise capabilities. The BOILER shall have alarm contacts for any failure, runtime contacts and data logging of runtime at given modulation rates, ignition attempts and ignition failures. The BOILER shall have a built-in multiple boiler sequence controls to rotate while maintaining modulation of different Btu inputs without utilization of an external controller. The internal multi boiler function shall be capable of lead-lag, efficiency optimization, front-end loading, and rotation of lead boiler every 24 hours.

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- E. The integral control shall increase fan speed to boost flame signal when a weak flame signal is detected during normal operation. A 0-10 VDC output signal shall control a variable speed boiler pump (pump shall be supplied by manufacturer) to keep a fixed Delta T across the boiler regardless of the modulation rate. The BOILER shall have the capability to receive a 0-10 VDC input signal from a variable speed system pump to anticipate changes in system heat load in order to prevent flow related issues such as erratic temperature cycling.
- F. The BOILER shall be equipped with terminal strips for electrical connection. A low voltage connection board for safety and operating controls, i.e., Alarm Contacts, Runtime Contacts, Low Water Cut Off, Louver Proving Switch, Tank Thermostat, Domestic Hot Water Building Recirculation Pump Contacts, Domestic Hot Water Building Recirculation Temperature Sensor Contacts, Remote Enable/Disable, System Supply Temperature Sensor, Outdoor Temperature Sensor, Tank Temperature Sensor, and Multi-boiler Control Circuit. A high voltage terminal strip shall be provided for Supply voltage. Supply voltage shall be 120 volt / 60 hertz / single phase on all models. The high voltage terminal strip plus integral relays are provided for independent pump control of the System pump, the Boiler pump and the Domestic Hot Water pump.
- G. The manufacturer shall verify proper operation of the burner, all controls and the integrity of the heat exchanger by connection to water and venting for a factory fire test prior to shipping.

### **2.3 HIGH EFFICIENCY CONDENSING BOILER VENTING**

- A. The BOILER shall be installed and vented with a Direct Vent system with horizontal concentric sidewall termination of both the exhaust vent and combustion air. The flue shall be Category IV approved material constructed of PVC, CPVC, Polypropylene or Stainless Steel. A separate pipe shall supply combustion air directly to the boiler from the outside. The boiler's total combined air intake length shall not exceed 100 equivalent feet. The boiler's total combined exhaust venting length shall not exceed 100 equivalent feet..

## **PART 3 EXECUTION**

### **3.1 INSTALLATION**

- A. Install in strict accordance with manufacturer's installation instructions.
- B. Install equipment in strict compliance with state and local codes and applicable NFPA standards.
- C. Maintain manufacturer's recommended clearances around sides and over top of equipment.
- D. Install components that were furnished loose with equipment for field installation.
- E. Provide all interconnecting electrical control and power wiring. Provide for connection to electrical service.
- F. Provide all piping for boiler pipe connections.
- G. Pipe relief valves to 6" above floor drain.
- H. Pipe condensate drains to acidic condensate neutralizer. Provide p-trap upstream of neutralizer. All piping shall be PVC and supplied/installed by the contractor. Plastic tubing is an acceptable alternative when used with barbed fittings. All PVC joints shall be glued in place and all barbed fittings shall be secured with tie wraps. All neutralizing tubes shall be secured to the floor or wall so as not to be exposed to damage or within a normal walkway. The contractor shall fill all "P-traps" and neutralizing tubes with tap water before the firing of any boiler.



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#### **3.2 MANUFACTURER'S FIELD SERVICES**

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- A. Prepare and start systems under provisions of Division 01. Instruct operating personnel.
- B. Submit written report after start-up including control settings and performance chart of control system.
- C. Coordinate all work with Specification Section 23 09 23 and 23 09 93. Perform start-up in conjunction with testing of BAS systems to insure interface between boiler controls and BAS controls are complete and fully functional. Verify system operation in accordance with the sequence of operation.
- D. Commission Boilers per manufacturer's recommendations provide field start-up service by factory certified boiler technician.
- E. Equipment inspection: Boiler manufacturer's representative to provide jobsite assistance to inspect boilers and other equipment verifying completeness of equipment supplied. Casing, insulation and boiler mounted controls shall ship loose for field assembly by Manufacturer's Representative after boiler has been set and mounted on legs by installing contractor. Installing contractor shall provide laborer for assistance.
- F. Start-up shall be conducted by experienced and factory authorized technician in the regular employment of the boiler supplier, and shall include the following:
  - 1. Demonstrate that boiler, burner, controls and accessories comply with requirements of this Section as proposed by the boiler and accessories supplier. Pre-test all items prior to scheduling the final testing that will be witnessed by the test engineer.
  - 2. Readings at different firing rates (20, 50, 75 and 100%) of load for the modulating burner shall be taken with a written report of the tests submitted to the engineer. The reports shall include readings for each firing rate tested and shall include stack temperatures, O<sub>2</sub>, CO, NO<sub>x</sub>, and overall boiler efficiency.
  - 3. Auxiliary Equipment and Accessories: Observe and check all valves, draft fans and electric motors, as well as other accessories and appurtenant equipment during the operational and capacity tests for leakage, malfunctions, defects, and non-compliance with referenced standards or overloading as applicable.
- G. Substantial Completion Demonstration Requirements:
  - 1. Fireside inspection.
  - 2. Set up fuel train and combustion air system.
  - 3. Set up operating set points.
  - 4. Check all safeties, including: Flame safeguard, LWCO, ALWCO, Air flow, Fuel pressures, High limits.
  - 5. Set up and verify efficiencies at 20%, 50%, 75%, and 100%.
  - 6. Set up and verify burner turndown.

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- 7. Training to include all safety procedures, maintenance procedures, control operations, and diagnostic procedures. Training to be provided in a single 4 hour continuous session to accommodate operator's availability on site.
- H. Submit written report after start-up including control settings and performance chart of control system.

**END OF SECTION 23 52 16**

## **SECTION 23 82 00 - CONVECTION HEATING AND COOLING UNITS**

### **PART 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- A. Gas Fire Unit Heaters.

#### **1.2 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION**

- A. Section 23 09 00 – Instrumentation and Control for HVAC: Installation of room thermostats.
- B. Section 26 05 83 - Wiring Connections: Installation of room thermostats.

#### **1.3 RELATED SECTIONS**

- A. Section 23 09 00 – Instrumentation and Control for HVAC.
- B. Section 23 11 23 – Facility Natural Gas Piping
- C. Section 26 05 83 - Wiring Connections: Electrical supply to units.

#### **1.4 REFERENCES**

- A. ANSI/NFPA 70 - National Electrical Code.

#### **1.5 SUBMITTALS**

- A. Submit product data under provisions of Division 01.
- B. Submit schedules of equipment and enclosures typically indicating length and number of pieces of element and enclosure, corner pieces, end caps, cap strips, access doors, pilaster covers, and comparison of specified heat required to actual heat output provided.
- C. Indicate mechanical and electrical service locations and requirements, specifically indicating deviations from indicated products.

#### **1.6 PROJECT RECORD DOCUMENTS**

- A. Submit record documents under provisions of Division 01.
- B. Accurately record actual locations of access doors in radiation cabinets required for access or valving.

#### **1.7 OPERATION AND MAINTENANCE DATA**

- A. Submit operation and maintenance data under provisions of Division 01.
- B. Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listings.

#### **1.8 QUALIFICATIONS**

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- A. Manufacturer: Company specializing in manufacturing the products specified in this Section with minimum three years' experience.

### **1.9 REGULATORY REQUIREMENTS**

- A. Conform to applicable code for internal wiring of factory wired equipment.

### **1.10 DELIVERY, STORAGE AND HANDLING**

- A. Deliver products to site under provisions of Division 01.
- B. Store and protect products under provisions of Division 01.
- C. Protect units from physical damage by storing in protected areas and leaving factory covers in place.

### **1.11 SEQUENCING AND SCHEDULING**

- A. Install radiation, convectors, fan-coil units, unit ventilators and radiant heaters (equipment exposed to finished areas) after walls and ceiling are finished and painted. Avoid damage.

### **1.12 WARRANTY**

- A. Provide one year manufacturer's warranty under provisions of Division 01.
- B. Warranty: Include coverage of unit heater motors.

## **PART 2 PRODUCTS**

### **2.1 MANUFACTURERS – GAS FIRED UNIT HEATERS**

- A. Modine.
- B. Trane.
- C. Beacon Morris.
- D. Substitutions: Under provisions of Division 01.

### **2.2 UNIT HEATERS**

- A. Casing: 20 gauge aluminized steel with minimization of exposed fasteners
- B. Finish: Factory apply baked enamel color as selected on visible surfaces of enclosure or cabinet.
- C. Fan: Direct drive propeller type, statically and dynamically balanced, with fan guard; horizontal models with permanently lubricated sleeve bearings; vertical models with grease lubricated ball bearings.
- D. The unit shall be separated combustion. The venting shall be a power exhausted arrangement with a separate combustion air intake pipe connection to allow for fresh combustion air from outside the conditioned space. The unit shall be tested to insure proper ignition when the unit is subjected to 40 mile per hour wind velocities.

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- E. Furnace(s) section with 82% minimum efficiency provided by an indirect-fired tubular heat exchanger with individually fired tubes.
- F. Single-stage gas controls with a single-stage combination gas control, an ignition control, and a single-stage low voltage thermostat. The unit fires at 100% full fire based on a call for heat from a room thermostat.
- G. An automatic reset high limit switch mounted in the air stream to shut off the gas supply in the event of overheating.
- H. Air Outlet: 30° non-velocity generating downward air deflector hood constructed of 20 ga cold rolled steel with baked-on gray-green polyester powder paint.
- I. Motor: Refer to Section 23 21 23; horizontal models with permanently lubricated sleeve bearings; vertical models with grease lubricated ball bearings.
- J. Concentric vent kit for sidewall installation.
- K. Control: Local disconnect switch.
- L. Capacity: Based on 65° F entering air temperature, 180° F average water temperature.

### **PART 3 EXECUTION**

#### **3.1 EXAMINATION**

- A. Verify that surfaces are ready to receive work and opening dimensions are as instructed by the manufacturer.
- B. Verify that required utilities are available, in proper location, and ready for use.
- C. Beginning of installation means installer accepts existing surfaces.

#### **3.2 INSTALLATION**

- A. Install in accordance with manufacturer's instructions.
- B. Hang unit heaters from building structure, with pipe hangers anchored to building, not from piping. Mount as high as possible to maintain greatest headroom unless otherwise indicated.
- C. Protect units with protective covers during balance of construction.

#### **3.3 CLEANING**

- A. Clean work under provisions of Division 01.
- B. After construction is completed, including painting, clean exposed surfaces of units. Vacuum clean coils and inside of cabinets.
- C. Touch-up marred or scratched surfaces of factory-finished cabinets, using finish materials furnished by manufacturer.

**END OF SECTION 23 82 00**

## **SECTION 26 01 26 – MAINTENANCE TESTING OF ELECTRICAL SYSTEMS**

### **PART 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- A. Receptacle Branch Circuit Testing.
- B. Ground Fault Circuit Interrupter Testing.
- C. Electrical Service Ground Testing.

#### **1.2 REFERENCES**

- A. NETA ATS – Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.
- B. ANSI/IEEE Std 81-1983 Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System.
- C. ANSI/TIA/EIA – 568-B.1 and Addendums, General Cabling System Requirements.

#### **1.3 COORDINATION**

- A. Provide written 72 hours advance notice of all tests to be performed to allow Owner's Representative to witness testing.

#### **1.4 REQUIRED TEST INSTRUMENTS**

##### **A. BRANCH CIRCUIT ANALYZER**

- 1. Product Description: Branch circuit analyzer capable of receptacle testing of voltage drop under load, hot-neutral-ground conductor resistances, common mode (N-G) Voltage, and G.F.C.I. trip point.
- 2. Manufacturer: Ideal SureTest. Model: 61-156 ST-1THD Wiring/Harmonic Distortion Analyzer or approved equal.

##### **B. GROUND RESISTANCE CLAMP-ON METER**

- 1. Product Description: Digital, direct reading clamp-on resistance ground tester.
- 2. Manufacturer: AEMC. Model: 3711 or approved equal.

##### **C. MULTIMETER**

- 1. Product Description: Digital True RMS Multimeter.

#### **1.5 TEST INSTRUMENT CALIBRATION**

- A. All test equipment shall be in good mechanical and electrical condition.
- B. Provide calibration for each test instrument directly traceable to the National Institute of Standards and Technology (NIST) of higher accuracy than that of the instrument tested.

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- C. Provide calibration labels visible on all test equipment. Records, which show date and results of instruments calibrated or tested, shall be kept up-to-date.

### **1.6 MINIMUM REPORT INFORMATION**

- A. Report Criteria: After each test, promptly submit one copy of report to the Owner's Representative. Provide form with the minimum following information:
  - 1. Date issued.
  - 2. Project title and number.
  - 3. Name and Model of Tester and witnesses.
  - 4. Date and time of sampling or inspection.
  - 5. Identification of product and specifications section.
  - 6. Type of inspection or test.
  - 7. Date of test.
  - 8. Results of tests.
  - 9. Indicate compliance or non-compliance with Contract Documents.
  - 10. Final adjustment setting values where applicable.

### **1.7 GENERAL REQUIREMENTS**

- A. Submit test results within 3 working days of each test and included in the O&M manual.
- B. Provide qualified personnel at site to perform all testing.
- C. Perform specified testing of products in accordance with specified standards or as denoted in this specification whichever is more stringent.
- D. Promptly notify Owner's Representative of irregularities or non-conformance of Work or products.
- E. Perform additional tests when test is performed incorrectly, deemed inaccurate, or incorrectly documented.
- F. The Contractor shall provide all forms, instrumentation and test equipment, loads, and other consumables required to demonstrate the systems to Owner's Representative satisfaction.
- G. Perform and submit all testing prior to substantial completion and system acceptance.
- H. Replace and retest all material installed which does not meet or exceed the minimum acceptable limits set forth in this specification in accordance with the contract original requirements at no additional charge to Contract Sum/Price.

## **PART 2 PRODUCTS**

Not Used

**3.1 RECEPTACLE GROUND FAULT CIRCUIT INTERRUPTER TEST**

A. Test Criteria:

1. Use Branch Circuit Analyzer to perform test of each GFCI protected receptacle.
2. Record trip level in ma for each outlet.
3. Submit test results to Owner's Representative.

B. Test Values:

1. Trip Range: Between 6-9 mA.

**3.2 ELECTRICAL SERVICE GROUND TEST**

A. Test Criteria:

1. Use ground resistance clamp-on meter to measure the resistance of service ground with meter clamped between system neutral bond and each grounding electrode. Perform this test on new or existing services and all separately derived systems.
2. Record resistance value in Ohms.
3. Submit test results to Owner's Representative.

B. Test Values:

1. Maximum ground resistance: 10 Ohms.

**3.3 PHASE LOAD BALANCE TEST**

- A. After energizing building loads conduct a phase load balance test for each panelboard with a clamp on ammeter.
- B. Shift loads to provide current balance within 20% of the other phases. Revise circuit directory and all conductor labels to reflect any changes.
- C. Notify Owner's Representative at least 72 hours in advance before test.

**END OF SECTION 26 01 26**



## **SECTION 26 05 00 - COMMON WORK RESULTS FOR ELECTRICAL**

### **PART 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- A. General Requirements specifically applicable to Division 26, in addition to Division 01 provisions.
- B. The electrical system equipment and installation shall comply with all provisions and requirements of this specification, as well as any and all applicable national, state and local codes and standards.

#### **1.2 WORK SEQUENCE**

- A. Construct Work in sequence under provisions of Division 01.

#### **1.3 COORDINATION**

- A. Coordinate the Work specified in this Division under provisions of Division 01.
- B. Prepare drawings showing proposed rearrangement of Work to meet job conditions, including changes to Work specified under other Sections. Obtain permission of Architect prior to proceeding.

#### **1.4 REFERENCES**

- A. ANSI/NFPA 70 - National Electrical Code, latest adopted edition including all state and local amendments.
- B. NECA - Standard of Installation.
- C. NETA ATS – Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.
- D. Electrical Reference Symbols: The Electrical "Legend" on drawings is standardized version for this project. All symbols shown may not be used on drawings. Use legend as reference for symbols used on plans.
- E. Electrical Drawings: Drawings are diagrammatic; complimentary to the Architectural drawings; not intended to show all features of work. Install material not dimensioned on drawings in a manner to provide a symmetrical appearance. Do not scale drawings for exact equipment locations. Review Architectural, Civil, Structural, and Mechanical Drawings and adjust work to conform to conditions shown thereon. Field verification of dimensions, locations and levels is directed.

#### **1.5 REGULATORY REQUIREMENTS**

- A. Conform to ANSI/NFPA 70.
- B. Conform to the latest adopted edition of the International Building Code and the International Fire Code including all state and local amendments thereto.
- C. Obtain electrical permits, plan review, and inspections from authority having jurisdiction.

**1.6 SUBMITTALS**

- A. Submittal review is for general design and arrangement only and does not relieve the Contractor from any requirements of Contract Documents. Submittal not checked for quantity, dimension, fit or proper operation. Where deviations of substitute product or system performance have not been specifically noted in the submittal by the Contractor, provisions of a complete and satisfactory working installation is the sole responsibility of the Contractor.
- B. In addition to requirements referenced in Division 01, the following is required for work provided under this division of the specification.
  - 1. Provide material and equipment submittals containing complete listings of material and equipment shown on Electrical Drawings and specified herein. Separate from work furnished under other divisions.
  - 2. Submittals shall be provided in PDF format with each section indexed in the PDF document. Submittals for Division 26 shall be complete and submitted at one time. Unless given prior approval, partial submittals will be returned unreviewed.
  - 3. Clearly identify all material and equipment by item, name or designation used on drawings and in specifications.
  - 4. Submit only pages which are pertinent; mark catalog sheets to identify pertinent products, referenced to Specification Section and Article number. Show reference standards, performance characteristics, and capacities; wiring diagrams and controls; component parts; finishes; dimensions; and required clearances.
  - 5. Modify manufacturer's standard schematic drawings and diagrams to supplement standard information and to provide information specifically applicable to the work. Delete information not applicable.
  - 6. Review submittals prior to transmittal; determine and verify field measurements, field construction criteria, manufacturer's catalog numbers, and conformance of submittal with requirements of Contract Documents.
  - 7. Coordinate submittals with requirements of work and of Contract Documents.
  - 8. Certify in writing that the submitted shop drawings and product data are in compliance with requirements of Contract Documents. Notify Architect/Engineer in writing at time of submittal, of any deviations from requirements of Contract Documents.
  - 9. Do not fabricate products or begin work which requires submittals until return of submittal with Architect/Engineer acceptance.
  - 10. Equipment scheduled by manufacturer's name and catalog designations, manufacturer's published data and/or specification for that item, in effect on bid date, are considered part of this specification. Approval of other manufacturer's item proposed is contingent upon compliance therewith.

## **1.7 SUBSTITUTIONS**

- A. In accordance with the General Conditions and the General Requirements, Substitution and Product Options, all substitute items must fit in the available space, and be of equal or better quality including efficiency performance, size, and weight, and must be compatible with existing equipment.

## **1.8 PROJECT RECORD DRAWINGS**

- A. Maintain project record drawings in accordance with Division 01.
- B. In addition to the other requirements, mark up a clean set of drawings as the work progresses to show the location and routing of all electrical work which will become permanently concealed. Show complete routing and sizing of any significant revisions to the systems shown.
- C. Record drawing field mark-ups shall be maintained on-site and shall be available for examination of the Owner's Representative at all times.

## **1.9 DEMONSTRATION OF ELECTRICAL SYSTEMS**

- A. During substantial completion inspection:
  - 1. Conduct operating test for approval under provisions of Division 01.
  - 2. Demonstrate installation to operate satisfactorily in accordance with requirements of Contract Documents.
  - 3. Should any portion of installation fail to meet requirements of Contract Documents, repair or replace items failing to meet requirements until items can be demonstrated to comply.
  - 4. Have instruments available for measuring light intensities, voltage and current values, and for demonstration of continuity, grounds, or open circuit conditions.
  - 5. Provide personnel to assist in taking measurements and making test

## **1.10 WARRANTY**

- A. In addition to the requirements of Division 01, or as specified in other sections. Warrant all materials, installation and workmanship for one (1) year from date of acceptance.

## **PART 2 PRODUCTS**

### **2.1 MATERIALS AND EQUIPMENT**

- A. All Materials and Equipment shall be new.
- B. All Materials and Equipment shall be listed by Underwriter's Laboratories or equivalent third party listing agency for the use intended.
- C. Materials and Equipment shall be acceptable to the authority having jurisdiction as suitable for the use intended when installed per listing and labeling instructions.

- D. No materials or equipment containing asbestos in any form shall be used. Where materials or equipment provided by this Contractor are found to contain asbestos such items shall be removed and replaced with non-asbestos containing materials and equipment at no cost to the Owner.
- E. In describing the various items of equipment, in general, each item will be described singularly, even though there may be numerous similar items.

### **PART 3 EXECUTION**

#### **3.1 WORKMANSHIP**

- A. Install Work using procedures defined in NECA Standard of Installation and/or the manufacturer's installation instructions.

#### **3.2 TESTS**

- A. Perform tests in accordance with Section 26 01 26 – Maintenance Testing of Electrical Systems.
- B. Notify the Owner's representative at least 72 hours prior to conducting any tests.
- C. Following completion of installation, test system ground in accordance with the requirements of NETA ATS 7.13. Submit logs of values obtained, and nameplate data of instruments used prior to final inspection.
- D. Perform additional tests required under other sections of these specifications.
- E. Perform all tests in the presence of the Owner's representative.
- F. The Contractor shall provide written notification to the Owner's representative and the State Electrical Inspector thirty days in advance of requests for rough-in and substantial completion inspections.

**END OF SECTION 26 05 00**

**SECTION 26 05 19 – LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Building Wire.
- B. Cable.
- C. Wiring Connections and Terminations.

**1.2 RELATED SECTIONS**

- A. Section 26 05 53 – Identification for Electrical Systems.

**1.3 REFERENCES**

- A. ANSI/NEMA WC 70-2009 – Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy.
- B. NFPA 70 – National Electrical Code.
- C. UL 83 – Thermoplastic Insulated Wire and Cable.
- D. UL 1063 – Standard for Machine and Tool Wire and Cable.
- E. UL 1581 – Reference Standard for Electrical Wires, Cables and Flexible Cords.

**1.4 SUBMITTALS**

- A. Submit data under provisions of Division 01 and Section 26 05 00.
- B. Product Data: Submit product data for all components provided which fall under this section showing configurations, finishes, and dimensions. Each catalog sheet should be clearly marked to indicate exact part number provided, including all options and accessories.

**PART 2 PRODUCTS**

**2.1 BUILDING WIRE**

- A. Thermoplastic-insulated Building Wire: NEMA WC 70.
- B. Feeders and Branch Circuits Larger Than 6 AWG: Copper, stranded conductor, 600 volt insulation, THW, THHN/THWN or XHHW-2 as indicated.
- C. Feeders and Branch Circuits 6 AWG and Smaller: Copper conductor, 600 volt insulation, THHN/THWN or XHHW-2. 6 and 8 AWG, stranded conductor; smaller than 8 AWG, solid or stranded conductor.

D. Branch Circuit Wire Color Code:

1. Color code wires by line or phase as follows:
  - a. Black, red and white for 120/240V systems.
2. For conductors 6 AWG and smaller, insulation shall be colored. For conductors 4 AWG and larger, identify with colored phase tape at all terminals, splices, and boxes.
3. Grounding conductors 6 AWG and smaller shall have green colored insulation. For 4 AWG and larger, use green tape at both ends and at all other visible points in between, including pull and junction boxes.

E. Control Circuits: Copper, stranded conductor 600 volt insulation, THHN/THNN or XHHW-2.

## **2.2 WIRING CONNECTIONS AND TERMINATIONS**

A. For conductors 8 AWG and smaller:

1. Dry interior areas: Spring wire connectors, pre-insulated "twist-on" rated 105 degrees C per UL 468C. Where stranded conductors are terminated on screw type terminals, install crimp insulated fork or ring terminals. Thomas & Betts Sta-Kon or equal.
2. Motor connections: Spring wire connectors, pre-insulated "twist-on" rated 105 degrees C per UL 468C. Provide a minimum of 8 wraps of Scotch 33+ electrical tape around conductors and connector to eliminate connector back off.
3. Wet or exterior: Spring wire connectors, pre-insulated "twist-on", resin filled rated for direct burial per UL 486D.

B. For conductors 6 AWG and larger:

1. Bus lugs and bolted connections: 600 V, 90 degrees C., two hole long barrel irreversible compression copper tin plated. Thomas & Betts or approved equal.
2. Two way connector for splices or taps: 600 V, 90 degrees C., compression long barrel, copper tin plated. Thomas & Betts or approved equal. Insulate with Scotch 23 rubber insulating base covering and Scotch 33+ outer wrap.

## **PART 3 EXECUTION**

### **3.1 GENERAL WIRING METHODS**

- A. Use no wire smaller than 12 AWG for power and lighting circuits, and no smaller than 18 AWG for control wiring.
- B. Use 10 AWG conductor for 20 ampere, 120 volt branch circuit home runs longer than 75 feet.
- C. Splice only in junction or outlet boxes.
- D. Neatly train and lace wiring inside boxes, equipment, and panelboards.
- E. Wiring in lighting fixture channels shall be rated for 90° C minimum.

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- F. Do not share neutral conductors. Provide a dedicated neutral conductor for each branch circuit that requires a neutral.

### **3.2 WIRING INSTALLATION IN RACEWAYS**

- A. Pull all conductors into a raceway at the same time. Verify that raceway is complete and properly supported prior to pulling conductors. Use UL listed wire pulling lubricant for pulling 4 AWG and larger wires.
- B. Install wire in raceway after interior of building has been physically protected from the weather and all mechanical work likely to injure conductors has been completed.
- C. Do not install XHHW-2 conductors when ambient temperatures are below -5 degrees C and THHN/THWN conductors when ambient temperatures are below 0 degrees C.
- D. Conductors shall be carefully inspected for insulation defects and protected from damage as they are installed in the raceway. Where the insulation is defective or damaged, the cable section shall be repaired or replaced at the discretion of the Owner and at no additional cost to the Owner.
- E. Route conductors from each system in independent raceway system and not intermix in the same raceway, enclosure, junction box, wireway, or gutter as another system unless otherwise shown on the plans.
- F. No more than six current carrying conductors shall be installed in any homerun unless otherwise indicated on the drawings or without prior approval from the Engineer.
- G. Completely and thoroughly swab raceway system before installing conductors.
- H. When two or more neutrals are installed in one conduit, identify each with the proper circuit number in accordance with Section 26 05 53.

### **3.3 WIRING CONNECTIONS AND TERMINATIONS**

- A. Stranded wire shall not be wrapped around screw terminals.
- B. Splice only in accessible junction boxes.
- C. Thoroughly clean wires before installing lugs and connectors.
- D. Make splices, taps and terminations to carry full ampacity of conductors without perceptible temperature rise.
- E. Terminate spare conductors with twist on connectors or heat shrink insulation to proper voltage rating.
- F. Control systems wiring in conjunction with mechanical, electrical or miscellaneous equipment to be identified in accordance with wiring diagrams furnished with equipment.
- G. Do not exceed manufacturer's recommended pull tensions.

### **3.4 FIELD QUALITY CONTROL**

- A. Field inspection and testing will be performed under provisions of Division 01 and Section 26 01 26.
  - B. Inspect wire and cable for physical damage and proper connection.
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C. Torque conductor connections and terminations to manufacturer's recommended values.

**3.5 WIRE AND CABLE INSTALLATION SCHEDULE**

A. All Locations: Building wire and/or remote control and signal cable in raceways.

**END OF SECTION 26 05 19**



## **SECTION 26 05 26 – GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS**

### **PART 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- A. Power System Grounding.
- B. Electrical Equipment and Raceway Grounding and Bonding.

#### **1.2 RELATED SECTIONS**

- A. The Work under this section is subject to requirements of the Contract Documents including the General Conditions, Supplementary Conditions, and sections under Division 01 General Requirements, Section 26 05 00 – Common Work Results for Electrical, Division 27 and Division 28.
- B. Section 26 01 26 – Maintenance Testing of Electrical Systems.
- C. Section 26 05 19 – Low-Voltage Electrical Power Conductors and Cables.

#### **1.3 REFERENCE STANDARDS**

- A. ANSI/NEMA GR-1, Ground Rod Electrodes and Ground Rod Electrode Couplings.
- B. ANSI/NFPA 70 – National Electrical Code.
- C. ASTM B 3 – Standard Specification for Soft or Annealed Copper Wire.
- D. IEEE Std 81 – Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System.
- E. IEEE Std 142 – Recommended Practice for Grounding of Industrial and Commercial Power System.
- F. UL 467 – Standard for Grounding and Bonding Equipment.

#### **1.4 SYSTEM DESCRIPTION**

- A. Provide a complete grounding system for services and equipment as required by State and Local Codes, NEC, applicable portions of other NFPA codes, and as indicated herein.

#### **1.5 CLOSEOUT SUBMITTALS**

- A. Project Record Drawings
  - 1. Show the actual installed routing of grounding electrode conductor, and size/type of bonding conductors and termination locations of all major bonding connections (water, piping, steel, fuel tanks, etc.).
- B. Test Reports
  - 1. See Section 26 01 26 - Maintenance Testing of Electrical Systems for Grounding System Tests.

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2. Each test report shall include:
  - a. Date of test.
  - b. Test operator.
  - c. Instrument or other test equipment used.
  - d. Ground impedance in ohms.
  - e. Assumptions made - if required.

### **1.6 COORDINATION**

- A. Division 01 – Administrative Requirements: Requirements for Coordination.
- B. Complete grounding and bonding of building reinforcing steel prior to concrete placement.

## **PART 2 PRODUCTS**

### **2.1 MATERIALS**

- A. Solid Ground Rods: ANSI/NEMA GR-1, copper-encased steel,  $\frac{3}{4}$  inch diameter, minimum length 10 feet. Ground rods shall be clean and smooth.
- B. Bonding Conductors: Solid bare copper wire for sizes No. 8 AWG and smaller diameter. Stranded bare copper wire for sizes No. 6 AWG and larger diameter. Conductors may be insulated conductors if used provide green insulation.
- C. Grounding Conductors: Copper conductor bare or green insulated.
- D. Mechanical Grounding and Bonding Connectors: Non-reversible crimp type lugs only. Use factory made compression lug for all terminations.
- E. Exothermic Grounding and Bonding Connectors: AWS A5.8/A5.8M Exothermic welded type. Welding procedure shall include the proper mold and powder charge and shall conform to the manufacturer's recommendations.

## **PART 3 EXECUTION**

### **3.1 INSTALLATION**

- A. Provide a separate, insulated equipment-grounding conductor in all feeder and branch circuits. Terminate each end on a grounding lug, bus, or bushing. Multiple conductors on single lug not permitted. Each grounding conductor shall terminate on its own terminal lug.
- B. Connect grounding electrode conductors to metal water pipe and building steel using a suitable ground clamp. Make connections to flanged piping at street side of flange. Provide bonding jumper around water meter and back flow preventors.
- C. Provide grounding and bonding at Utility Company's metering equipment.

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- D. Bond together system neutrals, service equipment enclosures, exposed non-current carrying metal parts of electrical equipment, metal raceway systems, grounding conductor in raceways and cables, receptacle ground connectors, and plumbing and fuel systems.
- E. Grounding conductors for branch circuits shall be sized in accordance with NEC, except minimum size grounding conductor shall be No. 12 AWG.
- F. Grounding conductor is in addition to neutral conductor and in no case shall neutral conductor serve as grounding means.
- G. Ground rods shall be installed so that the top of the rod is not less than 12 inches below finished grade. Conceal after inspection.

### **3.2 FIELD QUALITY CONTROL**

- A. Inspect grounding and bonding system conductors and connections for tightness and proper installation.
- B. Perform system ground test as specified in Section 26 01 26 - Maintenance Testing of Electrical Systems.
- C. Upon completion of the ground installation and before connection to the permanent facility power the Contractor shall measure the ground resistance of the grounding electrode system. The Contractor shall notify the Owner's representatives a minimum of 5 business days prior to the scheduled ground testing date so they may be present at the time of testing. The Contractor shall immediately notify the Owner's representative if the measured ground resistance is above 20 ohms. The Contractor shall submit a copy of the test report to the Owner's representative within 10 days after testing and before the ground system becomes inaccessible.
- D. Continuity Test: Continuity test shall be performed on all power receptacles to ensure that the ground terminals are properly grounded to the facility ground system.

**END OF SECTION 26 05 26**

## **SECTION 26 05 29 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS**

### **PART 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- A. Section included hangers and supports for Power Systems.
- B. Conduit Supports.
- C. Formed Steel Channel.
- D. Spring Steel Clips.
- E. Equipment Bases and Supports.

#### **1.2 RELATED SECTIONS**

- A. The Work under this section is subject to requirements of the Contract Documents including the General Conditions, Supplementary Conditions, and sections under Division 01 General Requirements, and Section 26 05 00 – Common Work Results for Electrical, Division 27 and Division 28.
- B. Section 26 05 48 - Vibration and Seismic Controls for Electrical Systems.

#### **1.3 REFERENCES**

- A. International Building Code (IBC), Chapter 16 – Structural Design.

#### **1.4 SUBMITTALS**

- A. Division 01: Requirements for submittals.
- B. Product Data: Submit product data for specialty supports.

#### **1.5 QUALITY ASSURANCE**

- A. Support systems shall be adequate for weight of equipment and conduit, including wiring, which they carry.

### **PART 2 PRODUCTS**

#### **2.1 CONDUIT SUPPORTS**

- A. Manufacturers:
  - 1. Allied Tube & Conduit Corp.
  - 2. Minerallac Fastening Systems.
  - 3. O-Z Gedney Co.
  - 4. Substitutions: per Division 01

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- B. Hanger Rods: Threaded high tensile strength galvanized carbon steel with free running threads.
- C. Beam Clamps: Malleable Iron, with tapered hole in base and back to accept either bolt or hanger rod. Set screw: hardened steel.
- D. Conduit clamps for trapeze hangers: Galvanized steel, notched to fit trapeze with single bolt to tighten.
- E. Conduit clamps - general purpose: One-hole malleable iron for surface mounted conduits.

### **2.2 FORMED STEEL CHANNEL**

- A. Manufacturers:
  - 1. B-Line Systems.
  - 2. Allied Tube & Conduit Corp.
  - 3. Unistrut Corp.
  - 4. Substitutions: per Division 01.
- B. Product Description: Galvanized 12 gage thick steel. With holes 1-1/2 inches on center.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Division 01: Verification of existing conditions before starting work.
- B. Verify openings are ready to receive sleeves.

### **3.2 PREPARATION**

- A. Obtain permission from Owner's Representative before using powder-actuated anchors.
- B. Obtain permission from Owner's Representative before drilling or cutting structural members.

### **3.3 INSTALLATION - GENERAL**

- A. Fasten hanger rods, conduit clamps, and outlet and junction boxes to building structure using precast insert system, expansion anchors, preset inserts, beam clamps, or spring steel clips.
- B. Use self-drilling anchors or expansion anchor on concrete surfaces; sheet metal screws in sheet metal studs; and wood screws in wood construction.
- C. Do not fasten supports to piping, ductwork, mechanical equipment, conduit, or ceiling suspension system.
- D. Do not penetrate by drilling or screwing into metal roof decking. All penetrations into metal roof decking must be approved by the Project Manager in writing.
- E. Fabricate supports from structural steel or steel channel, rigidly welded or bolted to present a neat appearance. Use hexagon head bolts with spring lock washers under all nuts.

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- F. Install surface-mounted cabinets and panelboards with minimum of four anchors.
- G. Bridge studs top and bottom with channels to support flush-mounted cabinets and panelboards in stud walls.
- H. Securely fasten fixtures and equipment to building structure in accordance with manufacturer's recommendations and to provide necessary earthquake anchorage.
- I. Provide wall attached fixtures and equipment weighing less than 50 pounds with backing plates of at least 1/8" x 10" sheet steel or 2" x 10" fire retardant treated wood securely built into the structural walls. Submit attachment details of heavier equipment for approval.
- J. Earthquake Anchorages:
  - 1. Equipment weighing more than 50 pounds shall be adequately anchored to the building structure to resist lateral earthquake forces.
  - 2. Total lateral (earthquake) forces shall be 1.5 times the equipment weight acting laterally in any direction through the equipment center of gravity. Provide adequate backing at structural attachment points to accept the forces involved.

**END OF SECTION 26 05 29**

## **SECTION 26 05 33 – RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS**

### **PART 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- A. Metal Conduit.
- B. Flexible Metal Conduit.
- C. Liquidtight Metal Conduit.
- D. Fittings and Conduit Bodies.
- E. Wall and Ceiling Outlet Boxes.
- F. Pull and Junction Boxes.

#### **1.2 RELATED SECTIONS**

- A. The Work under this section is subject to requirements of the Contract Documents including the General Conditions, Supplementary Conditions, and sections under Division 01 - General Requirements and Section 26 05 00 – Common Work Results for Electrical.
- B. Division 07 - Thermal and Moisture Protection.
- C. Section 26 05 19 – Low-Voltage Electrical Power Conductors and Cables.
- D. Section 26 05 26 – Grounding and Bonding for Electrical Systems.
- E. Section 26 05 29 – Hangers and Supports for Electrical Systems.
- F. Section 26 05 53 – Identification for Electrical Systems.
- G. Section 26 27 26 – Wiring Devices.

#### **1.3 REFERENCES**

- A. American National Standards Institute (ANSI):
  - 1. ANSI C80.1 - Rigid Steel Conduit, Zinc Coated.
- B. American Society for Testing and Materials (ASTM):
  - 1. ASTM A 123 – Specification for Zinc Coatings on Products Fabricated from Rolled, Pressed, and Forged Steel Shapes, Plates, Bars and Strip.
- C. National Electrical Manufacturers Association (NEMA):
  - 1. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies.
  - 2. NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports.

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3. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

D. Underwriters Laboratory (UL):

1. UL 6 - Rigid Steel Conduit, Zinc Coated.
2. UL 514B – Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies.

E. National Fire Protection Association (NFPA):

1. NFPA 70 - National Electrical Code.

F. International Building Code (IBC):

1. IBC chapters 16 and 17 seismic requirements.

### **1.4 RACEWAY AND BOX INSTALLATION SCHEDULE**

A. Underground more than 5 feet from foundation wall:

1. Raceway: Provide rigid steel conduit or intermediate metal conduit.
  - a. Provide detectable warning tape over all underground raceways per section 26 05 53.
  - b. Provide 3-inch minimum spacing between raceways.
  - c. Provide 3/4 inch minus, non-frost susceptible material 6 inches above and below conduit. Backfill remaining trench free of debris or rocks greater than 1 inch in diameter.
2. Boxes and Enclosures: Provide concrete type 1A handhole.

B. Under or in concrete slab, or underground within 5 feet of foundation wall:

1. Raceway: Provide rigid steel conduit or intermediate metal conduit. Arrange raceway so the curved portion of bend is not visible above finished slab.
2. Boxes and Enclosures: Provide concrete tight cast and sheet metal steel metal boxes.

C. Outdoor Above Grade, Damp or Wet Interior Locations:

1. Raceway: Provide rigid steel conduit or intermediate metal conduit.
2. Boxes and Enclosures: Provide weatherproof malleable iron for branch circuit junction and outlet boxes. Provide weatherproof NEMA 3R sheet metal enclosures for safety and disconnect switches and NEMA 4 sheet metal enclosures with gaskets for motor controllers and control panels.
3. Fittings: Provide galvanized malleable iron with gaskets. Provide Myers threaded hubs for all conduit entries into top and side of sheet metal enclosures.



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### **D. Exposed Locations:**

1. Raceway: Provide rigid steel conduit or intermediate metal conduit.
2. Boxes and Enclosures: Provide cast metal boxes.
3. Fittings: Provide galvanized malleable iron and steel.
4. Surface Raceway and Boxes. Provide surface raceway and boxes in all locations.

### **E. Branch Circuits 60 Amperes or Larger and Feeders:**

1. Raceway: Provide rigid steel conduit or intermediate metal conduit.
2. Boxes and Enclosures: Provide sheet-metal boxes.
3. Fittings: Provide galvanized malleable iron and steel.

### **F. Equipment Connections: Provide short extensions (three feet maximum) of liquid tight flexible metal conduit for connections to light fixtures, motors, vibrating equipment or equipment that requires removal for maintenance or replacement.**

## **1.5 DESIGN REQUIREMENTS**

### **A. Raceway Minimum Size:**

1. Below Grade: Provide 1 inch minimum, unless otherwise noted.
2. Above Grade or Slab on Grade: Provide 1/2 inch minimum, unless otherwise noted. Raceway may be reduced to 1/2 inch for final connection of raceway up to 6 feet for connection to fixture or device where maximum conduit entry size is 1/2 inch.
3. Line Voltage Circuits: Raceway is sized on the drawings for copper conductors with 600-Volt type XHHW insulation, unless otherwise noted. Where a raceway size is not shown on the drawings, it shall be calculated to not exceed the percentage fill specified in the NEC Table 1, Chapter 9 using the conduit dimensions of the NEC Table 4, Chapter 9 and conductor properties of the NEC Table 5, Chapter 9.
4. Low-Voltage Circuits: Where installed in raceways, the raceway size shall be calculated to not exceed the percentage fill specified in the NEC Table 1, Chapter 9, using the conduit dimensions of the NEC Table 4, Chapter 9, and cable diameter provided by the manufacturer.

### **B. Box Minimum Size: Provide all boxes sized and configured per NEC Article 370 and as specified in this section.**

### **C. Seismic Support: Provide support in accordance with section 26 05 29 – Hangers and Supports for Electrical Systems and 26 05 48 – Vibration and Seismic Support for Electrical Systems.**

## **1.6 DELIVERY, STORAGE, AND HANDLING**

- ### **A. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.**

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#### **PART 2 PRODUCTS**

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##### **2.1 RIGID METAL CONDUIT (RMC)**

- A. Rigid Steel Conduit: ANSI C80.1, UL 6.
- B. Fittings and Conduit Bodies: NEMA FB 1, UL 514B; Galvanized malleable iron with threaded hubs for all conduit entries. Provide threaded connections and couplings only. Set Screw and running thread fittings are not permitted.
- C. Provide insulated throat bushings at all conduit terminations.

##### **2.2 INTERMEDIATE METAL CONDUIT (IMC)**

- A. Product Description: ANSI C80.6, UL 1242; Galvanized Steel Conduit.
- B. Fittings and Conduit Bodies: NEMA FB 1, UL 514B; use fittings and conduit bodies specified above for rigid steel conduit.
- C. Provide insulated throat bushings at all conduit terminations.

##### **2.3 FLEXIBLE METAL CONDUIT (FMC)**

- A. Product Description: UL 1, FS WW-C-566; galvanized or zinc-coated flexible steel, full or reduced-wall thickness.
- B. Fittings and Conduit Bodies: ANSI/NEMA FB 1; steel or malleable iron with insulated throat bushings. Die cast zinc or threaded inside throat fittings are not acceptable.

##### **2.4 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)**

- A. Product Description: UL 360, flexible metal conduit with interlocked steel construction and PVC jacket.
- B. Fittings and Conduit Bodies: ANSI/NEMA FB 1; liquid tight steel or malleable iron with insulated throat bushings. Die cast fittings are not acceptable.

##### **2.5 ELECTRICAL METALLIC TUBING (EMT)**

- A. Not approved for use on this project.

##### **2.6 RIGID NONMETALLIC CONDUIT (RNC)**

- A. Not approved for use on this project.

##### **2.7 HIGH DENSITY POLYETHYLENE CONDUIT (HDPE)**

- A. Not approved for use on this project.

##### **2.8 ELECTRICAL NONMETALLIC TUBING (ENT)**

- A. Not approved for use on this project.

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#### **2.9 OUTLET BOXES**

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- A. Sheet Metal Outlet Boxes: ANSI/NEMA OS 1, UL514A galvanized steel, with plaster ring where applicable.
  - 1. Minimum Size: 4 inches square or octagonal, 1-1/2 inches deep, unless otherwise noted.
  - 2. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; furnish 1/2 inch male fixture studs where required. Minimum Size: 4 inches square or octagonal, 2-1/8 inches deep.
- B. Cast Boxes: NEMA FB 1, Type FD, galvanized malleable iron. Furnish gasketed cover by box manufacturer. Furnish threaded hubs. "Bell" boxes are not acceptable.
- C. Wall Plates: As specified in Section 26 27 26.

#### **2.10 PULL AND JUNCTION BOXES**

- A. Sheet Metal Pull and Junction Boxes: ANSI/NEMA OS 1, UL514A galvanized steel.
  - 1. Minimum Size: 4 inches square or octagonal, 1-1/2 inches deep, unless otherwise noted.
- B. Sheet Metal Boxes Larger Than 12 Inches in Any Dimension: Hinged enclosure Hoffman or approved equal.
- C. Cast Metal Boxes for all except underground Location Installations: NEMA 250, Type 4X; flat-flanged, surface mounted junction box, UL listed as raintight:
  - 1. Material: Galvanized cast iron.
  - 2. Cover: Furnish with ground flange, neoprene gasket, and stainless steel cover and screws.
- D. Cast Metal Boxes for Underground Installations: NEMA 250, Type 4; flat-flanged, flush-mounted junction box, UL listed as raintight:
  - 1. Material: Galvanized cast iron.
  - 2. Cover: Furnish with outside flange, neoprene gasket, and recessed stainless steel cover and screws.
- E. Fiberglass Concrete composite Type 1A Handholes: Die-molded glass-fiber concrete composite hand holes with pre-cut 6 x 6 inch cable entrance at center bottom of each side:
  - 1. Cover: Glass-fiber concrete composite, weatherproof cover with non-skid finish.
  - 2. Cover Legend: "ELECTRIC".
- F. Polymer Concrete Junction Boxes for Underground Installations: Polymer concrete consisting of sand and aggregate bound together with a polymer resin. Internal reinforcement shall be provided by means of steel, fiberglass or a combination of the two. The installed enclosure shall be rated for a minimum test load of 7500 pounds distributed over a 10 inch by 10 inch area and used in occasional, non-deliberate vehicular traffic or pedestrian traffic application. All hardware shall be stainless steel.

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**2.11 BUSHINGS**

- A. Non-grounding: Threaded impact resistant plastic.
- B. Grounding: Insulated galvanized malleable iron/steel with hardened screw bond to raceway and conductor lug.

**2.12 LOCKNUTS**

- A. Threaded Electro Zinc Plated Steel designed to cut through protective coatings for ground continuity.

**PART 3 EXECUTION**

**3.1 INSTALLATION**

- A. Ground and bond raceway and boxes in accordance with Section 26 05 26.
- B. Provide seismic support and fasten raceway and box supports to structure and finishes in accordance with Section 26 05 29.
- C. Unless otherwise noted, do not inter-mix conductors from separate panelboards or any other system in the same raceway system or junction boxes.

**3.2 INSTALLATION - GENERAL RACEWAY**

- A. Install raceway for all systems, unless otherwise noted.
- B. Install an equipment grounding conductor inside of all raceways containing line voltage conductors.
- C. Do not route conduits on roofs, outside of exterior walls, or along the surface of interior finished walls unless specifically noted on the plans.
- D. Raceway routing and boxes are shown in approximate locations unless dimensioned. Where raceway routing is not denoted, field-coordinate to provide complete wiring system.
- E. Do not route raceways on floor. Arrange raceway and boxes to maintain a minimum of 6 feet 6 inches of headroom and present a neat appearance. Install raceways level and square to a tolerance of 1/8" per 10 feet. Route exposed raceways and raceways above accessible ceilings parallel and perpendicular to walls, ceiling, and adjacent piping.
- F. Maintain minimum 6-inch clearance between raceway and mechanical and piping and ductwork. Maintain 12-inch clearance between raceway and heat sources such as flues, steam pipes, heating pipes, heating appliances, and other surfaces with temperatures exceeding 104 degrees F.
- G. Do not install raceway imbedded in spray applied fire proofing.
- H. Raceways and boxes penetrating vapor barriers or penetrating areas from cold to warm shall be taped and sealed with a non-hardening duct sealing compound to prevent the accumulation of moisture, and shall include a vapor barrier on the outside.
- I. Conduit embedded in concrete shall not be larger than 1/3 the thickness of the wall or slab and shall be spaced not less than three diameters apart. No cutting of reinforcing bars shall be

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- permitted unless specifically approved. Should structural members prevent the installation of conduit or equipment, notify the Contracting Officer before proceeding.
- J. Route conduits in slabs to have 1 inch minimum cover. Conduits in slab shall not compromise the structural integrity of the slab.
  - K. Field coordinate the installation of all conduit installed in or through concrete slabs containing radiant heating piping to avoid conflict with the piping prior to the concrete being poured. Core drilling of slabs with radiant heat piping installed is not allowed.
  - L. Arrange raceway supports to prevent misalignment during wiring installation. Support raceway using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.
  - M. Do not attach raceway to piping systems and do not fasten raceway with wire or perforated pipe straps. Remove all wire used for temporary raceway support during construction, before conductors are pulled. Raceway shall be installed to permit ready removal of equipment, piping, ductwork, or ceiling tiles.
  - N. Group raceway in parallel runs where practical and use conduit rack constructed of steel channel with conduit straps or clamps, as specified in Section 26 05 29. Provide space on each rack for 25 percent additional raceway.
  - O. Cut conduit square; de-burr cut ends. Bring conduit to the shoulder of fittings and couplings and fasten securely. Where locknuts are used, install with one inside box and one outside with dished part against box.
  - P. Use threaded raintight conduit hubs for fastening conduit to cast boxes, and for fastening conduit to sheet metal boxes in damp or wet locations. Sealing locknuts are not acceptable.
  - Q. Install no more than the equivalent of three 90-degree bends between boxes.
  - R. Install conduit bodies to make sharp changes in direction, such as around beams. "Goosenecks" in conduits are not acceptable.
  - S. Use hydraulic one-shot conduit bender or factory elbows for bends in conduit larger than 2 inch size.
  - T. Provide protective plastic bushings or insulated throat bushings at each raceway termination not installed to an enclosure. Bushings shall be threaded to the raceway end or connector.
  - U. Install fittings and flexible metal conduit to accommodate 3-axis movements where raceway crosses seismic joints.
  - V. Provide weatherhead on all raceway stub ups which are outdoors and do not terminate into equipment.
  - W. Use cable sealing fittings forming a watertight non-slip connection to pass cords and cables into conduit. Size cable sealing fitting for the conductor outside diameter. Use Appleton CG series or equal cable sealing fittings.
  - X. Use suitable caps to protect installed raceway against entrance of dirt and moisture.
  - Y. Provide nylon "jet-line" or approved equal pull string in empty raceway, except sleeves and nipples.
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#### **3.3 INSTALLATION – GENERAL BOXES**

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- A. Provide electrical boxes as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections, and code compliance. All electrical box locations shown on Drawings are approximate unless dimensioned.
- B. Coordinate layout and installation of boxes to provide adequate headroom and working clearance.
- C. Align wall-mounted outlet boxes for switches, thermostats, and similar devices.
- D. Use multiple-gang boxes where more than one device are mounted together; do not use sectional boxes. Provide barriers to separate wiring of different voltage systems and where normal and emergency power circuits occur in the same box.
- E. Adjust box location up to 6 feet prior to rough-in to accommodate intended purpose.
- F. Orient boxes to accommodate wiring devices oriented as specified in Section 26 27 26.
- G. Unless otherwise specifically noted, locate outlet boxes for light switches within 6 inches of the door jamb on the latch side of the door.
- H. Position outlets to locate luminaires as shown on reflected ceiling plans.
- I. Provide knockout closures for unused openings.
- J. Install boxes in walls without damaging wall insulation or reducing its effectiveness.
- K. Do not fasten boxes to piping systems.
- L. Support boxes independently of conduit.
- M. Clean interior of boxes to remove dust, debris, and other material and clean exposed surfaces and restore finish.
- N. Provide blank covers or plates for all boxes that do not contain devices.

#### **3.4 INSTALLATION – BURIED CONDUITS**

- A. Excavation and backfilling shall be in accordance with these specifications and the applicable portions of Division 31:
  - 1. Excavate and backfill as necessary for proper installation or work.
  - 2. Provide bracing and shoring as necessary or required.
  - 3. Compact backfill under footings, floor slabs and paving using materials and methods specified under Division 31, Earthwork.
  - 4. All conduits outside the building perimeter shall be buried a minimum of 24 inches below grade. Bottom of trench shall be smoothed and all rocks and cobbles 3 inches and larger shall be removed. Conduits shall be bedded in a minimum of 2 inches of sand and shall have a cover of 2 inches minimum of sand. Trench shall be backfilled with non-frost susceptible material and compacted.
  - 5. Conduits below slab on grade shall be installed in the top 6 inches of classified material.

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6. Damage to existing underground utilities shall be repaired immediately by the Contractor at no cost to the Owner.

**END OF SECTION 26 05 33**

**SECTION 26 05 48 – VIBRATION AND SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. This section includes requirements for vibration and seismic restraints for electrical equipment installed in seismic categories C, D, E or F.

**1.2 RELATED SECTIONS**

- A. The Work under this section is subject to requirements of the Contract Documents including the General Conditions, Supplementary Conditions, and sections under Division 01 General Requirements, Section 26 05 00 – Common Work Results for Electrical, Division 27 and Division 28.
- B. Section 26 05 33 - Raceway and Boxes for Electrical Systems.
- C. Section 26 05 29 – Hangers and Supports for Electrical Systems.
- D. Section 26 24 16 – Panelboards.
- E. Section 26 51 00 – Interior Lighting.
- F. Section 26 52 00 – Emergency Lighting.
- G. Section 26 56 00 – Exterior Lighting.

**1.3 DESCRIPTION**

- A. Provide seismic anchorage and restraint of electrical systems including, equipment, raceways, lighting fixtures, etc.
- B. Seismic Category D, E and F:
  - 1. All electrical items that are of Importance Factor (Ip) = 1.5 are required to be seismically braced. This applies to the following:
    - a. The component is required to function for life safety purposes after an earthquake, including fire protection systems, fire alarm systems, emergency lighting, etc.
- C. All other electrical equipment shall be assigned a component importance factor (Ip) = 1.0 and are required to be seismically braced unless one of the following conditions is satisfied:
  - 1. Component is MOUNTED (connection to structure) at less than 4' above the floor (to the center of gravity of the component), and weighs less than 400 lbs.
  - 2. Component is mounted higher than 4' (to the center of gravity of the component), but weighs less than 50 lbs (if it is concealed).



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3. Component is mounted higher than 4' (to the center of gravity of the component), but weighs less than 100 lbs (if it is exposed).
  4. Flexible connections between the components and associated conduit are provided.
  5. All runs or groupings of conduits on or off of trapezes shall be seismically braced, unless the distribution system (including conduit, wiring and fittings) weighs less than 5 pounds per linear foot.
  6. Lighting fixtures, lighted signs and ceiling fans that are not rigidly connected to conduit, that are supported by chains or otherwise suspended from structure, are not required to be seismically braced, as long as:
    - a. The attachment points can carry at least 140% of the weight of the fixture, and
    - b. The swinging light will not create a falling debris problem by bumping into ceiling of other finishes, and
    - c. Connections to structure allow for movement of the fixture without damaging the connections.
- D. In accordance with ASCE 7-10 13.6.4, all electrical components with  $I_p = 1.5$  shall also satisfy the following requirements:
1. Provisions shall be made to eliminate seismic impact between components.
  2. Loads imposed on the components by attached utility or service lines that are attached to separate structures shall be evaluated.
  3. Electrical control panels, and other items with slide-out components shall have a latching mechanism to hold the components in place.
  4. Electrical cabinet design shall comply with the applicable National Electrical Manufacturers Association (NEMA) standards. Cutouts in the lower shear panel that have not been made by the manufacturer and reduce significantly the strength of the cabinet shall be specifically evaluated.
  5. The attachments of additional external items weighing more than 100 lbs shall be specifically evaluated if not provided by the manufacturer.
  6. Where conduit or similar electrical distribution components are attached to structures that could displace relative to one another and for isolated structures where such components cross the isolation interface, the components shall be designed to accommodate the seismic relative displacements defined in ASCE 7-10 Section 13.3.2.
- E. Unless otherwise exempted above, electrical component supports and the means by which they are attached to the component shall be designed for the Seismic Category they are installed in accordance with ASCE 7-10 Section 13.6.5, which includes the following additional requirements:

#### **1.4 REFERENCE STANDARDS**

- A. Seismic anchorage and restraints shall be designed and installed in accordance with codes and standards as enforced by authorities having jurisdiction in Kenai, Alaska. Authorities shall include Owner's insurance company.

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- B. Where applicable, building standards supersede those of other evaluation or listing agencies referenced in specification.
- C. International Building Code (IBC), Chapter 16 – Structural Design.
- D. ASCE 7-10 Chapter 13.

**PART 2 PRODUCTS**

**2.1 MATERIALS**

- A. Materials and devices shall be in accordance with applicable codes and standards and shall be appropriate for intended use.
- B. Anchors and attachments to building structure shall be as approved by building Structural engineer.

**2.2 EQUIPMENT**

- A. Equipment available with seismic rating shall be provided with rating applicable to seismic zone of project location.

**PART 3 EXECUTION**

**3.1 INSTALLATION**

- A. Secure stationary equipment, raceways and equipment supports to structure or special supports to provide protection against earthquakes and to restrain lateral or vertical movement.
- B. Coordinate seismic restraints with building Structural engineer and incorporate building Structural engineer's requirements.
- C. Seismic restraint methods and materials shall be supplementary to support devices specified in other sections of this specification and together shall serve as equipment support criteria.
- D. Coordinate installation of devices with other trades and incorporate their requirements.
- E. Modify raceway and equipment locations as required for seismic restraint system.
- F. Seismic restraint systems shall not interfere with installation of other building systems or access.

**END OF SECTION 26 05 48**

## **SECTION 26 05 53 – IDENTIFICATION FOR ELECTRICAL SYSTEMS**

### **PART 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- A. Nameplates.
- B. Wire and Cable Markers.
- C. Underground Warning Tape.

#### **1.2 RELATED SECTIONS**

- A. The Work under this section is subject to requirements of the Contract Documents including the General Conditions, Supplementary Conditions, and sections under Division 01 General Requirements, and Section 26 05 00 – Common Work Results for Electrical.
- B. Section 26 05 19 – Low-Voltage Electrical Power Conductors and Cables.
- C. Section 26 05 33 – Raceway and Boxes for Electrical Systems.
- D. Section 26 24 16 – Panelboards.
- E. Section 26 27 26 – Wiring Devices.

#### **1.3 ENVIRONMENTAL REQUIREMENTS**

- A. Install labels and nameplates only when ambient temperature and humidity conditions for adhesive are within range recommended by manufacturer.

### **PART 2 PRODUCTS**

#### **2.1 NAMEPLATES**

- A. Product Description: Laminated three-layer plastic with engraved white letters on black background. Nameplate for service disconnect shall be engraved white letters on red background.
- B. Letter Size:
  - 1. 1/4-inch high letters for identifying individual panel or equipment.
  - 2. 1/8-inch high letters for remaining lines with 1/8 inch spacing between lines.
- C. Minimum nameplate size: 1/8 inch thick with a consistent length and height for each type of nameplate wherever installed on the project.

#### **2.2 WIRE MARKERS**

- A. Power and Lighting Description: Machine printed heat-shrink tubing, cloth or wrap-on type, for all neutrals and Phase conductors.

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#### **2.3 UNDERGROUND WARNING TAPE**

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- A. Product Description: Red, 6-inch wide, detectable.
- B. Wording to read "Caution – Buried Electric Line Below".

### **PART 3 EXECUTION**

#### **3.1 GENERAL INSTALLATION**

- A. Degrease and clean surfaces to receive nameplates and tape labels.
- B. Install nameplates and tape labels parallel to equipment lines.
- C. Underground Warning Tape Installation: Install underground warning tape along length of each underground conduit, raceway, or cable 6 to 8 inches below finished grade, directly above buried conduit, raceway, or cable.

#### **3.2 NAMEPLATE INSTALLATION**

- A. Secure nameplates to equipment fronts using machine screws tapped and threaded into panelboard, or using rivets. The use of adhesives is not acceptable. Machine screws to not protrude more than 1/16 inch on back side.
- B. Service Disconnect Nameplate: Provide nameplate on exterior service disconnect that reads "SERVICE DISCONNECT".
- C. Branch Panelboard Nameplates:
  - 1. Provide nameplate for each panelboard with the following information:
    - a. Line 1: Panelboard name.
    - b. Line 3: Voltage, phase and wire configuration.
    - c. Line 4: AIC rating of the panelboard.
- D. Disconnects and Starters:
  - 1. Provide nameplate for each device with the following information:
    - a. Line 1: Load served.
    - b. Line 2: Panelboard and circuit number from which the device is fed.

#### **3.3 WIRE IDENTIFICATION**

- A. Provide wire markers on each conductor in panelboard gutters, pull boxes, outlet and junction boxes, and at load connection. Identification shall be as follows:
    - 1. Markers shall be located within one inch of each cable end, except at panelboards, where markers for branch circuit conductors shall be visible without removing panel deadfront.
    - 2. Each wire and cable shall carry the same labeled designation over its entire run, regardless of intermediate terminations.
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3. Color code phases, neutral, and ground per NEC requirements and Section 26 05 19.
  4. For power and lighting circuits, identify with branch circuit or feeder number.
  5. Control Circuits: Control wire number as indicated on schematic and shop drawings.
- B. Provide pull string markers at each end of all pull strings. Marker shall identify the location of the opposite end of the pull string.

**3.4 PANELBOARD IDENTIFICATION**

- A. Provide panelboard circuit directories in accordance with Section 26 24 16.

**END OF SECTION 26 05 53**

## **SECTION 26 05 80 - HEATING CABLES**

### **PART 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- A. Self-regulating roof and gutter de-icing cables (inside pipe).
- B. Controls.

#### **1.2 RELATED SECTIONS**

- A. The Work under this section is subject to requirements of the Contract Documents including the General Conditions, Supplementary Conditions, and sections under Division 01 - General Requirements and Section 26 05 00 – Common Work Results for Electrical.
- B. Division 02 – Water and Sewer Piping.
- C. Divisions 21, 22 and 23.
- D. Section 26 05 19 – Low-Voltage Electrical Power Conductors and Cables.
- E. Section 26 05 33 – Raceway and Boxes for Electrical Systems.
- F. Section 26 05 53 – Identification for Electrical Systems: Nameplates for Heat Trace Controls.
- G. Section 26 27 26 – Wiring Devices: Pilot Light Controls.

#### **1.3 SUBMITTALS**

- A. Product Data: Provide data for heating cable, terminations, and control components.

#### **1.4 QUALIFICATIONS**

- A. Manufacturer: Company specializing in manufacturing the products specified in this Section with minimum three years' experience.

#### **1.5 COORDINATION**

- A. Coordinate Work under provisions of Division 01.
- B. Coordinate installation of heating cable with installation of outfall piping.

#### **1.6 WARRANTY**

- A. The heat tracing cable shall be warranted against manufacturing defects for 10 years from date of shipment.

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#### **PART 2 PRODUCTS**

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##### **2.1 ACCEPTABLE MANUFACTURERS – SELF REGULATING ROOF AND GUTTER DE-ICING CABLE (INSIDE PIPE)**

- A. Raychem (Pentair).
- B. Thermon.
- C. Chromalox.
- D. Nelson (Emerson).
- E. Substitutions: Under the provisions of Division 01.

##### **2.2 SELF-REGULATING ROOF AND GUTTER DE-ICING CABLE (INSIDE PIPE)**

- A. Heating cables installed inside piping shall be the self-regulating type, listed for use as snow and ice de-icing cables.
- B. The heating cable shall consist of two 16-gauge tin-coated-copper bus wires embedded in parallel in a self-regulating polymer core. Power output shall vary in response to temperature all along its length, allowing the heating cable to be crossed over itself without overheating, to be cut to length in the field. The heating cable shall be covered by a crosslinked dielectric jacket and protected by a tinned-copper braid and a modified polyolefin or fluoropolymer outer jacket.
- C. Self-regulating heating cable be manufactured and tested for a design life of 20 years based on accelerated aging techniques specified in IEEE Standards 1, 98, & 99 and UL Standard 746B.
- D. The heating cable shall be of parallel circuit construction to allow the cable to be spliced if it is inadvertently cut during or after construction, and to be powered from both ends if it becomes advantageous to divide a circuit in two.
- E. The heating cable shall operate on 120 volts without the use of transformers.
- F. Heating cables shall have a minimum nominal power output of 12W/ft at the operating voltage.
- G. The heating cable power connection and end seal terminations shall be made in an above grade in an accessible NEMA 4X junction box.
- H. Accessories shall be listed for use with the heating cable, as recommended by the manufacturer:
  - 1. Power Connection Kit: Nema 4X rated or NEMA 1 rated if installed indoors.
  - 2. End Seal Kit: NEMA 4X rated, above-insulation end seal, cold-applied.
  - 3. Splice or Tee Connection Kit: Cold-applied, low-profile re-enterable splice for in-line connection.

##### **2.3 CONTROLS**

- A. Each heating cable circuit shall be protected by a 30-mA ground-fault protection device and be provided with a disconnecting means capable of being locked in the open position.

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- B. Lockable pilot light switch as specified in Section 26 27 26 – Wiring Devices.

### **PART 3 EXECUTION**

#### **3.1 EXAMINATION**

- A. Verify that piping is ready to receive work.
- B. Verify field measurements are as shown on shop drawings.
- C. Verify that required utilities are available, in proper location, and ready for use.
- D. Beginning of installation means installer accepts conditions.

#### **3.2 INSTALLATION**

- A. All power termination junctions shall be installed so they are accessible.
- B. Install the de-icing cables looped inside the drain and drain piping with the power termination kit located inside the building in an accessible location.
- C. The heating cable shall be installed according to the manufacturer's recommendations, the instructions supplied with the heating cable and components.
- D. Heating-cable repairs and splices shall be made using a splice kit provided by the manufacturer and specifically approved for the purposes. They shall pass the Megger test after installation.
- E. Do not exceed the maximum length allowable by the heat trace manufacturer for the circuit breaker installed.
- F. Clearly label any device controlling heat trace circuits with permanent markings per Section 26 05 53 – Identification for Electrical Systems.

#### **3.3 FIELD QUALITY CONTROL**

- A. Upon completion of the installation the heater cable shall be meggered to verify no damage has occurred. Tests should use at least a 500 VDC megger. Do not use a megger with an excess of 2500 VDC. Minimum acceptable readings should be 20 megohms per circuit, regardless of length. Field megger tests shall be recorded for each heater cable, and certified reports shall be submitted to the Owner.
- B. Each circuit shall be energized and voltage and current measured and documented to verify the installation is properly functioning.

#### **3.4 DEMONSTRATION**

- A. Demonstrate operation of heating cable controls.

**END OF SECTION 26 05 80**



## **SECTION 26 05 83 - WIRING CONNECTIONS**

### **PART 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- A. Electrical connections to equipment specified under other Sections or furnished by Owner.

#### **1.2 RELATED SECTIONS**

- A. Division 01 - Administrative Requirements; Summary: Owner-furnished equipment.
- B. Division 08 - Overhead Sectional Doors, Door Hardware.
- C. Division 22 – Plumbing Equipment.
- D. Division 23 – HVAC Equipment.
- E. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables.
- F. Section 26 05 33 - Raceway and Boxes for Electrical Systems.
- G. Section 26 28 16 - Enclosed Switches and Circuit Breakers.
- H. Section 26 29 13 - Enclosed Controllers.

#### **1.3 REFERENCES**

- A. FS W-C-596 - Electrical Power Connector, Plug, Receptacle, and Cable Outlet.
- B. National Electrical Manufacturers Association:
  - 1. NEMA WD 1 - General Purpose Wiring Devices.
  - 2. NEMA WD 5 - Specific-Purpose Wiring Devices.

#### **1.4 SUBMITTALS**

- A. Submit data under provisions of Division 01 and Section 26 05 00.
- B. Product Data: Submit wiring device manufacturer's catalog information showing dimensions, configurations, and construction.

#### **1.5 COORDINATION**

- A. Division 01 - Administrative Requirements: Coordination and project conditions.
- B. Obtain and review shop drawings, product data, manufacturer's wiring diagrams, and manufacturer's instructions for equipment furnished under other sections.
- C. Determine connection locations and requirements.
- D. Sequence rough-in of electrical connections to coordinate with installation of equipment.

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- E. Sequence electrical connections to coordinate with start-up of equipment.

### **PART 2 PRODUCTS**

#### **2.1 CORDS AND CAPS**

- A. Straight-blade Attachment Plug: NEMA WD 1.
- B. Locking-blade Attachment Plug: NEMA WD 5.
- C. Attachment Plug Configuration: Match receptacle configuration at outlet provided for equipment.
- D. Cord Construction: Oil-resistant thermoset insulated Type SO multiconductor flexible cord with identified equipment grounding conductor, suitable for extra hard usage in damp locations.
- E. Cord Size: Suitable for connected load of equipment and rating of branch circuit overcurrent protection.

### **PART 3 EXECUTION**

#### **3.1 INSPECTION**

- A. Verify that equipment is ready for electrical connection, wiring, and energization.

#### **3.2 PREPARATION**

- A. Review equipment submittals prior to installation and electrical rough-in. Verify location, size, and type of connections. Coordinate details of equipment connections with supplier and installer.

#### **3.3 INSTALLATION**

- A. Use wire and cable with insulation suitable for temperatures encountered in heat-producing equipment.
- B. Make conduit connections to equipment that is subject to vibration or movement using liquidtight flexible conduit..
- C. Install pre-finished cord set where connection with attachment plug is indicated or specified by the equipment manufacturer's installation instructions, or use attachment plug with suitable strain-relief clamps.
- D. Provide suitable strain-relief clamps for cord connections to outlet boxes and equipment connection boxes.
- E. Make wiring connections in control panel or in wiring compartment of pre-wired equipment in accordance with manufacturer's instructions. Provide interconnecting wiring where required.
- F. Install disconnect switches, controllers, control stations, and control devices such as limit switches and temperature switches and connect with conduit and wiring as indicated in the equipment manufacturer's installation instructions.

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#### **3.4 ADJUSTING**

- A. Cooperate with utilization equipment installers and field service personnel during checkout and starting of equipment to allow testing and balancing and other startup operations. Provide personnel to operate electrical system and checkout wiring connection components and configurations.

**END OF SECTION 26 05 83**

## **SECTION 26 09 23 - LIGHTING CONTROL DEVICES**

### **PART 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- A. This Section includes stand-alone (non-networked) automatic lighting control devices.
  - 1. Occupancy sensor wall switches.
  - 2. Outdoor Photocells.

#### **1.2 RELATED SECTIONS**

- A. Section 26 05 00 - Common Work Results for Electrical.
- B. Section 26 05 19 – Low-Voltage Electrical Power Conductors and Cables.
- C. Section 26 05 33 - Raceway and Boxes for Electrical Systems.
- D. Section 26 27 26 – Wiring Devices: Manual Light Switches.
- E. Section 26 51 00 – Interior Lighting.
- F. Section 26 52 00 – Emergency Lighting.
- G. Section 26 53 00 – Exterior Lighting

#### **1.3 SUBMITTALS**

- A. Product Data: Submit product data for all components provided that are specified in this section showing configurations, finishes, and dimensions. Each catalog sheet should be clearly marked to indicate exact part number provided, including all options and accessories.
- B. Fixture Compatibility: Submitted occupancy sensors shall have wattage ratings to match the circuits on which they are connected and shall be compatible with submitted lamps and ballasts/drivers in the fixtures which they will control.

### **PART 2 PRODUCTS**

#### **2.1 ACCEPTABLE MANUFACTURERS – OCCUPANCY SENSORS**

- A. Wattstopper.
- B. Sensor Switch.
- C. Hubbell.
- D. Leviton.
- E. Substitutions: Under provisions of Division 01.

## **2.2 OCCUPANCY SENSORS**

- A. Single-Relay, Dual-Tech Occupancy Sensor Wall Switch: Decora style, dual-technology, PIR and ultrasonic or microphonic sensor with self-adjusting delayed-OFF time interval, self-adjusting ambient light override, 180° adjustable field of view, manual ON/OFF pushbutton, LED indicator light to verify that detection is active, and non-volatile memory to retain automatic and manual settings during power outages. Sensor shall have selectable timer settings. Device color shall match other switches.

## **2.3 ACCEPTABLE MANUFACTURERS – OUTDOOR PHOTOCELLS**

- A. Intermatic.
- B. Tork.
- C. Substitutions: Under provisions of Division 01.

## **2.4 OUTDOOR PHOTOCELLS**

- A. Dusk-to-dawn lighting control with a delay action.
- B. Sonic-welded polycarbonate case and lens to seal out moisture.
- C. Fully enclosed weatherproof housing.
- D. Rated 15A, 120V.
- E. Rated for mounting on building exterior and -40°F temperature operation.

## **PART 3 EXECUTION**

### **3.1 INSTALLATION**

- A. Install occupancy sensor wall switches 48 inches above floor.
- B. Unless otherwise noted install wall sensor switches within 6 inches of the door jamb on the strike side, however the final layout shall be coordinated with furniture and equipment locations to avoid false OFF signals, due to obstruction of sensors.
- C. Install outdoor photocells on a Nema 4 enclosure and locate on the north side of the building turned away from artificial light sources, in accordance with the manufacturer's installation instructions. Do not install the photocell so that it directly faces the midday sun. Field adjust slider to turn lights On at dusk and OFF at dawn.

### **3.2 SENSOR TESTING AND CALIBRATION**

- A. Occupancy Sensors:
  - 1. Walk into room and confirm that the sensor immediately picks up the motion and turns the lights ON.
  - 2. Adjust the PIR and ultrasonic or microphonic sensitivity settings as required to avoid false tripping due to air movement.

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3. Adjust range on sensor to match room size, as a percentage of total sensor coverage.  
Example: For a 10' x 10' room, the maximum sensing distance in front of the sensor (40') is adjusted down to the minimum setting of 36% coverage.

**3.3 FIELD QUALITY CONTROL**

- A. Perform the following field tests and inspections and prepare test reports:
  1. After installing time switches and sensors, and after electrical circuitry has been energized, adjust and test for compliance with requirements.
  2. Operational Test: Verify operation of each lighting control device, and adjust time delays.
- B. Lighting control devices that fail tests and inspections are defective work.

**END OF SECTION 26 09 23**

## **SECTION 26 21 00 – LOW-VOLTAGE ELECTRICAL SERVICE ENTRANCE**

### **PART 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- A. Arrangement with Utility Company for permanent electric service including payment of Utility Company charges for service.
- B. Underground service entrance.

#### **1.2 RELATED SECTIONS**

- A. The Work under this section is subject to requirements of the Contract Documents including the General Conditions, Supplementary Conditions, and sections under Division 01 General Requirements and Section 26 05 00 – Common Work Results for Electrical.
- B. Section 26 05 26 – Grounding and Bonding for Electrical System.
- C. Section 26 05 33 – Raceway and Boxes for Electrical Systems.
- D. Section 26 05 48 – Vibration and Seismic Controls for Electrical Systems.
- E. Section 26 05 53 – Identifications for Electrical Systems.
- F. Section 31 23 16.13 – Trenching.

#### **1.3 REFERENCE STANDARDS**

- A. NEMA 250 – 2003 Enclosures for Electrical Equipment (1000 Volts Maximum).
- B. UL 50 – 1995 Enclosures for Electrical Equipment.
- C. UL 414 – 1999 Standard for Meter Sockets.

#### **1.4 SYSTEM DESCRIPTION**

- A. System Voltage: 120/240 volts, single phase, three-wire, 60 Hertz.
- B. Service Entrance: Underground.

#### **1.5 SUBMITTALS**

- A. Product Data: Submit product data for all components provided, showing electrical characteristics, material, finishes, and dimensions. Each catalog sheet should be clearly marked to indicate exact part number provided, including all options and accessories.
- B. Shop Drawings: Submit shop drawings and manufacturer's literature for self-contained meter base with circuit breaker disconnecting means.

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#### **1.6 QUALITY ASSURANCE**

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- A. Utility Company: Homer Electric Association (HEA).
- B. Install service entrance in accordance with Utility Company's rules and regulations.

## **PART 2 PRODUCTS**

### **2.1 METERING EQUIPMENT**

- A. Meter: Furnished and installed by the Utility Company.
- B. Self-Contained Meter Base: NEMA 3R rated self-contained meter socket with circuit breaker disconnecting means with safety socket feature and factory installed test-block/bypass facilities. Automatic type, slide type, horn type, screw type and lever type meter socket bypass devices are specifically prohibited. The service entry section and the meter socket shall be sealable and isolated or barriered from other integral enclosure sections to effectively prevent the attachment to un-metered conductors or terminals

## **PART 3 EXECUTION**

### **3.1 INSTALLATION**

- A. Make arrangements with Utility Company to obtain permanent electric service to the Project.
- B. Underground: Install service entrance conduits to building service entrance equipment. Utility Company will connect service lateral conductors to service disconnect.
- C. Spray all exposed conductor sections and termination lugs with Scotch #1602 Ivi-Spray or approved equal red electrical sealer.
- D. Meter sockets shall be installed with the centerline of the socket opening no more than 66 inches and no less than 60 inches above finished grade. The meter socket shall be installed with a minimum 10 inches of side clearance to each side of the socket.
- E. All service entrance equipment shall have signage for arc hazard installed. The marking shall be located to be clearly visible to qualified personnel before examination, adjustment, servicing or maintenance of the equipment. At a minimum the signage shall state the following:

Warning

Arc Flash and Shock Hazard

Appropriate PPE Required

**END OF SECTION 26 21 00**



## **SECTION 26 24 16 - PANELBOARDS**

### **PART 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- A. Lighting and Appliance Branch Circuit Panelboards.
- B. TVSS Equipment.

#### **1.2 RELATED SECTIONS**

- A. The Work under this section is subject to requirements of the Contract Documents including the General Conditions, Supplementary Conditions, and sections under Division 01 General Requirements, and Section 26 05 00 – Common Work Results for Electrical.
- B. Section 26 05 26 – Grounding and Bonding for Electrical Systems.
- C. Section 26 05 53 – Identification for Electrical Systems.
- D. Section 26 05 48 – Vibration and Seismic Control for Electrical Systems.

#### **1.3 REFERENCES**

- A. NEMA AB 1 - Molded Case Circuit Breakers.
- B. NEMA PB 1 - Panelboards.
- C. NEMA PB 1.1 - Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less.
- D. NEMA PB 2.2 - Application Guide for Ground-fault Protective Devices for Equipment.
- E. UL 50 – Enclosures for Electrical Equipment.
- F. UL 67 – Panelboards.
- G. UL 98 - Enclosed and Dead-front Switches.
- H. UL 489 – Molded Case Circuit Breakers and Circuit Breaker Enclosures.
- I. Federal Specification W-C-375B/Gen – Circuit Breakers, Molded Case, Branch Circuit and Service.

#### **1.4 SUBMITTALS**

- A. Submit data under provisions of Division 01 and Section 26 05 00.
- B. Product Data: Submit product data for all components provided which fall under this section showing configurations, finishes, and dimensions. Each catalog sheet should be clearly marked to indicate exact part number provided, including all options and accessories.

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- C. Shop drawings: Submit shop drawings for each panelboard indicating features and device arrangement and size. Include outline and support point dimensions, voltage, main bus ampacity, and integrated short circuit ampere rating.

### **1.5 CLOSEOUT SUBMITTALS**

- A. Project Record Drawings: Submit final record panel schedules as hardcopy and in Microsoft Excel format. Submit under Section 26 05 00.
- B. Panel Schedules: Prior to Substantial Completion, submit copies of all panel schedules for review by the Owner. The Owner will note any changes to the room numbers/names and the Contractor shall provide revised typed panel schedules to reflect all changes, at no additional cost to the Owner.

### **1.6 DELIVERY, STORAGE AND HANDLING**

- A. Deliver products to site under provisions of Division 01.
- B. Upon arrival at the site inspect equipment and report on any damage.
- C. Handle carefully on site to avoid any damage to internal components, enclosures and finishes.
- D. Store in a clean, dry environment. Maintain factory packaging and provide an additional heavy canvas or plastic cover to protect enclosures from dirt, water, construction debris and traffic.

### **1.7 WARRANTY**

- A. Manufacturer shall warrant specified equipment to be free of defects for a period of one year from the date of installation.

### **1.8 SPARE PARTS**

- A. Keys: Furnish 2 each to Owner.

## **PART 2 PRODUCTS**

### **2.1 MANUFACTURERS - PANELBOARDS**

- A. Siemens
- B. Square D.
- C. Cutler Hammer.
- D. General Electric.
- E. Substitutions: Under provisions of Division 01.

### **2.2 BRANCH CIRCUIT PANELBOARDS**

- A. Lighting and Appliance Branch Circuit Panelboards: NEMA PB 1; circuit breaker type.
- B. Enclosure: NEMA PB 1; Type 1 or 3R as indicated on Drawings. Boxes shall be galvanized steel constructed in accordance with UL50 requirements. Interiors shall be field convertible for top or

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bottom incoming feed. Main lug interiors up to 400 amperes shall be field convertible to main breaker. Interior leveling provisions shall be provided for flush mounted applications.

- C. Cabinet Size: 6 inches deep; 20 inches wide minimum.
- D. Provide flush or surface cabinet front as indicated on the Drawings with concealed trim clamps, concealed hinge and flush lock all keyed alike. Finish in manufacturer's standard gray enamel.
- E. Provide panelboards with copper bus, ratings as scheduled on Drawings. Provide one continuous bus bar per phase each. Panelboards shall have sequentially phased branch circuit connectors suitable for bolt-on branch circuit breakers. Bussing shall be fully rated.
- F. Integrated Short Circuit Rating: Provide panelboards with short circuit ratings as shown on the Drawings. Minimum ratings shall be 10,000 amperes RMS symmetrical.
- G. Branch Circuit Breakers: NEMA AB 1; Provide panelboards with bolt-on type thermal magnetic trip circuit breakers.
  - 1. Circuit breakers shall be operated by a toggle-type handle and shall have a quick-make, quick-break over-center switching mechanism that is mechanically trip-free with common trip handle for all poles.
  - 2. Lugs shall be UL Listed to accept copper and aluminum conductors and shall be suitable for 90°C rated wire, sized according to the 75 °C temperature rating per NEC Table 310-16. Lug body shall be bolted in place.
  - 3. Provide UL Class A and 30 mA EPD ground fault interrupter circuit breakers where scheduled on Drawings.

### 2.3 PANELBOARD IDENTIFICATION

- A. For each panelboard provide typed schedule denoting each circuit load by the load type and final name and room number actually designated by the Owner. Schedule shall not be typed with names shown on the Contract Drawings unless names are acceptable to the Owner.
- B. All panelboards shall have signage for arc hazard installed. The marking shall be located to be clearly visible to qualified personnel before examination, adjustment, servicing or maintenance of the equipment. At a minimum the signage shall state the following:

**Warning**

**Arc Flash and Shock Hazard**

**Appropriate PPE Required**

### 2.4 TRANSIENT VOLTAGE SURGE SUPPRESSOR

- A. Integral Surge Suppressor:
  - 1. The manufacturer of the TVSS shall be the same as the manufacturer of the distribution equipment in which the devices are installed and shipped. Also, this distribution equipment shall be fully tested and certified to the following UL standards:

UL 67 = Panelboards,

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2. Component recognized in accordance with UL 1449 and UL 1283.
3. Independently tested with category C3 high exposure waveform (20 kV-1.2/50us, 10kA-8/20 us) per IEEE C62.41.
4. Furnish copper bus bars for surge current path.
5. Construct using surge current modules (MOV based). Each module fused with user replaceable 200,000 AIR rated fuses. Status of each module monitored on front cover of panelboard enclosure and on module.
6. Furnish with audible alarm activated when one of surge current modules has failed. Furnish alarm on/off to silence alarm and alarm push-to-test switch to test alarm. Locate switches and alarm on front cover of panelboard enclosure.
7. Meet or exceed the following criteria:
  - a. Minimum surge current rating shall be 160 kA per phase (80 kA per mode) for service entrance and 80 kA per phase (40 kA per mode) for distribution applications.
  - b. Pulse Lift Test: Capable of protecting against and surviving 5000 IEEE C62.41 Category C transients without failure or degradation.
  - c. UL 1449 clamping voltage must not exceed the following:

<u>VOLTAGE</u>	<u>L-N</u>	<u>L-G</u>	<u>N-G</u>
240/120	800/400V	800/400V	400V
8. Furnish response time no greater than five nanoseconds for individual protection modes.
9. Designed to withstand maximum continuous operating voltage (MCOV) of not less than 115 percent of nominal RMS voltage.
10. Furnish visible indication of proper suppresser connection and operation. Lights indicate operable phase and module.
11. Furnish minimum EFI/RFI filtering of 34 dB at 100 kHz with insertion loss ratio of 50: 1 using Mil Std. 220A methodology.

### B. Panelboard Mounted:

1. UL 67 listed and TVSS device UL 1449 Component Recognized. TVSS device meets UL 1449. Furnish panelboard markings with clamp voltage at TVSS terminals and clamp voltage at panelboard line terminals.
2. Construct box of galvanized steel. Box size as indicated on Drawings.
3. Main bus constructed of copper and rated for load current.
4. Furnish interior with branch circuit breakers if not bus mounted type. Furnish [one] [60] amp circuit breaker for each TVSS, with appropriate number of poles, as dedicated disconnect for TVSS.

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5. Furnish with insulated ground bus and safety ground bus.

C. Enclosure Mounted:

1. UL 67 listed and TVSS device UL 1449 Component Recognized. TVSS device meets UL 1449.
2. Provide with surface mounted NEMA Type 1 enclosure. Construct box of galvanized steel. Box size as required for TVSS unit and in compliance with NFPA 70.
3. Provide panelboard mounted circuit breakers with appropriate number of poles and manufacturer required ampacity, as dedicated disconnect for TVSS.

**PART 3 EXECUTION**

**3.1 INSTALLATION**

- A. Install panelboards plumb and flush with wall finishes, in conformance with NEMA PB 1.1.
- B. Height: 6 feet, 6 inches to top of panelboard.
- C. Provide filler plates for unused spaces in panelboards.
- D. Panel Schedules: Revise schedules to reflect circuiting changes required to balance phase loads.

**3.2 FIELD QUALITY CONTROL**

- A. Measure steady state load currents at each panelboard feeder. Should the difference at any panelboard between phases exceed 20 percent, rearrange circuits in the panelboard to balance the phase loads within 20 percent. Take care to maintain proper phasing for multi-wire branch circuits.
- B. Visual and Mechanical Inspection: Inspect for physical damage, proper alignment, anchorage, and grounding. Check proper installation and tightness of connections for circuit breakers.

**END OF SECTION 26 24 16**

## **SECTION 26 27 26 - WIRING DEVICES**

### **PART 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- A. Wall Switches.
- B. Receptacles.
- C. Device Plates and Box Covers.

#### **1.2 RELATED SECTIONS**

- A. The Work under this section is subject to requirements of the Contract Documents including the General Conditions, Supplementary Conditions, and sections under Division 01 - General Requirements and Section 26 05 00 – Common Work Results for Electrical.
- B. Section 26 05 26 – Grounding and Bonding for Electrical Systems.
- C. Section 26 05 33 – Raceway and Boxes for Electrical Systems.
- D. Section 26 05 33.16 – Boxes for Electrical Systems.
- E. Section 26 05 53 – Identification for Electrical Systems.

#### **1.3 REFERENCE STANDARDS**

- A. FS W-C-596 – Federal Specification for Electrical Power Connector, Plug, Receptacle, and Cable Outlet.
- B. FS W-S-896 – Federal Specification for Switches, Toggle (Toggle and Lock), Flush Mounted.
- C. NEMA WD 1 - General Color Requirements for Wiring Devices.
- D. ANSI/NEMA WD 6 – Wiring Devices – Dimensional Requirement.
- E. UL 20 – General-Use Snap Switches.
- F. UL 498 - Attachment Plugs and Receptacles.
- G. UL 943 – Ground-Fault-Circuit-Interrupters.

#### **1.4 SUBMITTALS**

- A. Product Data: Submit product data for all components provided that are specified in this section showing configurations, finishes, and dimensions. Each catalog sheet should be clearly marked to indicate exact part number provided, including all options and accessories.

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#### **PART 2 PRODUCTS**

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##### **2.1 ACCEPTABLE MANUFACTURERS - WALL SWITCHES**

- A. Hubbell.
- B. Leviton.
- C. Pass & Seymour.
- D. Arrow Hart
- E. Substitutions: Under provisions of Division 01.

##### **2.2 WALL SWITCHES**

- A. Wall Switches for Lighting Circuits: UL 20; ANSI/NEMA WD-6; and Federal Specification FS W-S-896 AC industrial grade snap switch with toggle handle, rated 20 amperes and 120-277 volts AC. Handle: White nylon. Provide single-pole, 3-way, or 4-way switches as indicated on Plans.
- B. Pilot Light Type: UL 20; ANSI/NEMA WD-6; and Federal Specification FS W-S-896 AC industrial grade snap switch, rated 20 amperes and 120-277 volts AC. Handle: Red pilot light toggle (illuminated when load is on). Provide single pole unless otherwise indicated on Plans.

##### **2.3 ACCEPTABLE MANUFACTURERS - RECEPTACLES**

- A. Hubbell.
- B. Leviton.
- C. Pass & Seymour.
- D. Arrow Hart
- E. Substitutions: Under provisions of Division 01.

##### **2.4 RECEPTACLES**

- A. Convenience and Straight-blade Receptacles: UL 498, ANSI/NEMA WD-6 and Federal Specification FS W-C-596 industrial grade receptacle.
- B. Convenience Receptacle Configuration: ANSI/NEMA WD-6; Type 5-20R, white nylon face.
- C. GFCI Receptacles: ANSI/NEMA WD-6; 20A, duplex convenience receptacle with integral class 'A' ground fault current interrupter, LED indicator lamp and integral lockout.
- D. Weather-Resistant Receptacles: ANSI/NEMA WD-6; Listed to the weather-resistant supplement of UL498 and complying with the requirements of NEC 406.9.

##### **2.5 DEVICE PLATES**

- A. Decorative Cover Plate: Smooth 430 or 302 stainless steel.

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- B. Weatherproof Cover Plate: UL listed, cast aluminum, hinged outlet cover/enclosure, with gasket between the enclosure and the mounting surface, suitable for wet locations while in use and identified as "Extra Duty" per NEC 406.9 (B)(1).
- C. Exposed Work Cover Plate: ½ inch raised, square, pressed, galvanized or cadmium plated steel cover plate supporting devices independent of the outlet box.

### **PART 3 EXECUTION**

#### **3.1 INSTALLATION**

- A. Install wall switches 48 inches above floor, OFF position down.
- B. Unless otherwise noted install wall switches within 6 inches of the door jamb on the strike side.
- C. Unless otherwise noted install convenience receptacles 18 inches above floor, grounding pole on bottom.
- D. Unless otherwise noted, mounting heights are for finished floor to center line of outlet.
- E. Install decorative plates on switch, receptacle, and blank outlets in the mechanical room.
- F. Install weatherproof covers on outlets in all locations other than the mechanical room.
- G. Install devices and wall plates flush and level.
- H. Ground receptacles to boxes with a grounding wire. Grounding through the yoke or screw contact is not an acceptable alternate to the ground wire.

**END OF SECTION 26 27 26**



## **SECTION 26 29 13 - ENCLOSED CONTROLLERS**

### **PART 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- A. Manual Motor Starters.
- B. Magnetic Motor Starters.
- C. Combination Magnetic Motor Starters.

#### **1.2 RELATED SECTIONS**

- A. Division 22 – Plumbing.
- B. Division 23 – Heating, Ventilating, and Air Conditioning (HVAC).
- C. [Section 26 05 48 – Vibration and Seismic Controls for Electrical Systems.]
- D. Section 26 05 29 – Hangers and Supports for Electrical Systems.
- E. Section 26 05 53 – Identification for Electrical Systems.

#### **1.3 REFERENCES**

- A. The Work under this section is subject to requirements of the Contract Documents including the General Conditions, Supplementary Conditions, and sections under Division 01 General Requirements.
- B. ANSI/NEMA ICS 6 - Enclosures for Industrial Controls and Systems.
- C. NEMA AB 1 - Molded Case Circuit Breakers.
- D. NEMA ICS 2 - Industrial Control Devices, Controllers, and Assemblies.
- E. NEMA KS 1 - Enclosed Switches.

#### **1.4 SUBMITTALS**

- A. Submit shop drawings and product data under provisions of Division 01.
- B. Provide product data on motor starters and combination motor starters, relays, pilot devices, and switching and overcurrent protective devices.

### **PART 2 PRODUCTS**

#### **2.1 ACCEPTABLE MANUFACTURERS - MOTOR STARTERS**

- A. Square D.
- B. Allen Bradley.

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- C. Siemens.
- D. Cutler Hammer.
- E. Substitutions: Under provisions of Division 01.

### **2.2 MANUAL MOTOR STARTERS**

- A. Fractional Horsepower Manual Starter: NEMA ICS 2; AC general-purpose Class A manually operated, number of poles as required by the load served, full-voltage controller for fractional horsepower induction motors, with thermal overload unit, red pilot light, and toggle operator.
- B. Motor Starting Switch: NEMA ICS 2; AC general-purpose Class A manually operated 1 or 2 pole as required by the load, full-voltage controller for fractional horsepower induction motors, without thermal overload unit, red pilot light, and toggle operator.
- C. Enclosure: ANSI/NEMA ICS 6; Type 1.

### **2.3 MAGNETIC MOTOR STARTERS**

- A. Magnetic Motor Starters: NEMA ICS 2; AC general-purpose Class A magnetic controller for induction motors rated in horsepower.
- B. Full Voltage Starting: Non-reversing type.
- C. Coil Operating Voltage: 120 or 240 volts, 60 Hertz.
- D. Size: NEMA ICS 2; size as required by the load served.
- E. Overload Relay: NEMA ICS 2; bimetal.
- F. Enclosure: NEMA ICS 6; Type 1.
- G. Combination Motor Starters: Combine motor starters with motor circuit protector disconnect in common enclosure.
- H. Auxiliary Contacts: NEMA ICS 2; two field convertible contacts in addition to seal-in contact.
- I. Indicating Lights: NEMA ICS 2; RUN: red LED light in front cover.
- J. Selector Switches: NEMA ICS 2; HAND/OFF/AUTO, in front cover.
- K. Control Power Transformers: 120 volt secondary, VA capacity as required by the load served in each motor starter.

### **2.4 CONTROLLER OVERCURRENT PROTECTION AND DISCONNECTING MEANS**

- A. Motor Circuit Protector: NEMA AB 1; circuit breakers with integral instantaneous magnetic trip in each pole.

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#### **PART 3 EXECUTION**

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##### **3.1 INSTALLATION**

- A. Install motor control equipment in accordance with manufacturer's instructions.
- B. Select and install heater elements in motor starters to match installed motor characteristics.
- C. Motor Data: Provide neatly typed label inside each motor starter enclosure door identifying motor served, nameplate horsepower, full load amperes, code letter, service factor, and voltage/phase rating.
- D. Field adjust the trip settings of all motor starter magnetic trip only circuit breakers to approximately 11 times motor full load current. Determine full load current from motor nameplate following installation.
- E. Motor starting equipment shall be listed for use with the motors specified under Division 21, 22, and 23.

**END OF SECTION 26 29 13**

## **SECTION 26 51 00 – INTERIOR LIGHTING**

### **PART 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- A. Interior Luminaires and Accessories.
- B. Lamp Modules.
- C. LED Replacement Lamps.
- D. Drivers.

#### **1.2 RELATED SECTIONS**

- A. The Work under this section is subject to requirements of the Contract Documents including the General Conditions, Supplementary Conditions, and sections under General Conditions of the Contract General Requirements, and Section 26 05 00 – Common Work Results for Electrical.
- B. Section 26 05 19 – Low Voltage Electrical Power Conductors and Cables.
- C. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
- D. Section 26 05 29 - Hangers and Supports for Electrical Systems: General Supports for Luminaires.
- E. Section 26 05 33 – Raceway and Boxes for Electrical Systems.
- F. Section 26 05 48 - Vibration and Seismic Controls for Electrical Systems: Seismic Supports for Luminaires.
- G. Section 26 05 53 – Identification for Electrical Systems.
- H. Section 26 27 26 – Wiring Devices.
- I. Section 26 52 00 - Emergency Lighting: Luminaires with Emergency Drivers and Connections.

#### **1.3 DEFINITIONS**

- A. CCT: Correlated Color Temperature.
- B. CRI: Color Rendering Index.
- C. Driver: LED Power Supply.
- D. Fixture: See "Luminaire."
- E. IES: Illuminating Engineering Society of North America
- F. IP: International Protection or Ingress Protection Rating.
- G. Lamp Module: Replaceable LED board array/light engine including a plug-in connector.

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- H. LED: Light-emitting diode.
- I. Lumen: Measured output of lamp and luminaire, or both.
- J. Luminaire: Complete lighting unit, including lamp or lamp module, driver, reflector, and housing.
- K. THD: Total Harmonic Distortion.

### **1.4 REFERENCE STANDARDS**

- A. IES TM-21-11 Projecting Long Term Lumen Maintenance of LED Light Sources.
- B. IES LM-80 IES Approved Method: Measuring Luminous Flux and Color Maintenance of LED Packages, Arrays and Modules.

### **1.5 SUBMITTALS**

- A. Product Data: Submit the following:
  - 1. Luminaires: Include manufacturer's product data sheets and/or shop drawings including outline drawings showing support points, weights, and accessory information for each luminaire type. Clearly indicate all options being provided. Arrange data for luminaires in the order of fixture designation.
  - 2. Prior to preparing submittals, coordinate with the reflected ceiling plan for ceiling finishes and provide all necessary kits, brackets, stems, trim, etc. to install the specified fixtures in the ceilings provided. Clearly note these configurations on the product data sheets.
- B. Warranty: Provide copies of manufacturer's warranty information for each luminaire. If warranty information is the same for a group of manufacturer's luminaires, provide a letter or schedule clearly indicating what warranty applies to each fixture.
- C. LED Luminaire Substitutions: Due to the constantly evolving technology, it is difficult to evaluate a true "equal" LED luminaire since the wattage, lamp life, lumen output, lamp life, etc. vary significantly from fixture to fixture, even for luminaires that have a similar shape and style. The luminaires shown on the Plans in the Fixture Schedule are not intended to be sole sourced but are considered a Basis of Design. If a substitution is proposed by the contractor, it will be evaluated based on the following criteria:
  - 1. Does it have the same basic shape/style and characteristics? Note that there may be space constraints above the ceiling.
  - 2. Does the light have the same (or superior) light output and distribution? If not, would it still produce enough light to illuminate the space per minimum IES recommendations or other project specific lighting levels? Note that the Engineer may request .ies files or lighting calculations be provided by the Contractor to evaluate substitution requests.
  - 3. Does it use the same (or less) wattage than the specified fixture? If it uses slightly more power, does it provide enough value to the Owner by adding additional light to offset the additional power used? Is that appropriate for the project compliance requirements. (LEED, ASHRAE 90.1, etc.)

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4. Does it have the same nominal color temperature and CRI values? Note that for certain luminaires this may be more important where [medical procedures are being performed or where] artwork or merchandise is illuminated.
5. Does it have an equal or better lamp life as calculated in accordance with IES TM-21 and LM-80?
6. Does the manufacturer offer an equal or better warranty than the specified fixture?
7. Are the LED lamps modules and LED boards field changeable? What guarantees does the manufacturer have that replacement parts will be available in the future?

### **1.6 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver products to site, store and protect in a clean, dry environment under provisions of General Conditions of the Contract.

### **1.7 EXTRA MATERIALS**

- A. Provide spare parts under provisions of Division 01.
- B. Lenses: One of each size and type.
- C. Drivers: One of each size and type installed.
- D. LED Lamp Modules: Provide a minimum of 2 of each unique type of lamp module used on the project. Ship LED lamp modules (i.e. LED board) in protective packaging and label each lamp module to indicate the fixture type that it may be installed in. (i.e. Type A or Type D1).

## **PART 2 PRODUCTS**

### **2.1 INTERIOR LUMINAIRES AND ACCESSORIES**

- A. Luminaires: Provide UL listed luminaires as scheduled on the drawings or as approved equal.
- B. Listing: Luminaires shall be listed for use in the environment in which they are installed. For example, luminaires installed in return air plenums, direct contact with insulation, or in hazardous, wet, damp, or corrosive locations shall be UL listed for such application.
- C. Accessories: Provide all mounting kits, supports, interconnecting wiring, power supplies, trim kits, gaskets, etc. for a complete installation.
- D. Housing:
  1. Metal parts shall be free of burrs and sharp corners and edges. Form and support to prevent warping and sagging.
  2. Doors, Frames and Other Internal Access: Smooth operating, free of light leakage under operating conditions. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

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3. Luminaires shall be factory painted and free of discoloration. Color as scheduled.

### **2.2 LAMP MODULES – LED**

- A. All LED's shall be nominal 4000 degrees Kelvin within a 3-step MacAdam Ellipse unless special circumstances require a different color temperature application, see Luminaire Schedule on Plans.
- B. Color Rendering: Minimum CRI as scheduled on the Plans for each fixture. Under no circumstances shall the CRI be less than 70.
- C. Lamp Life: Minimum lamp life shall be calculated in accordance with IES LM-80. Lamp life for each luminaire shall be equal or greater than scheduled on the Plans. Under no circumstances shall a luminaire have a minimum rated life (L70) less than 50,000 hours at 75 degrees F average indoor ambient temperature.
- D. Replaceable: Unless otherwise scheduled, all LED modules shall be field replaceable with quick disconnect connections.

### **2.3 DRIVERS - LED**

- A. LED Driver: Provide UL listed power supply as recommended by the LED fixture manufacturer for operation of the specified LED lamps. Power supply shall be integral to the luminaire unless otherwise noted on the Plans. Power supply shall be dual voltage (120/277V) where available or operate at the supply voltage indicated on the Plans.

## **PART 3 EXECUTION**

### **3.1 INSTALLATION**

- A. Coordinate layout and installation of lighting fixtures and suspension system with other construction including but not limited to HVAC equipment.
- B. Unless otherwise noted on Plans, provide drivers integral to luminaires, pre-wired and installed at the factory, suitable for use with the selected LED lamps.
- C. Support surface-mounted luminaires directly from building structure. Install level and parallel/perpendicular with ceiling or wall surfaces.
- D. Provide luminaire disconnecting means in the wiring compartment of each luminaire. Where the luminaire is fed from a multi-wire branch circuit, provide multi-pole disconnect to simultaneously break all supply conductors to the ballast, including the grounded conductor.
- E. LED Power Supplies: Install power supplies to be readily accessible. Where power supplies are installed in plenum areas, provide plenum rated listing.
- F. Mechanical Rooms: Lighting fixture locations shown on Plans in mechanical equipment rooms are approximate. Coordinate mounting height and location of lighting fixtures to clear mechanical, electrical and plumbing equipment and to adequately illuminate meters, gauges and equipment. Support all lighting fixtures independently of duct work or piping.

### **3.2 RELAMPING**

- A. Re-lamp or replace luminaires that have failed lamps at completion of work.

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#### **3.3 ADJUSTING AND CLEANING**

- A. Align luminaires and clean lenses and diffusers at completion of work. Clean paint splatters, dirt, and debris from installed luminaires.
- B. Touch up luminaire finish at completion of work.

**END OF SECTION 26 51 00**



## **SECTION 26 52 00 - EMERGENCY LIGHTING**

### **PART 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- A. Emergency Lighting Units.
- B. Emergency Exit Signs.

#### **1.2 RELATED SECTIONS**

- A. The Work under this section is subject to requirements of the Contract Documents including the General Conditions, Supplementary Conditions, and sections under Division 01 General Requirements, and Section 26 05 00 – Common Work Results for Electrical.
- B. Section 26 05 19 – Low-Voltage Electrical Power Conductors and Cables.
- C. Section 26 05 33 - Raceway and Boxes for Electrical Systems.
- D. Section 26 05 48 – Vibration and Seismic Controls for Electrical Systems.
- E. Section 26 05 53 – Identification for Electrical Systems.
- F. Section 26 51 00 – Interior Lighting.
- G. Section 26 56 00 – Exterior Lighting.

#### **1.3 REFERENCE STANDARDS**

- A. NFPA 101 - Code for Safety to Life from Fire in Buildings and Structures.
- B. NECA/IESNA 500 – Recommended Practice for Installation Indoor Commercial Lighting System.
- C. UL 924 - Emergency Lighting and Power Equipment.

#### **1.4 DEFINITIONS**

- A. Driver: LED power supply.
- B. Fixture: See "Luminaire."
- C. IES: Illuminating Engineering Society of North America.
- D. Lamp Module: Replaceable LED board array/light engine including a plug-in connector.
- E. LED: Light-emitting diode.
- F. Luminaire: Complete lighting unit, including lamp or lamp module, driver, reflector, and housing.

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**1.5 SUBMITTALS**

- A. Product Data: Include manufacturer's product data sheets and/or shop drawings including outline drawings showing support points, weights, and accessory information for all equipment. Clearly indicate all options being provided. Arrange data for luminaires in the order of fixture designation.

**1.6 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver products to site, store and protect under provisions of Division 01.

**1.7 REGULATORY REQUIREMENTS**

- A. Conform to State and local building code and NFPA 101 for installation requirements.
- B. Furnish emergency lighting units and exit signs that are UL 924 listed and labeled for their indicated use and location on this project.

**1.8 WARRANTY**

- A. Emergency Lighting Units: Submit a warranty, mutually executed by the manufacturer and the installer, agreeing to replace emergency lighting units that fail in materials or workmanship within five years, beginning on the date of manufacturer.
- B. LED Exit Signs: Submit a warranty, mutually executed by the manufacturer and the installed, agreeing to replace LED exit signs that fail in materials or workmanship within five years, beginning on the date of substantial completion.

**PART 2 PRODUCTS**

**2.1 EMERGENCY LIGHTING UNITS**

- A. Provide emergency lighting units as scheduled on the Plans or approved equal.

**2.2 EXIT SIGNS**

- A. Provide exit signs as scheduled on the Plans or approved equal.

**PART 3 EXECUTION**

**3.1 INSTALLATION**

- A. Install units plumb and level.
- B. Aim directional lamp heads to illuminate the path of egress.
- C. Coordinate location of wall mounted emergency lighting units with mechanical equipment, ductwork, piping, etc.
- D. Wiring installed between a luminaire and an emergency lighting inverter or remote emergency driver is considered "emergency" wiring and shall be separated from the normal wiring and installed in a dedicated raceway per NEC 700.9.

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#### **3.2 FIELD QUALITY CONTROL**

- A. Tests: Perform tests listed below according to manufacturer's written instructions. Test unit functions, operations, and protective features. Adjust to ensure operation complies with Specifications. Perform tests required by NFPA 70, Articles 700 and 701. Perform tests on completion of unit installation and after building circuits have been energized. Provide instruments to permit accurate observation of tests. Include the following tests:
  - 1. Simulate power outage: Verify proper operation of each individual emergency power supply.
  - 2. Verify emergency supply duration.
  - 3. Verify operation of remote test switches.
  - 4. Provide reports for load test conducted on individual batteries.
- B. Retest: Correct deficiencies identified by tests and observations and retest until specified requirements are met.

#### **3.3 ADJUSTING**

- A. Aim lamp on wall-mounted emergency lighting units to obtain the following illumination of egress pathway:
  - 1. An average of 1 foot-candle.
  - 2. A minimum at any point of 0.1 foot-candle measured along the path of egress at floor level.
  - 3. Maximum-to-minimum illumination uniformity ratio of 40 to 1 shall not be exceeded.
- B. Test emergency lighting equipment in accordance with the manufacturer's instructions and NECA/IESNA 500.

#### **3.4 CLEANING**

- A. On completion of installation, inspect unit components. Remove paint splatters and other spots, dirt, and debris. Touch up scratches and abrasions in finish to match original finish. Clean unit internally using methods and materials recommended by manufacturer.

#### **3.5 DEMONSTRATION**

- A. Walk owner's representative through the emergency lighting system. Note how to maintain, test and troubleshoot all units. Provide maintenance schedule for NFPA required testing and note locations of test switches, and which units have self-diagnostic features.

**END OF SECTION 26 52 00**

## **SECTION 26 56 00 – EXTERIOR LIGHTING**

### **PART 1 GENERAL**

#### **1.1 WORK INCLUDED**

- A. Exterior Luminaires and Accessories.

#### **1.2 RELATED WORK**

- A. The Work under this section is subject to requirements of the Contract Documents including the General Conditions, Supplementary Conditions, and sections under Division 01 General Requirements, and Section 26 05 00 – Common Work Results for Electrical.
- B. Section 26 05 19 – Low Voltage Electrical Power Conductors and Cables.
- C. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
- D. Section 26 05 29 - Hangers and Supports for Electrical Systems: General supports for luminaires.
- E. Section 26 05 48 – Vibration and Seismic Controls for Electrical Systems.
- F. Section 26 09 23 – Lighting Control Devices.

#### **1.3 DEFINITIONS**

- A. CCT: Correlated color temperature.
- B. CRI: Color Rendering Index.
- C. Driver: LED power supply.
- D. Fixture: See "Luminaire."
- E. IES: Illuminating Engineering Society of North America.
- F. IP: International Protection or Ingress Protection Rating.
- G. Lamp Module: Replaceable LED board array/light engine including a plug-in connector.
- H. LED: Light-emitting diode.
- I. Lumen: Measured output of lamp and luminaire, or both.
- J. Luminaire: Complete lighting unit, including lamp or lamp module, driver, reflector, and housing.

#### **1.4 REFERENCES**

- A. ASTM D635 - Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position.
- B. IES TM-21-11 Projecting Long Term Lumen Maintenance of LED Light Sources.

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- C. IES LM-80 IES Approved Method: Measuring Luminous Flux and Color Maintenance of LED Packages, Arrays and Modules.

### **1.5 SUBMITTALS**

- A. Product Data: Submit the following:

- 1. Luminaires: Include manufacturer's product data sheets and/or shop drawings including outline drawings showing support points, weights, and accessory information for each luminaire type. Clearly indicate all options being provided. Arrange data for luminaires in the order of fixture designation.
- B. LED Luminaire Substitutions: Due to the constantly evolving technology, it is difficult to evaluate a true "equal" LED luminaire since the wattage, lamp life, lumen output, lamp life, etc. vary significantly from fixture to fixture, even for luminaires that have a similar shape and style. The luminaires shown on the Plans in the Fixture Schedule are not intended to be sole sourced but are considered a Basis of Design. If a substitution is proposed by the contractor, it will be evaluated based on the following criteria:
    - 1. Does it have the same basic shape/style and characteristics? Note that there may be space constraints above the ceiling.
    - 2. Does the light have the same (or superior) light output and distribution? If not, would it still produce enough light to illuminate the space per minimum IES recommendations or other project specific lighting levels? Note that the Engineer may request .ies files or lighting calculations be provided by the Contractor to evaluate substitution requests.
    - 3. Does it use the same (or less) wattage than the specified fixture? If it uses slightly more power, does it provide enough value to the Owner by adding additional light to offset the additional power used? Is that appropriate for the project compliance requirements (LEED, ASHRAE 90.1, etc.)
    - 4. Does it have the same nominal color temperature and CRI values?
    - 5. Does it have an equal or better lamp life as calculated in accordance with IES TM-21 and LM-80?
    - 6. Does the manufacturer offer an equal or better warranty than the specified fixture?
    - 7. Are the LED lamps modules and LED boards field changeable? What guarantees does the manufacturer have that replacement parts will be available in the future?

### **1.6 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver products to site, store and protect under provisions of Division 01.

### **1.7 EXTRA MATERIALS**

- A. Provide spare parts under provisions of Division 01.
- B. Lenses: One of each size and type.
- C. Drivers: One of each size and type installed.

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- D. LED Lamp Modules: Provide a minimum one (1) of each unique type of lamp module used on the project. Ship LED lamp modules (i.e. LED board) in protective packaging and label each lamp module to indicate the fixture type that it may be installed in. (i.e. Type S1 or Type S2).
- E. Where luminaires do not have replaceable lamp modules, provide one spare fixture for each type.

### **PART 2 PRODUCTS**

#### **2.1 EXTERIOR LUMINAIRES AND ACCESSORIES**

- A. Luminaires: Provide UL listed luminaires as scheduled on the drawings or as approved equal.
- B. Listing: Luminaires shall be listed for use in the environment in which they are installed. For example, luminaires installed in return air plenums, direct contact with insulation, or in hazardous, wet, damp, or corrosive locations shall be UL listed for such application.
- C. Accessories: Provide all mounting kits, supports, interconnecting wiring, power supplies, trim kits, gaskets, etc. for a complete installation.

#### **2.2 LAMP MODULES**

- A. Light Emitting Diode (LED): 4000° K (nominal), with minimum 70CRI and a minimum rated life (L70) of 75,000 hours at 40 degrees F average outdoor ambient temperature.
- B. Luminaires and lamps installed outdoors shall be rated for starting and operating at a minimum of -40F.
- C. Replaceable: Unless otherwise scheduled, all LED modules shall be field replaceable with quick disconnect connections

#### **2.3 DRIVERS**

- A. LED Driver: Provide UL listed power supply as recommended by the LED fixture manufacturer for operation of the specified LED lamps. Power supply shall be integral to the luminaire unless otherwise noted on the Plans. Power supply shall be dual voltage (120/277V) where available or operate at the supply voltage indicated on the Plans.
- B. All luminaire drivers and power supplies installed outdoors shall be rated for starting and operating at a minimum of -40F.

### **PART 3 EXECUTION**

#### **3.1 INSTALLATION**

- A. Unless otherwise noted on Plans, provide driver integral to luminaires, pre-wired and installed at the factory, suitable for use with the LED module.
- B. Support surface-mounted luminaires directly from building structure. Maintain wall waterproofing.

#### **3.2 RELAMPING**

- A. Relamp luminaires which have failed lamps at completion of work.

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#### **3.3 ADJUSTING AND CLEANING**

- A. Align luminaires and clean lenses and diffusers at completion of work. Clean paint splatters, dirt, and debris from installed luminaires.
- B. Touch up luminaire at completion of work.

**END OF SECTION 26 56 00**

## **SECTION 28 13 00 - ACCESS CONTROL**

### **PART 1 GENERAL**

#### **1.1 SUMMARY**

- A. Section Includes:
  - 1. Security access devices and control panels.
  - 2. Signal and control wiring.
- B. Related Requirements:
  - 1. Section 08 71 00 - Door Hardware: Modifications to existing and proposed door hardware as required by Work of this Section.
  - 2. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables: Execution requirements as required for Work of this Section.
  - 3. Section 26 05 26 - Grounding and Bonding for Electrical Systems: Execution requirements as required for Work of this Section.

#### **1.1 COORDINATION**

- A. Division 01: Requirements for coordination.
- B. Coordinate Work of this Section with Work of other Sections.

#### **1.2 SUBMITTALS**

- A. Division 01: Requirements for submittals.
- B. Product Data: Submit catalog data showing electrical characteristics and connection requirements.
- C. Shop Drawings: Indicate system wiring diagram showing each device and wiring connection; indicate annunciator layout and sequence of operation.
- D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- E. Manufacturer Instructions: Submit detailed instructions on installation requirements, including storage and handling procedures.
- F. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

#### **1.3 CLOSEOUT SUBMITTALS**

- A. Division 01: Requirements for submittals.
- B. Project Record Documents: Record actual locations of security access equipment.



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### **1.4 MAINTENANCE MATERIAL SUBMITTALS**

- A. Division 01: Requirements for maintenance materials.
- B. Spare Parts:
  - 1. Furnish 50 keycards.

### **1.5 QUALITY ASSURANCE**

- A. Perform Work according to NECA standards.

### **1.6 QUALIFICATIONS**

- A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum **three** years' documented experience.
- B. Installer: Company specializing in performing Work of this Section with minimum three years' documented experience and approved by manufacturer.

### **1.7 DELIVERY, STORAGE, AND HANDLING**

- A. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.
- B. Store materials according to manufacturer instructions.
- C. Protection:
  - 1. Protect materials from moisture and dust by storing in clean, dry location remote from areas involved in construction operations areas.
  - 2. Provide additional protection according to manufacturer instructions.

### **1.8 EXISTING CONDITIONS**

- A. Field Measurements:
  - 1. Verify field measurements prior to fabrication.
  - 2. Indicate field measurements on Shop Drawings.

### **1.9 WARRANTY**

- A. Division 01: Requirements for warranties.
- B. Furnish **five** year manufacturer's warranty for controller.

## **PART 2 PRODUCTS**

### **2.1 SYSTEM DESCRIPTION**

- A. Security Access Systems: Control access to selected areas using encoded cards and coded keypads.

**2.2 CONTROL PANELS**

- A. Manufacturers:
  - 1. Continental Instruments to match existing.
  - 2. Substitutions: Not permitted.
- B. Description: Modular control panel with surface mounted enclosure.
- C. Power Supply:
  - 1. Adequate to serve control panel modules, card key readers, and access hardware devices.
- D. Display:
  - 1. Indicate status of each point using LEDs.
- E. Entry and Exit Time Delays: Adjustable.

**2.3 CARD READERS**

- A. Manufacturers:
  - 1. HID.
  - 2. Substitutions: Not permitted.
  - 3. Description: Card Readers accessible using coded data stored in compatible credential card.
  - 4. Type: Proximity.
  - 5. Credential Card Type: Wiegand.
  - 6. Furnish housing suitable for installation in cold weather as needed for operation at Site.
  - 7. Furnish enrollment equipment to support local encryption of credential cards.
- B. Display:
  - 1. **LED** indicator.
  - 2. Indicate power ON-OFF, and whether requests have been accepted or rejected.
- C. Mounting: Pedestal.

**2.4 PUSH BUTTONS**

- A. Manufacturers:
  - 1. STI.
  - 2. Substitutions: As specified in Section 01 63 00 - Product Options and Substitutions.

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- B. Description:
  - 1. Communications protocol compatible with local processor.
  - 2. NEMA 3R Weatherproof button with green LED lens, contact block, exit label and protective cover.
  - 3. UL Listed.
- C. Mounting: Pedestal.

### **2.5 ACCESS CARDS**

- A. Manufacturers:
  - 1. HID.
  - 2. Substitutions: Not permitted.
- B. Store binary-coded data stored in scrambled pattern as a unique identifier, readable by card readers.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Division 01: Requirements for installation examination.
- B. Verify that Site conditions comply with Contract Documents.
- C. Verify that surfaces to receive access control devices are ready for installation.

### **3.2 PREPARATION**

- A. Division 01: Requirements for installation preparation.
- B. Existing Work:
  - 1. Remove exposed, abandoned security access wiring.
  - 2. Cut cable flush with walls and floors, and patch surfaces.
  - 3. Disconnect and remove abandoned security access equipment.
  - 4. Access:
    - a. Maintain access to existing access control equipment, and other installations remaining active and requiring access.
    - b. Modify installation or provide access panel.
  - 5. Extend existing security access installations using materials and methods compatible with existing installations, as specified.

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6. Clean and repair existing security access equipment that is to remain or to be reinstalled.

#### **3.3 INSTALLATION**

- A. Wiring:
  1. Install **16**-AWG minimum size conductors for circuit conductors.
  2. Install wiring in conduit.
  3. Install conduit and wiring connections to gate operating system devices.
- B. Ground and bond security access equipment and circuits as specified in Section 26 05 26 - Grounding and Bonding for Electrical Systems.

#### **3.4 FIELD QUALITY CONTROL**

- A. Division 01: Requirements for testing, adjusting, and balancing.
- B. Manufacturer Services: Furnish services of manufacturer's representative experienced in installation of products furnished under this Section for not less than **2 hours** on Site for installation, inspection, startup, field testing, and instructing Owner's personnel in maintenance of equipment.
- C. Equipment Acceptance:
  1. Adjust, repair, modify, or replace components failing to perform as specified and rerun tests.
  2. Make final adjustments to equipment under direction of manufacturer's representative.
- D. Furnish installation certificate from equipment manufacturer's representative attesting that equipment has been properly installed and is ready for startup and testing.

#### **3.5 DEMONSTRATION**

- A. Division 01: Requirements for demonstration and training.
- B. Demonstrate equipment startup, shutdown, routine maintenance, and emergency repair procedures to Owner's personnel.

#### **3.6 MAINTENANCE**

- A. Division 01: Requirements for maintenance service.
- B. Provide service and maintenance of security access equipment for **one year** from date of Substantial Completion.

**END OF SECTION 28 13 00**

## **SECTION 31 10 00 – SITE CLEARING**

### **PART 1 GENERAL**

#### **1.1 SUMMARY**

- A. Section includes protecting existing vegetation to remain, removing existing vegetation, clearing and grubbing, removing above- and below-grade site improvements, disconnecting, capping, or sealing site utilities, temporary erosion and sediment control, and the removal of pavements as indicated on the Contract Drawings.
- B. Related Requirements:
  - 1. 31 20 00 Earthwork

#### **1.2 DEFINITIONS**

- A. Clearing: Cut and dispose of all trees, down timber, tubs, brush, bushes and debris from all areas designated to be cleared.
- B. Grubbing: Remove and dispose of all stumps, roots, moss, grass, turf, debris or other objectionable materials as required within the project area.

#### **1.3 MATERIAL OWNERSHIP**

- A. Except for materials indicated to be stockpiled or otherwise remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

#### **1.4 PROJECT CONDITIONS**

- A. Vegetation clearing will follow the USFWS Recommended Time Periods for Avoiding Vegetation Clearing in Alaska, unless the USFWS has been consulted to determine the most appropriate clearing methods to avoid impacts to nesting migratory species. The project area is located within Southcentral Alaska, in which the USFWS recommends avoiding vegetation clearing from May 1 through July 15th in forested/woodland and shrub/open areas.
- B. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.
  - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Project Representative and authorities having jurisdiction.
- C. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.
- D. Salvable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises where indicated.
- E. Utility Locator Service: Notify Locate Call Center and City of Kenai Public Works before site clearing.
- F. Do not commence site clearing operations until temporary erosion and sedimentation control measures are in place.

**PART 2 PRODUCTS (NOT USED)**

**PART 3 PART 3 EXECUTION**

**3.1 PREPARATION**

- A. Protect and maintain benchmarks and survey control points from disturbance during construction.
- B. Locate and clearly flag trees and vegetation to remain or to be relocated.
- C. Protect existing site improvements to remain from damage during construction.
  - 1. Restore damaged improvements to their original condition, as acceptable to Project Representative.

**3.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL**

- A. Provide temporary erosion- and sedimentation-control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to Division 01 Section – Temporary Stormwater Pollution Controls.
- B. Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
- C. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

**3.3 EXISTING UTILITIES**

- A. Locate, identify, disconnect, and seal or cap off utilities indicated to be removed.
  - 1. Arrange with utility companies to shut off indicated utilities.
- B. Interrupting Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others, unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
  - 1. Notify Project Representative not less than two days in advance of proposed utility interruptions.
- C. Do not proceed with utility interruptions without Project Representative's written permission.
- D. Do not disrupt utility service of adjacent buildings and leaseholders.

**3.4 CLEARING AND GRUBBING**

- A. The areas denoted on the Drawings to be cleared and grubbed shall be staked or otherwise marked on the ground by the Contractor. The clearing and grubbing shall be done far enough ahead of the earthwork operation to permit cross-sectioning prior to excavation or embankment.
- B. Mechanical brush cutting equipment may be used for clearing. Dozers or other mechanical equipment not specifically designed for brush cutting may not be used. A root-rake

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- attachment or other approved suitable method shall be used to grub and remove the root mat.
- C. The removal of existing structures and utilities required to permit orderly progress of work shall be accomplished by local agencies, unless otherwise shown on the Plans. Whenever a utility pole, pipeline, conduit, sewer, or other utility is encountered and must be removed or relocated, the Contractor shall advise the Owner's Representative who will notify the proper local authority or owner and attempt to secure prompt action.
  - D. The Contractor shall clear the designated area of all objectionable materials. Trees unavoidably falling outside the specified limits must be cut up, removed, and disposed of in a satisfactory manner. In order to minimize damage to trees that are to be left standing, trees shall be felled toward the center of area being cleared. The Contractor shall preserve and protect from injury all trees not to be removed.
  - E. Remove all stumps, roots, buried logs, brush, and other unsatisfactory materials. Tap roots and other projections over 1.5 inches in diameter shall be grubbed out to a depth of at least 18 inches below the finished subgrade or slope elevation.

### **3.5 REMOVAL OF PAVEMENT, SIDEWALKS, CURBS AND GUTTERS**

- A. In removing concrete pavements, curbs, walks, driveways and similar structures, make all cuts clean, vertical, and true to designated lines where an abutting structure or a part of a structure is to be left in place.

### **3.6 DISPOSAL OF SURPLUS AND WASTE MATERIALS**

- A. Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.

**END OF SECTION 31 10 00**

## **SECTION 31 20 00 - EARTHWORK**

### **PART 1 GENERAL**

#### **1.1 SUMMARY**

**A. Section Includes:**

1. Excavating and filling for rough grading the Site.
2. Preparing subgrades for slabs-on-grade, pavements, and turf and grasses.
3. Excavating and backfilling for buildings and structures.
4. Drainage course for concrete slabs-on-grade.
5. Subbase course for concrete pavements.
6. Subbase course and base course for asphalt paving.
7. Excavating and backfilling trenches for utilities and pits for buried utility structures.
8. Rigid insulation board for water and sewer service lines as shown on the Drawings.

**B. Related Requirements:**

1. Section 03 30 00 – Cast-in-Place Concrete
2. Section 31 23 19 – Dewatering
3. Section 32 91 19.13 – Topsoil Placement and Grading
4. Section 32 92 19.16 – Hydraulic Seeding
5. Section 33 10 00 – Water Utility
6. Section 33 34 00 – Onsite Wastewater Disposal

**C. References:**

The latest revision of the publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

**AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)**

ASTM C 136	Sieve Analysis of Fine and Coarse Aggregates
ASTM D 422	Particle-Size Analysis of Soils
ASTM D 1140	Amount of Material in Soils Finer than the No. 200 (75-micrometer) Sieve
ASTM D 1557	Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/cu. ft. (2,700 kN-m/cu. m.))



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ASTM D 2487	Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 2922	Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D 3017	Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)
ASTM D 4318	Liquid Limit, Plastic Limit, and Plasticity Index of Soils

### 1.2 DEFINITIONS

- A. Backfill: Soil material used to fill an excavation.
  - 1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
  - 2. Final Backfill: Backfill placed over initial backfill to fill a trench.
- B. Base Course: Aggregate layer placed between the subbase course and hot-mix asphalt paving.
- C. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.
- D. Borrow. Additional satisfactory material beyond the material obtained from Usable Excavation that is required for the construction of grading improvements or for other portions of the work. Borrow material shall be obtained from designated sources within the limits of work first, then from off-site, contractor furnished sources.
- E. Degree of Compaction. Degree of compaction required, except as noted in the second sentence, is expressed as a percentage of the maximum density obtained by the test procedure presented in ASTM D 1557 abbreviated as a percent of laboratory maximum density. Since ASTM D 1557 applies only to soils that have 30 percent or less by weight of their particles retained on the 3/4 inch sieve, the degree of compaction for material having more than 30 percent by weight of their particles retained on the 3/4 inch sieve shall be expressed as a percentage of the maximum density in accordance with AASHTO T 180 Method D and corrected with AASHTO T 224. To maintain the same percentage of coarse material, the "remove and replace" procedure as described in the NOTE 8 in Paragraph 7.2 of AASHTO T 180 shall be used.
- F. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.
  - 1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by the Engineer.
  - 2. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Engineer. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.
- G. Fill: Soil materials used to raise existing grades.

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- H. Nonfrost Susceptible (NFS) Material. Nonfrost susceptible material shall be inorganic soil containing less than 6 percent by weight finer than #200 sieve grain size. Test methods shall be in accordance with ASTM C136 and ASTM D 422.
- I. Rock. Solid homogeneous interlocking crystalline material with firmly cemented, laminated, or foliated masses or conglomerate deposits, neither of which can be removed without systematic drilling and blasting, drilling and the use of expansion jacks or feather wedges, or the use of backhoe-mounted pneumatic hole punchers or rock breakers; also large boulders, measuring 1 cubic yard in volume or larger, buried masonry, or concrete other than pavement exceeding ½ cubic yard in volume.
- J. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, wetwells, vaults, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
- K. Subbase Course: Aggregate layer placed between the subgrade and base course for hot-mix asphalt pavement, or aggregate layer placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.
- L. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.
- M. Utilities: On-site underground pipes, conduits, ducts, and cables as well as underground services within buildings.

### **1.3 SUBMITTALS**

#### **A. Product Data (Action Submittal)**

- 1. Source sieve analysis and certificate for select granular materials.
- 2. Rigid insulation board.

#### **B. Test Reports (Informational Submittals)**

- 1. Field Density Tests: Submit density test reports within 24 hours of field testing
- 2. Laboratory Tests: Submit laboratory test reports prior to use of materials
- 3. Qualifications: Submit qualification of commercial testing laboratory or Contractor's testing facilities prior to construction.

### **1.4 SUBSURFACE DATA AND CONDITIONS**

- A. Subsurface soil boring logs are shown in the Geotechnical Report for Kenai Municipal Airport Sand Storage Building dated May 2020 and included as Appendix A with these Contract Documents.

### **1.5 CLASSIFICATION OF EXCAVATION**

- A. General. Excavation specified shall be done on a classified basis, in accordance with the following designations and classifications:

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1. Usable Excavation. Usable excavation shall include the excavation of satisfactory materials re-used on the site in fills or backfills. Usable excavation does not include excavation of Borrow.
2. Unusable Excavation. Unusable excavation shall include the excavation and disposal of all materials not re-used on the site, including surplus satisfactory material and unsatisfactory materials.

### **1.6 CRITERIA FOR BIDDING**

#### **A. Base bids on the following criteria:**

1. Surface elevations are as indicated.
2. Pipes or other artificial obstructions, except those indicated, will not be encountered.
3. Ground water elevations indicated by the boring log were those existing at the time subsurface investigations were made and do not necessarily represent ground water elevation at the time of construction.
4. Material character is indicated by the boring logs.

## **PART 2 PRODUCTS**

### **2.1 SOIL MATERIALS**

- A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.
- B. Suitable Material. Suitable material may be obtained from excavation or borrow. The Project Representative will approve material as "suitable" for use in embankment when the material meets the following criteria:
  1. Sand, rock, gravel;
  2. Gradation of 100% by weight passing 6 inch screen; and
  3. Meets definition of Non-Frost Susceptible material.
- C. Unsuitable Materials. Material that does not meet the testing requirement for Suitable Material. Material containing vegetable or organic matter, such as muck, peat, organic silt, or sod is considered unsuitable for use in embankment construction. Material that is contaminated by hazardous substances, including fuel or oil, in greater quantity than state and federal standards allow is considered unsuitable for use. Project Representative shall be notified of any contaminated materials.

### **2.2 SELECT GRANULAR MATERIAL**

- A. Subbase. Subbase shall be ADOT&PF P-154 Subbase. The subbase material shall consist of hard durable particles or fragments of granular aggregates. This material will be mixed or blended with fine sand, clay, stone dust, or other similar binding or filler materials produced from approved sources. This mixture must be uniform and shall comply with the requirements of these Specifications as to gradation, soil constants, and shall be capable of being compacted into a dense and stable subbase. The material shall be free from vegetable matter, lumps or

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excessive amounts of clay, and other objectionable or foreign substances. Pit-run material may be used, provided the material meets the requirements specified.

Aggregate gradation shall meet the requirements of the following, determined according to ATM 304.

1. Subbase shall be graded within the limitations below:

SUBBASE	
Sieve designation (square opening)	Percentage by weight passing sieves
3 in	90-100
No. 4	20-55
No. 200	0-6

The percent passing the No. 200 sieve will be determined on minus 3-inch material.

The portion of the material passing the No. 40 sieve shall have a liquid limit of not more than 25 and a plasticity index of not more than 6 when tested according to ATM 204 and ATM 205.

The gradations shall be well graded from coarse to fine and shall not vary from the low limit on one sieve to the high limit on the adjacent sieves, or vice versa.

- B. Base Course. Base Course shall be ADOT&PF P-209 Crushed Aggregate Base Course. Base Course shall consist of clean, sound, durable particles of crushed stone or crushed gravel and shall be free from vegetable matter, excess coatings of clay, silt, or other objectionable materials and shall contain no clay balls or other deleterious materials. The method used to produce the crushed gravel shall result in the fractured particles in the finished product as consistent and uniform as practicable. Fine aggregate passing the No. 4 sieve shall consist of fines from the coarse aggregate crushing operation. If necessary, fine aggregate may be added to produce the correct gradation. The fine aggregate shall be produced by crushing stone and gravel that meet the coarse aggregates requirements for wear and soundness.

1. Meet the following requirements:

Material Test	Requirement	Standard
<b>Coarse Aggregate</b>		
Resistance to Degradation	Loss: 45% maximum	AASHTO T 96
Soundness of Aggregates by Use of Sodium Sulfate	Loss after 5 cycles: 12% maximum using Sodium sulfate	AASHTO T 104
Percentage of Fractured Particles	Minimum 90% by weight of particles with at least two fractured faces and 100% with at least one fractured face <sup>1</sup>	ATM 305
Flat Particles, Elongated Particles, or Flat and Elongated Particles	10% maximum, by weight, of flat, elongated, or flat and elongated particles <sup>2</sup>	ATM 306
Degradation Value	45%, minimum	ATM 313

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<b>Fine Aggregate</b>		
Liquid limit	Less than or equal to 25	ATM 204
Plasticity Index	Not more than six (6)	ATM 205

- <sup>1</sup> The area of each face shall be equal to at least 75% of the smallest mid-sectional area of the piece. When two fractured faces are contiguous, the angle between the planes of fractures shall be at least 30 degrees to count as two fractured faces.
  - <sup>2</sup> A flat particle is one having a ratio of width to thickness greater than five (5); an elongated particle is one having a ratio of length to width greater than five (5).
2. The gradation of the final aggregate base material shall meet the requirements of the gradation given in the table below when tested per ATM 304. The gradation shall be well graded from coarse to fine and shall not vary from the lower limit on one sieve to the high limit on an adjacent sieve or vice versa:

<b>BASE COURSE</b>		
<b>U.S. Std. Sieve Designation</b>	<b>Design Range, Percentage by Weight Passing</b>	<b>Job Control Grading Band Tolerance (Percent)</b>
	<b>Base Course - D-1</b>	
1 in.	100	+/- 5
¾ in.	70-100	+/- 8
3/8 in.	50-80	+/- 8
No. 4	35-65	+/- 8
No. 8	20-50	+/- 8
No. 50	6-30	+/- 5
No. 200	0-5	+/- 3

- C. Class C Bedding. Used for pipe bedding and initial backfill. Material shall be manufactured on-site by screening excavated materials or material shall be imported by the Contractor.

1. Class C Bedding shall be graded within the limitations delineated below:

<b>CLASS C BEDDING</b>	
<b>U.S. Std. Sieve Designation</b>	<b>Cumulative Percent Passing by Weight</b>
2 in	100%
½ in	40-100
No. 4	20-75
No 10	12-60
No. 40	2-30
No. 200	0-6

2. In addition to the bedding limits listed above, the fraction of material passing the #200 sieve shall not be greater than 20% of that fraction passing the #40 sieve.

- D. Sand blanket. Used over and under rigid insulation board.

1. Material shall contain no muck, frozen material, roots, sod, or other deleterious matter and with a plasticity index not greater than 6 as determined by ATM 204 and ATM 205. Meet the grading requirements below as determined by ATM 304:

**SAND BLANKET**

<b>U.S. Std. Sieve Designation</b>	<b>Cumulative Percent Passing by Weight</b>
3/8 in	100%
No. 4	15-65
No. 200	0-6

- E. Class 1 Riprap. Stone for this work shall be hard angular quarry stones and have a percentage of wear of not more than fifty (50) at five hundred (500) revolutions as determined by ASTM C-535. The least dimension of any piece of stone shall be not less than one-fourth (1/4) its greatest dimension. Stones shall meet the following gradation requirement:
1. No more than ten percent (10%) of the stones by total weight shall weigh more than fifty (50) pounds per piece and no more than fifty percent (50%) by total weight of the stones shall weigh less than twenty-five (25) pounds per piece.

## **2.3 ACCESSORIES**

- A. Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility; colored to comply with local practice or requirements of authorities having jurisdiction.
- B. Detectable Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored to comply with local practice or requirements of authorities having jurisdiction.

## **2.4 RIGID INSULATION BOARD**

- A. Insulation board shall be 60 psi polystyrene meeting the requirements of AASHTO M 230, Type VI, except that the maximum water absorption by weight is 10%, as determined by ASTM C 272. Meet or exceed R value of 4.5 per inch (ASTM C 177).

## **PART 3 EXECUTION**

### **3.1 PREPARATION**

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth-moving operations.
- B. Protect and maintain erosion and sedimentation controls during earth-moving operations.
- C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

### **3.2 EXCAVATION, GENERAL**

- A. Perform excavation of every type of material encountered within the limits of the project to the lines, grades, and elevations indicated and as specified. Grading shall be in conformity with the typical sections shown and the tolerances specified in paragraph FINISHING. Suitable excavated materials shall be transported to and placed in fill or embankment within the limits of the work. Unsuitable materials encountered within the limits of the work shall be excavated

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below grade and replaced with suitable materials as directed. Such excavated material and the suitable material ordered as replacement shall be included in excavation. Surplus suitable excavated material not required for fill or embankment shall be disposed of, unless otherwise indicated on Drawings. Unsuitable excavated material shall be disposed of. During construction, excavation and fill shall be performed in a manner and sequence that will provide proper drainage at all times. Material required for fill or embankment in excess of that produced by excavation within the grading limits shall be obtained from Borrow.

- B. Drainage. Provide for the collection and disposal of surface and subsurface water encountered during construction. Completely drain construction site during periods of construction to keep soil materials sufficiently dry. The Contractor shall grade the construction area to provide positive surface water runoff away from the construction activity and/or provide temporary ditches, swales, and other drainage features and equipment as required to maintain dry soils. When unsuitable working platforms for equipment operation and unsuitable soil support for subsequent construction features develop, remove unsuitable material and provide suitable fill. It is the responsibility of the Contractor to assess the soil and ground water conditions presented by the plans and specifications and to employ necessary measures to permit construction to proceed.
- C. Dewatering. Groundwater flowing toward or into excavations shall be controlled to prevent sloughing of excavation slopes and walls, boils, uplift and heave in the excavation and to eliminate interference with orderly progress of construction. French drains, sumps, ditches or trenches will not be permitted within 3 feet of the foundation of any structure, except with specific written approval, and after specific contractual provisions for restoration of the foundation area have been made. Control measures shall be taken by the time the excavation reaches the water level in order to maintain the integrity of the in situ material. While the excavation is open, the water level shall be maintained continuously, at least 2 feet below the working level. Operate dewatering system continuously until construction work below existing water levels is complete. Submit performance records weekly. Dewatering shall be in accordance with Section 31 23 19.
- D. Stockpiles. Stockpiles shall be kept in a neat and well drained condition, giving due consideration to drainage at all times. The ground surface at stockpile locations shall be cleared, grubbed, and sealed by rubber-tired equipment, excavated satisfactory and unsatisfactory materials shall be separately stockpiled. Stockpiles of satisfactory materials shall be protected from contamination which may destroy the quality and fitness of the stockpiled material. If the Contractor fails to protect the stockpiles, and any material becomes unsuitable, such material shall be removed and replaced with suitable material from approved sources.
- E. Separation of Subbase. Excavation which meets the specification for Subbase shall be stockpiled and utilized for subgrade preparation in locations as indicated on the plans.
- F. Underground Utilities. Movement of construction machinery and equipment over pipes and utilities during construction shall be at the Contractor's risk. Perform work adjacent to non-owner utilities as indicated in accordance with procedures outlined by utility company. Report damage to utility lines or subsurface construction immediately to the Engineer.

### **3.3 GROUND SURFACE PREPARATION**

- A. General Requirements. Ground surface on which fill is to be placed shall be cleared and grubbed in accordance with Section 31 10 00. Sloped surfaces steeper than 1 vertical to 4 horizontal shall be stepped or benched so that the fill material will bond with the existing material. Ground surfaces shall be plowed, disked, or otherwise broken up to a depth of 6 inches; pulverized; moistened or aerated as necessary; thoroughly mixed; and compacted to at least 95 percent laboratory maximum density. Compaction shall be accomplished by sheepsfoot rollers,

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pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment. The prepared ground surface shall be scarified and moistened or aerated as required just prior to placement of embankment materials to assure adequate bond between embankment material and the prepared ground surface.

- B. Frozen Material. Fill shall not be placed on a foundation which contains frozen material, or which has been subjected to freeze-thaw action. This prohibition encompasses all foundation types, including the natural ground, all prepared subgrades (whether in an excavation or on an embankment) and all layers of previously placed and compacted earth fill which become the foundations for successive layers of earth fill. All material that freezes or has been subjected to freeze-thaw action during the construction work, or during periods of temporary shutdowns, such as, but not limited to, nights, holidays, weekends, winter shutdowns, or earthwork operations, shall be removed to a depth that is acceptable to the Engineer and replaced with new material. Alternatively, the material will be thawed, dried, reworked, and recompact to the specified criteria before additional material is placed. The Engineer will determine when placement of fill shall cease due to cold weather. The Engineer may elect to use average daily air temperatures, and/or physical observation of the soils for his determination. Fill material shall not contain frozen clumps of soil, snow, or ice.

### **3.4 UTILIZATION OF EXCAVATED MATERIALS**

- A. Unsuitable excavated materials removed from excavations shall be disposed of off-site in Contractor provided approved locations. Suitable material removed from excavations shall be used, insofar as practicable, in the construction of fills, embankments, subgrades, shoulders, and for similar purposes. No suitable excavated material shall be wasted without specific written authorization. Coarse rock from excavations shall be stockpiled and used for constructing slopes or embankments adjacent to streams, or sides and bottoms of channels and for protecting against erosion, where directed.

### **3.5 EXCAVATION FOR STRUCTURES**

- A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 0.1 feet. Extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.
  - 1. Excavations for Footings and Foundations: When excavations for footings and foundations extend below the bottom of Subbase, do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.
- B. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill may be used when approved by Engineer.
- C. Fill all other unauthorized excavations with Subbase compacted to minimum 95 percent laboratory maximum density.

### **3.6 EXCAVATION FOR WALKS AND PAVEMENTS**

- A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

### **3.7 BACKFILL FOR STRUCTURES**

- A. Place and compact backfill in excavations promptly, but not before completing the following:



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1. Construction below finish grade including, where applicable, dampproofing, waterproofing, footing drains and perimeter insulation.
  2. Surveying locations of underground utilities for record documents.
  3. Inspecting and testing underground utilities.
  4. Removing concrete formwork.
  5. Removing trash and debris.
  6. Removing temporary shoring and bracing, and sheeting.
  7. Installing permanent or temporary horizontal bracing on horizontally supported walls.
- B. Place backfill and fill materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.
- C. Place backfill and fill materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.
- D. Compact soil to not less than 95 percent of laboratory maximum density.

### **3.8 SUBGRADE PREPARATION**

- A. Construction. Subgrade shall be shaped to line, grade, and cross section, and compacted as specified. This operation shall include plowing, disking, and any moistening or aerating required to obtain specified compaction. Soft or otherwise unsuitable material shall be removed and replaced with suitable excavated material or other approved material as directed. Rock encountered in the cut section shall be excavated to a depth of 6 inches below finished grade for the subgrade. Low areas resulting from removal of unsuitable material or excavation of rock shall be brought up to required grade with suitable materials, and the entire subgrade shall be shaped to line, grade, and cross section and compacted as specified. After rolling, the surface of the subgrade for areas to receive paving shall not show deviations greater than ½ inch when tested with a 10 foot straightedge applied both parallel and at right angles to the centerline of the area. The elevation of the finish subgrade shall not vary more than 0.05 foot from the established grade and cross section.
- B. Compaction. Compaction shall be accomplished by sheepfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment. Each layer of the embankment shall be compacted to at least 95 percent of laboratory maximum density.

### **3.9 MOISTURE CONTROL**

- A. Provide water for compaction. Water for compaction shall be incidental to the construction.
- B. Uniformly moisten or aerate subgrade and each subsequent fill or backfill layer before compaction to within 2 percent of optimum content.
1. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.

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2. Remove and replace, or scarify and air-dry, otherwise suitable soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry density.

#### **3.10 GRADING**

- A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
- B. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to elevations required to achieve indicated finish elevations, within the following subgrade tolerances:
  1. Turf or Unpaved Areas: Plus or minus 1 inch.
  2. Pavements: Plus or minus ½ inch when tested with a 10-foot straightedge.
  3. Grading inside Building Lines: Finish subgrade to a tolerance of ½ inch when tested with a 10-foot straightedge.

#### **3.11 SUITABLE MATERIAL, SUBBASE, AND BASE COURSES**

- A. Place suitable material, subbase course, and base course on subgrades free of mud, frost, snow, or ice.
- B. On prepared subgrade, place respective material as follows:
  1. Shape material to required crown elevations and cross-slope grades.
  2. Place subbase course and base course in successive horizontal layers of not more than 8 inches in loose depth for the full width of the cross section, unless otherwise approved by the Engineer.
  3. The material in the layer being placed shall be with  $\pm 2\%$  of optimum moisture content immediately prior to compaction.
  4. Compact material to required grades, lines, cross sections, and thickness to not less than 95 percent of laboratory maximum dry density.

#### **3.12 DRAINAGE COURSE UNDER CONCRETE SLABS-ON-GRADE**

- A. Place drainage course on subgrades free of mud, frost, snow, or ice.
- B. On prepared subgrade, place drainage course under concrete slabs-on-grade as follows:
  1. Place drainage course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
  2. Compact each layer of drainage course to required cross sections and thickness to not less than 95 percent of laboratory maximum dry density.

#### **3.13 EXCAVATION FOR UTILITY TRENCHES**

- A. General. Excavation shall be performed to the lines and grades indicated. During excavation, material satisfactory for backfilling shall be stockpiled in an orderly manner at a distance from the banks of the trench equal to 1/2 the depth of the excavation, but in no instance closer than

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- 2 feet. Excavated material not required or not satisfactory for backfill shall be removed from the site. Grading shall be done as may be necessary to prevent surface water from flowing into the excavation, and any water accumulating shall be removed to maintain the stability of the bottom and sides of the excavation. Unauthorized over excavation shall be backfilled in accordance with paragraph UTILITY TRENCH BACKFILLING AND COMPACTION.
- B. Trench Excavation Requirements. The trench shall be excavated as recommended by the manufacturer of the pipe to be installed. Trench walls below the top of the pipe shall be made vertical, and of such width as recommended in the manufacturer's installation manual. Where no manufacturer's installation manual is available, trench walls shall be made vertical. Trench walls more than 4 feet high shall be shored, cut back to a stable slope, or provided with equivalent means of protection for employees who may be exposed to moving ground or cave in. Vertical trench walls more than 4 feet high shall be shored. Trench walls which are cut back shall be excavated to at least the angle of repose of the soil. Special attention shall be given to slopes which may be adversely affected by weather or moisture content. The trench width below the top of pipe shall not exceed 30 inches plus pipe outside diameter (O.D.) for pipes of less than 24 inches inside diameter and shall not exceed 42 inches plus pipe outside diameter for sizes larger than 24 inches inside diameter. Where recommended trench widths are exceeded, redesign, stronger pipe, or special installation procedures shall be utilized by the Contractor. The cost of redesign, stronger pipe, or special installation procedures shall be borne by the Contractor without any additional cost to the Owner.
1. Bottom Preparation. The bottoms of trenches shall be accurately graded to provide uniform bearing and support for the bottom quadrant of each section of the pipe. Bell holes shall be excavated to the necessary size at each joint or coupling to eliminate point bearing. Stones of 2 inches or greater in any dimension, or as recommended by the pipe manufacturer, whichever is smaller, shall be removed to avoid point bearing.
  2. Removal of Unstable Material. Where unstable material is encountered in the bottom of the trench, such material shall be removed to the depth directed and replaced to the proper grade with select granular material as provided in paragraph UTILITY TRENCH BACKFILLING AND COMPACTION. When removal of unstable material is required due to the Contractor's fault or neglect in performing the work, the resulting material shall be excavated and replaced by the Contractor without additional cost to the Owner.
  3. Excavation for Appurtenances. Excavation for manholes, inlets, or similar structures shall be sufficient to leave at least 12 inches clear between the outer structure surfaces and the face of the excavation or support members. Rock shall be cleaned of loose debris and cut to a firm surface either level, stepped, or serrated, as shown or as directed. Loose disintegrated rock and thin strata shall be removed. Removal of unstable material shall be as specified above. When concrete or masonry is to be placed in an excavated area, special care shall be taken not to disturb the bottom of the excavation. Excavation to the final grade level shall not be made until just before the concrete or masonry is to be placed.
- C. Drainage. During construction, excavation and fill shall be performed in a manner and sequence that will provide proper drainage at all times. Provide for the collection and disposal of surface and subsurface water encountered during construction. Completely drain construction site during periods of construction to keep soil materials sufficiently dry. The Contractor shall grade the construction area to provide positive surface water runoff away from the construction activity and/or provide temporary ditches, swales, and other drainage features and equipment as required to maintain dry soils. When unsuitable working platforms for equipment operation and unsuitable soil support for subsequent construction features develop, remove unsuitable material and provide new soil material as specified herein. It is the responsibility of the Contractor to assess the soil and ground water conditions presented by

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- the plans and specifications and to employ necessary measures to permit construction to proceed.
- D. Dewatering. Groundwater flowing toward or into excavations shall be controlled to prevent sloughing of excavation slopes and walls, boils, uplift and heave in the excavation and to eliminate interference with orderly progress of construction. French drains, sumps, ditches or trenches will not be permitted within 3 feet of the foundation of any structure, except with specific written approval, and after specific contractual provisions for restoration of the foundation area have been made. Control measures shall be taken by the time the excavation reaches the water level in order to maintain the integrity of the in situ material. While the excavation is open, the water level shall be maintained continuously, at least 2 feet below the working level. Operate dewatering system continuously until construction work below existing water levels is complete. Submit performance records weekly. Dewatering shall be in accordance with Section 31 23 19.
  - E. Stockpiles. Stockpiles shall be kept in a neat and well-drained condition, giving due consideration to drainage at all times. The ground surface at stockpile locations shall be cleared, grubbed, and sealed by rubber-tired equipment, excavated satisfactory and unsatisfactory materials shall be separately stockpiled. Stockpiles of satisfactory materials shall be protected from contamination which may destroy the quality and fitness of the stockpiled material. If the Contractor fails to protect the stockpiles, and any material becomes unsatisfactory, such material shall be removed and replaced with satisfactory material from approved sources.

#### **3.14 UTILITY TRENCH BACKFILLING AND COMPACTION**

- A. Place backfill on subgrades free of mud, frost, snow, or ice.
- B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.
- C. Trenches under Footings: Backfill trenches excavated under footings and within 18 inches of bottom of footings with Subbase.
- D. General Trench Backfill. Trenches shall be backfilled to the grade shown. The trench shall be backfilled to a minimum of 3 feet above the top of pipe prior to performing the required pressure tests.
  - 1. Replacement of Unstable Material. Unstable material removed from the bottom of the trench or excavation shall be replaced with Satisfactory Material placed in layers not exceeding 8 inches loose thickness.
  - 2. Bedding and Initial Backfill. Bedding and initial backfill shall be material and thickness as shown on the Drawings. Initial backfill material shall be placed and compacted with approved tampers to a height above the pipe as shown on the Drawings. The backfill shall be brought up evenly on both sides of the pipe for the full length of the pipe. Care shall be taken to ensure thorough compaction of the fill under the haunches of the pipe. Bedding and backfill shall be placed in horizontal layers of not more than 8 inches loose depth and compacted to 95% of maximum dry density.
  - 3. Final Backfill. The remainder of the trench shall be filled with material as detailed on the Drawings. Backfill material shall be placed and compacted as follows:

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- a. Backfill shall be deposited in layers of a maximum of 8 inch loose thickness, and compacted to 95% maximum dry density. Compaction by water flooding or jetting will not be permitted.
- E. Warning Tape: Install warning tape directly above utilities, where shown on Drawings.
- F. Backfill for Appurtenances. After the manhole, catch basin, inlet, or similar structure has been constructed, backfill shall be placed in such a manner that the structure will not be damaged by the shock of falling earth. The backfill material shall be deposited and compacted as specified for final backfill, and shall be brought up evenly on all sides of the structure to prevent eccentric loading and excessive stress.
- G. Frozen Material. Embankment shall not be placed on a foundation which contains frozen material, or which has been subjected to freeze-thaw action. This prohibition encompasses all foundation types, including the natural ground, all prepared subgrades (whether in an excavation or on an embankment) and all layers of previously placed and compacted earth fill which become the foundations for successive layers of earth fill. All material that freezes or has been subjected to freeze-thaw action during the construction work, or during periods of temporary shutdowns, such as, but not limited to, nights, holidays, weekends, winter shutdowns, or earthwork operations, shall be removed to a depth that is acceptable to the Engineer and replaced with new material. Alternatively, the material will be thawed, dried, reworked, and recompact to the specified criteria before additional material is placed. The Engineer will determine when placement of fill shall cease due to cold weather. The Engineer may elect to use average daily air temperatures, and/or physical observation of the soils for his determination. Embankment material shall not contain frozen clumps of soil, snow, or ice.

#### **3.15 SPECIAL REQUIREMENTS**

Special requirements for both excavation and backfill relating to the specific utilities are as follows:

- A. Gas Distribution. Trenches shall be excavated to a depth that will provide not less than 24 inches of cover.
- B. Water Lines. Trenches shall be of a depth to provide a minimum cover of 10 feet from the indicated finished grade, to the top of the pipe. Where minimum cover is not achievable, insulation is to be installed as indicated on the Drawings.
- C. Sewer Lines. Trenches shall be of a depth to provide a minimum cover of 8 feet in non-traffic areas from the indicated finished grade, to the top of the pipe, except as indicated on the Drawings. In traffic areas, trenches shall be of a depth to provide a minimum cover of 10 feet. Where minimum cover is not achievable, insulation is to be installed as indicated on the Drawings.
- D. Condensate Lines. Trenches shall be to the depths shown on the Drawings.
- E. Electrical Distribution System. Direct burial cable and conduit or duct line shall have a minimum cover of 24 inches from the finished grade, unless otherwise indicated.

#### **3.16 RIGID INSULATION BOARD**

- A. Where rigid insulation board is required by the Drawings, place a minimum two-inch (2") layer of Sand Blanket. Set each board accurately to the line and grade established and anchor firmly in place. Place insulation to the required thickness, using a minimum of two layers. Stagger all joints between layers. Cover the insulation board with 4 inches (4") of Sand Blanket material prior to placing subsequent lifts. Use approved spreading and compacting equipment.

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**3.17 FIELD QUALITY CONTROL**

A. The following number of tests, if performed at the appropriate time, will be the minimum acceptable for each item and type of operation:

Item description	Test type	Test standard (select one if given a choice)	Testing frequency
Fills From Suitable Material	gradation	WAQTC FOP for AASHTO T 27 and 11	1 per source, and as required by changes in the material, not less than 1 per 10,000 tons (5,000 CY)
	maximum density	WAQTC FOP for AASHTO T 99 and T 180 <b>OR</b> ASTM 212	At least 2 and as required by changes in material
	field density	WAQTC FOP for AASHTO T 310 <b>OR</b> WAQTC FOP for AASHTO T 255 and T 265	1 per lift per 500 tons (250 CY), but not less than 2
Trench Bedding and Backfill	gradation	WAQTC FOP for AASHTO T 27 and 11	At least 1 and as required by changes in material
	maximum density	WAQTC FOP for AASHTO T 99 and T 180 <b>OR</b> ATM 212	At least 1 and as required by changes in material
	field density	WAQTC FOP for AASHTO T 310 <b>OR</b> WAQTC FOP for AASHTO T 255 and T 265	1 per lift per 100 LF or portion thereof for each separate alignment designation
Base Course	fracture	WAQTC FOP for AASHTO TP 61	1 per source, prior to use
	wear	AASHTO T 96	1 per source, prior to use
	Na <sub>2</sub> SO <sub>4</sub> soundness loss	AASHTO T 104	1 per source prior to use
	degradation	ATM 313	1 per source, prior to use
	liquid limit	WAQTC FOP for AASHTO T 89	1 per 2,000 tons (1,000 CY)
	plasticity index	WAQTC FOP for AASHTO T 90	1 per 2,000 tons (1,000 CY)
	gradation	WAQTC FOP for AASHTO T 27 and T 11	At least 2 and as required by changes in material
	maximum density	WAQTC FOP for AASHTO T 99 and T 180 <b>OR</b> ASTM 212	At least 2 and as required by changes in material
	field density	WAQTC FOP for AASHTO T 310	1 per 30 L.F. of footing but not less than 3 per structure.
	field density	WAQTC FOP for AASHTO T 310	1 per 500 S.F. of slab but not less than 3 per structure
	field density	WAQTC FOP for AASHTO T 310	1 per 1,000 S.F., but not less than one per lift or 4 total

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Item description	Test type	Test standard (select one if given a choice)	Testing frequency
Subbase	plasticity index	WAQTC FOP for AASHTO T 90	1 per source but not less than 1 per 5,000 tons (2,500 CY)
	gradation	WAQTC FOP for AASHTO T 27 and T 11	1 per source but not less than 1 per 5,000 tons (2,500 CY)
	maximum density	WAQTC FOP for AASHTO T 99 and T 180 <b>OR</b> ASTM 212	1 per source and as required by changes in material
	field density	WAQTC FOP for AASHTO T 310	1 per 30 L.F. of footing but not less than 3 per structure.
	field density	WAQTC FOP for AASHTO T 310	1 per 500 S.F. of slab but not less than 3 per structure
	field density	WAQTC FOP for AASHTO T 310	1 per lift per 500 tons (250 CY) but not less than 2 per lift

- B. Testing Facilities. Tests shall be performed by an approved commercial testing laboratory or may be tested by facilities furnished by the Contractor. No work requiring testing will be permitted until the facilities have been inspected and approved by the Engineer.
- C. Owner Testing. Owner may, at his option, provide additional field and laboratory testing for quality assurance.
- D. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

### **3.18 PROTECTION**

- A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
- B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
  - 1. Scarify or remove and replace soil material to depth as directed by Engineer, reshape and recompact.
- C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
  - 1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to the greatest extent possible.

**END OF SECTION 31 20 00**

## **SECTION 31 23 19 - DEWATERING**

### **PART 1 GENERAL**

#### **1.1 SUMMARY**

- A. Section includes construction dewatering.
- B. Related Sections:
  - 1. Section 31 20 00 – Earthwork
  - 2. Section 33 10 00 – Water System
  - 3. Section 33 40 00 – Onsite Wastewater Disposal

#### **1.2 SUBMITTALS**

- A. Shop Drawings for Information. For dewatering system, show arrangement, locations and details of wells and well points; locations of headers and discharge lines; and means of discharge and disposal of water.

#### **1.3 FIELD CONDITIONS**

- A. Survey Work: Engage a qualified land surveyor or professional engineer to survey adjacent existing buildings, structures, and site improvements; establish exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations.

### **PART 2 PRODUCTS**

#### **2.1 PERFORMANCE REQUIREMENTS**

- A. Dewatering Performance: Design, furnish, install, test, operate, monitor, and maintain dewatering system of sufficient scope, size, and capacity to control hydrostatic pressures and to lower, control, remove, and dispose of ground water and permit excavation and construction to proceed on dry, stable subgrades.
- B. Regulatory Requirements: Comply with water disposal requirements of authorities having jurisdiction.

### **PART 3 EXECUTION**

#### **3.1 PREPARATION**

- A. Provide temporary grading to facilitate dewatering and control of surface water.
- B. Protect and maintain temporary erosion and sedimentation controls.

#### **3.2 INSTALLATION**

- A. Install dewatering system utilizing wells, well points, or similar methods complete with pump equipment, standby power and pumps, filter material gradation, valves, appurtenances, water disposal, and surface-water controls.



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1. Space well points or wells at intervals required to provide sufficient dewatering.
  2. Use filters or other means to prevent pumping of fine sands or silts from the subsurface.
- B. Place dewatering system into operation to lower water to specified levels before excavating below ground-water level.
- C. Provide standby equipment on-site, installed and available for immediate operation, to maintain dewatering on continuous basis if any part of system becomes inadequate or fails.

### **3.3 OPERATION**

- A. Operate system continuously until drains, sewers, and structures have been constructed and fill materials have been placed or until dewatering is no longer required.
- B. Operate system to lower and control ground water to permit excavation, construction of structures, and placement of fill materials on dry subgrades. Drain water-bearing strata above and below bottom of foundations, drains, sewers, and other excavations.
1. Do not permit open-sump pumping that leads to loss of fines, soil piping, subgrade softening, and slope instability.
  2. Reduce hydrostatic head in water-bearing strata below subgrade elevations of foundations, drains, sewers, and other excavations.
- C. Remove dewatering system from Project site on completion of dewatering. Plug or fill well holes with sand or cut off and cap wells a minimum of 36 inches below overlying construction.
- D. Promptly repair damages to adjacent facilities caused by dewatering operations.

**END OF SECTION 31 23 19**

## **SECTION 32 12 16 - ASPHALT PAVING**

### **PART 1 GENERAL**

#### **1.1 SUMMARY**

A. Section includes:

1. Hot-mix asphalt paving and patching.
2. Removal, disposal and replacement of existing asphaltic surfacing, including aggregate base course and existing traffic markings, as indicated on the Drawings.

B. Related Requirements:

1. Section 31 20 00 – Earthwork

#### **1.2 REFERENCES**

- A. AASHTO MP 1 Standard Specification for Performance Graded Asphalt Binder
- B. ASTM D 3665 Standard Practice for Random Sampling of Construction Materials

#### **1.3 ACTION SUBMITTALS**

A. Product Data:

1. For each type of product indicated. Include technical data and tested physical and performance properties.

B. Hot-mix asphalt mix designs. Certification of approval of each job mix proposed for the Work.

#### **1.4 INFORMATIONAL SUBMITTALS**

A. Material Certificates:

1. Aggregates.
2. Asphalt binder.
3. Joint Sealant.

#### **1.5 PROJECT CONDITIONS**

A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp or if the following conditions are not met:

1. Tack Coat: Minimum ambient air temperature of 60 degrees Fahrenheit.
2. Asphalt Course: Do not place asphalt concrete when it is raining or when rain is imminent, on a saturated or yielding surface, when the base material is frozen, or when

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weather conditions prevent proper handling or finishing of the mixture. Minimum surface temperature of 45 degrees Fahrenheit and ambient air temperature is 32 degrees Fahrenheit and not descending.

## **PART 2 PRODUCTS**

### **2.1 AGGREGATES**

#### **A. Hot-Mix Asphalt:**

1. Coarse aggregate is all mineral retained on the No. 4 sieve. The aggregate retained on a No. 4 sieve shall contain at least eight percent (80%) by weight of crushed pieces having two or more mechanically fractures surfaces.
  - a. All coarse aggregate shall be free from coatings of clay, silt, or other objectionable material. Coarse aggregate shall be tested for soundness in accordance with the requirements of ASTM C-88, or will have proven sound through adequate record of service.
  - b. When aggregate grading is such that the material will tend to segregate in stockpile or handling, it shall be supplied in two or more sizes. Each size of aggregate required to produce the combined gradation specified shall be placed in individual stockpiles at the plant site and separated by bulkheads or other means. When it is necessary to blend two or more aggregate sizes, the blending shall be done through separate bins at the cold elevator feeders and not in the stockpile.
2. Fine aggregate is composed of all mineral matter passing the No. 4 sieve. It shall consist of natural and/or manufactured material derived by crushing gravel.
  - a. The aggregate particles shall be clean, tough, durable, moderately sharp, and free from coating of clay, silt, or other objectionable matter and shall not contain clay balls or other aggregations of fine material. Fine aggregate shall be tested for soundness in accordance with the requirements of ASTM C-88, or shall have a satisfactory soundness record. When tested for soundness, the number of cycles shall be five, the solution shall be sodium sulphate; the maximum loss shall be nine percent (9%) by weight. Fine aggregates shall be maintained in individual stockpiles, suitably separated to prevent intermingling.
3. Mineral filler shall conform to the requirements of ASTM D-242.

### **2.2 ASPHALT MATERIALS**

- A. Asphalt Binder: Asphalt cement or binder shall conform to the requirements of AASHTO M-320 and Certified Performance Grade Asphalt Binder PG 52-28.
- B. Joint Sealant shall be STE-1, undiluted CSS-1, or approved equal.

### **2.3 MIXES**

- A. Hot-Mix Asphalt: Use Municipality of Anchorage Standard Specifications (MASS) A.C. Pavement, Class E. Paving mixture shall be composed of aggregate and paving asphalt within the broad band limits set forth in the following table:

**ASPHALT PAVING MIXTURE**

<b>U.S. Std. Sieve Designation</b>	<b>Cumulative Percent Passing by Weight</b>
1 in	-----
3/4 in	100
1/2 in	78-96
3/8 in	66-86
No. 4	46-66
No 8	34-52
No. 16	24-42
No. 30	16-32
No. 50	10-24
No. 100	7-16
No. 200	3-9
Asphalt Cement*	5.0-7.0

\*By weight of total mix.

- B. Job Mix: Submit for approval a job mix formula within the limits specified above. Provide correction factor ignition points generated in accordance with AASHTO T-308. The aggregate gradation of the job mix formula, when plotted upon an aggregate grading chart, shall closely approximate the shape of average gradations for the limits specified. For that portion of the aggregate passing No. 4 sieve, gradings which range from at or near the maximum of one (1) sieve to at or near the minimum of the next sieve will not be permitted. The Engineer may require increased asphalt content up to one half percent (0.5%) above that indicated by Marshall Design Criteria. Upon requiring increased asphalt content, the lower limit of percent voids and the upper limit of percent voids filled shall be waived.
- C. Maximum Permissible Variations: Tolerances to the approved Job Mix Formula shall not exceed the permissible variations presented in the following table. The Job Mix Formula band shall mean the approved Job Mix Formula plus-or-minus ( $\pm$ ) the numeric values for the maximum permissible variations.

<b>Maximum Permissible Variation (Percent by Weight of Total Aggregate)</b>	
<b>Sieve Size</b>	<b>Class E Asphalt</b>
3/8" and Larger	$\pm 5.0$
#4	$\pm 5.0$
#8	$\pm 4.0$
#s 16, 30 & 50	$\pm 4.0$
#100	$\pm 3.0$
#200	$\pm 2.0$
Asphalt	$\pm 0.4$

When these permissible variations are applied, the individual sieve shall not exceed the Broad Band limits.

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- D. Maximum temperature shall not vary more than twenty-five degrees (25°) Fahrenheit from the approved Job Mix Formula design.
- E. Test Methods: The job-mix shall be determined according to the Marshall Method, as set forth in the Asphalt Institute Manual series no. 2 (M5-2), Fourth Edition. Upon compaction and testing of the job-mix specimens, the mixture shall conform to the aforementioned specifications within the following limits:

ASPHALT PAVING MIXTURE LIMITS

Stability (Marshall) Pounds Minimum	1200
Flow (Marshall) Maximum	8 to 16
Percent Voids	3 to 5
Percent Voids Filled with Asphalt	75 to 85

## PART 3 EXECUTION

### 3.1 REMOVE EXISTING AC PAVING

- A. General: Saw cut perimeter of area to be removed and excavate existing pavement section. Remove existing base course and gravel fill where in the opinion of the Project Representative, construction operations have compromised the existing materials. Excavate rectangular or trapezoidal areas, extending 12 inches into adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Whenever possible, cuts shall be made at lane markings. Remove and dispose of excavated material.

### 3.2 SURFACE PREPARATION

- A. Proof-roll subbase using heavy, pneumatic-tired rollers to locate areas that are unstable or that require further compaction.
- B. Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.
  - 1. Sweep loose granular particles from surface of unbound-aggregate base course. Do not dislodge or disturb aggregate embedded in compacted surface of base course.
- C. The area to be paved shall be true to line and grade, having a smooth dry, compacted surface prior to the start of paving operations.
- D. Contractor shall notify the Engineer, a minimum of twenty-four (24) hours prior to paving, that the newly constructed existing surface has been prepared in conformance with the Drawings and Specifications and is ready to be paved. Project Representative shall inspect the grade through the use of string line, straightedge, levels, or any other means necessary. Upon determining the grade that has been proposed for paving is in conformance with the Drawings and Specifications, Project Representative will provide written authorization for the Contractor to proceed with the paving. The Contractor shall not initiate paving prior to receiving written authorization to proceed.

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- E. The surface of the Base Course, when finished, shall not demonstrate any deviation in excess of 1/2 inch in ten feet 1/2" in 10') parallel with, and at right angles to, the centerline, or more than five-eighths inch (5/8") total from centerline to face of curb of the area to be paved. Any deviation in excess of this amount shall be corrected by loosening, adding, or removing material and reshaping and compacting to satisfy the above requirement.

### **3.3 HOT-MIX ASPHALT PREPARATION**

- A. The asphalt shall be heated at the paving plant to a temperature at which it can be properly handled through the pumping system, but at no time shall the temperature of the asphalt exceed that recommended by the asphalt supplier or manufacturer, or be greater than three hundred twenty five degrees (325°) Fahrenheit or less than two hundred fifty degrees (250°) Fahrenheit.

### **3.4 HOT-MIX ASPHALT PLACEMENT**

- A. Haul trucks used for the transportation of hot mix asphalt from the plant to the Project shall have tight metal bottoms and shall be free from dust, screenings, petroleum oils, volatiles, and other mineral spirits which may affect the mix being hauled. The truck beds shall be cleaned as often as required, but at least once a day. After this operation the truck bed shall be elevated and thoroughly drained; no excess solution shall be permitted.
  - 1. When requested by the Engineer, trucks shall be equipped with covers of canvas, insulated boxes, or other suitable material, and be of sufficient size and weight to protect the load from adverse weather conditions and to maintain the required mix temperatures.
- B. Use asphalt pavers to distribute asphalt concrete. Asphalt pavers shall be self-propelled units provided with a heated vibratory screed. Grade and cross slope shall be controlled through the use of automatic grade and slope control devices. The paver shall be equipped with a receiving hopper having sufficient capacity for a uniform spreading operation. The hopper shall be equipped with a distribution system to place the asphalt concrete mixture uniformly in front of the screed without segregation and/or tearing.
  - 1. The term "screed" includes any strike off device operated by cutting, crowding, or other action which is effective on mixes at workable temperatures, without tearing, shoving, or gouging, and which produces a finished surface of an even and uniform texture. The screed shall be adjustable as to level and section and shall have provisions for vibration and heat.
  - 2. The screed assembly shall produce a finished surface of the required smoothness, thickness, and texture without tearing, shoving, displacing or segregating the asphalt concrete mixture. Screed extensions used for paving a constant width shall be heated and vibrated. Auger extensions shall be within one and one half feet (1.5') of the screed extension on both sides.
- C. Place the asphalt concrete upon the approved surface, spread, strike off, and adjust surface irregularities. The maximum compacted lift thickness allowed is 3 inches. Use hand tools to spread, rake, and lute asphalt concrete in areas where irregularities or unavoidable obstacles make mechanical spreading and finishing equipment impracticable.
- D. Do not place asphalt concrete abutting curbs or other concrete structures until they have cured for a minimum of 72 hours.

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- E. The asphalt concrete shall be placed on the road surface at a temperature not less than two hundred fifty degrees (250°) Fahrenheit or greater than three hundred degrees (300°) Fahrenheit. Additionally, the maximum temperature to which the asphalt concrete is heated shall not exceed the supplier's recommendation. The asphalt concrete temperature shall be measured directly behind the paver screed at the time of placement.
- F. Joint temperature shall be at least 150 degrees Fahrenheit. Any joint with a temperature less than 150 degrees Fahrenheit shall be saw cut and tack coated prior to placing asphalt materials.
- G. Longitudinal joints and edges shall be constructed to true line markings. Lines shall be established parallel to the center line for the paver to follow in placing individual lanes. The paver shall be operated and positioned to closely follow the established line. When backing trucks to the finisher, care shall be taken not to jar the paver.
- H. The texture of the unrolled surface shall be checked to determine its uniformity. The adjustment of the screed, tamping, feed screws, hopper feed, etc., shall be checked frequently to assure uniform spreading of the mix. Segregation of the material shall not be permitted. If segregation occurs, the spreading operation shall be immediately suspended until the cause is determined and corrected.
- I. Any irregularities left by the paver shall be corrected by trimming directly behind the machine by use of lutes or covered rakes. Immediately after trimming, the edges of the course shall be thoroughly compacted by tamping. Distortion of the pavement during this operation shall be avoided.
- J. Edges against which additional pavement is to be placed shall be vertically formed to true line. A lute or covered rake shall be used immediately behind the finisher, when required to obtain a true line and vertical edge. Any irregularities in the surface of the pavement course shall be corrected directly behind the paver. Excess material forming high spots shall be removed by a shovel or lute. Indented areas shall be filled with hot mix and smoothed with the back of a shovel pulled over the surface. Fanning of material over such areas shall not be permitted.
- K. On longitudinal joints, the paver shall be positioned so that in spreading, the material overlaps the edge of the lane previously placed by one or two inches (1" or 2") and is sufficiently high to allow for compaction. The coarse aggregate in the material overlapping the joint shall all be raked out into the cold lane as soon as possible behind the paver and broomed up and wasted. In no case shall scattered rocks be rolled into the surface of either lane.
- L. Asphalt concrete mixture which is contaminated or segregated will be rejected.

### **3.5 COMPACTION**

- A. Thoroughly and uniformly compact the asphalt concrete by rolling. The complete pavement shall have a mat density equal to or greater than 96 percent of the maximum density (Marshall Method). The compacted specimens on which the maximum density is determined, shall be produced from a laboratory specimen made from the same days mix, and as close to the lay down temperature as practicable.
  - 1. Rollers shall be self-propelled, reversible, and equipped to maintain clean and straight contact surfaces.
  - 2. The number, weight, and type of rollers furnished shall be sufficient to obtain the required density and surface requirements while the mix is in a workable condition, but

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not less than two rollers shall be operated. Rollers shall be operated in a workmanlike manner by the Contractor. There shall be at least one operator for each roller.

3. Steel Drum Rollers: Steel drum roller may be of two (2) types:
    - a. Two axle static drum rollers, 8 to 22 tons in weight.
    - b. Two axle vibratory drum rollers, 8 to 22 tons in weight.
  4. All rollers shall be equipped with power units of not less than four (4) cylinders and under working conditions shall develop a compression in the rear wheels of two hundred fifty (250) to three hundred fifty (350) pounds per inch of roller width. Rollers shall be in good working condition and be free from backlash, faulty steering mechanism, or worn parts. Rollers shall be equipped with adjustable scrapers to keep the drums clean and with efficient means of keeping the drums/wheels wet to prevent mixes from sticking to the drums. Rollers/Drums shall be free of flat areas, openings or projections which will mar the surface of the pavement.
- B. Immediately after the asphalt mixture has been spread, struck off and surface irregularities adjusted, it shall be thoroughly and uniformly compacted by rolling.
  - C. The surface shall be rolled when the mixture is in the proper condition and when the rolling does not cause undue displacement, cracking, or shoving.
  - D. Initial rolling shall be done with a steel drum roller with the drive roll operating toward the paver, and/or a suitable pneumatic tired roller. Initial rolling shall be completed while the bituminous mat temperature is above two hundred twenty five degrees (225°) Fahrenheit.
  - E. Following the initial rolling, at least three coverages of the pavement shall be completed with a steel drum or pneumatic tired roller, while the mat temperature is above one hundred seventy five degrees (175°) Fahrenheit.
  - F. Final rolling shall be completed with a steel-drum roller and shall continue until roller marks and further compression are not evident in the pavement and specified density has been achieved.
  - G. Unless otherwise directed, rolling shall begin at the sides and proceed longitudinally parallel to the paving joints, each trip overlapping one half the roller width, gradually progressing to the crown/grade break. When paving abutting a previously placed pass, the longitudinal joint should be rolled first followed by the regular rolling procedure.
  - H. Any displacement occurring as result of the reversing of the direction of a roller, or from other causes, shall be corrected at once by the use of rakes and addition of fresh mixture when required. Care shall be exercised in rolling not to displace the line and grade of the edges of the asphalt mixture.
  - I. To prevent adhesion of the mixture to the rollers, the wheels shall be kept properly moistened with water or water mixed with very small quantities of detergent or other approved material. Excess liquid will not be permitted.
  - J. Along forms, curbs, headers, walls, and other places not accessible to the rollers, the mixture shall be thoroughly compacted with hot hand tampers, smoothing irons, or with mechanical tampers. On depressed areas, a trench roller may be used or cleated compression strips may be used under the roller to transmit compression to the depressed area.



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- K. Rollers or other vehicles shall not be parked or left standing on pavement that has not cooled sufficiently to prevent indentation by wheels.
- L. When requested by the Owner's Representative, the Contractor shall, without charge, provide the Project Representative with test samples of asphalt concrete cored from the completed pavement. All cores shall be at least four inches (4") in diameter and the core holes shall be patched by the Contractor within seventy-two (72) hours.

#### **3.6 JOINTS**

- A. Align joints to grade breaks, as much as practicable. Joints shall be constructed to ensure a continuous bond between old and new sections of the course. All joints shall present the same texture and smoothness as other sections of the course.
- B. Joint density shall be equal to or greater than 92 percent of the maximum specific gravity as determined by ATM 409.
- C. When joining existing pavement and new pavement, the old pavement shall be cut in a neat line with a power driven saw.
- D. Improperly formed joints resulting in surface irregularities shall be removed full depth, replaced with fresh asphalt concrete mixture, and thoroughly compacted. Rolling of joints after the material has cooled below one hundred seventy degrees (170°) Fahrenheit shall not be allowed. All pavement removal shall be precut to a neat line with a power driven saw.
- E. A coat of joint sealant (tack coat) shall be applied on all cold joints and joints at concrete structures (manholes, vaults, etc.) and allowed to break prior to placing fresh asphalt concrete mixture against the joint. This Work shall be completed by Contractor just prior to paving.

#### **3.7 REPAIR AND REPLACEMENT**

- A. Asphalt concrete mixture that becomes contaminated with foreign material or is in any way defective as determined by the Project Representative shall be removed. Skin patching will not be permitted. Defective materials shall be removed for the full thickness of the course. The pavement shall be cut so that all edges are vertical, the sides are parallel to the direction of traffic, and the ends are skewed between fifteen and twenty-five degrees (15° and 25°). Edges shall be coated with joint sealant. Fresh asphalt concrete mixture shall be placed in sufficient quantity so that the finished surface will conform to grade and smoothness requirements. The asphalt concrete mixture shall be compacted to the density specified. Any area determined to have an excess or deficiency of asphalt concrete shall be corrected by full depth removal and replacement.

#### **3.8 INSTALLATION TOLERANCES**

- A. The final surface shall be of a uniform texture conforming to true grade, and cross sections in accordance with the Drawings.

#### **3.9 FIELD QUALITY CONTROL**

- A. Provide Quality Control Testing to evaluate that actual products incorporated into the Work and completed construction comply with the requirements of this Section.
- B. The Contractor shall develop a Quality Control Plan. The plan shall address all elements which affect the quality of the pavement including, but not limited to:

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1. Mix Design
  2. Aggregate Grading
  3. Quality of Materials
  4. Stockpile Management
  5. Proportioning
  6. Mixing and Transportation
  7. Placing and Finishing
  8. Joints
  9. Compaction
  10. Surface smoothness
- C. Owner may use a testing agency to perform field and laboratory testing to verify compliance with the requirements of this Section.
- D. The Contractor shall perform all quality control tests necessary to control the production and construction processes applicable to these Specifications and as set forth in the approved Quality Control Plan. The testing program shall include, but not necessarily limited to, tests for the control of asphalt content, aggregate gradation, temperatures, aggregate moisture, field compaction, and surface smoothness. A Quality Control Testing Plan shall be developed as part of the Quality Control Plan. For each day of paving, the following shall apply.
1. Asphalt Binder Content. A minimum of 2 asphalt binder content tests shall be performed
  2. Gradation. Aggregate gradations shall be determined a minimum of twice from mechanical analysis of aggregate according to ATM 408 and ATM 304. When asphalt content is determined by the nuclear method, aggregate gradation shall be determined from hot bin samples on batch plants, or from the cold feed on drum mix or continuous mix plants, and tested according to ATM 304 using actual batch weights to determine the combined aggregate gradation of the mixture.
  3. Moisture Content of Aggregate. The moisture content of aggregate used for production shall be determined a minimum of once according to ATM 202.
  4. Moisture Content of Mixture. The moisture content of the mixture shall be determined minimum of once according to ATM 407.
  5. Temperatures. Temperatures shall be checked, at least 4 times, at necessary locations to determine the temperatures of the dryer, the bitumen in the storage tank, the mixture at the plant, and the mixture at the job site.
  6. In-Place Density Monitoring. The Contractor shall conduct any necessary testing to ensure that the specified density is being achieved. A nuclear gauge may be used to monitor the pavement density according to ATM 411.

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7. Additional Testing. Any additional testing that the Contractor deems necessary to control the process may be performed at the Contractor's option.
  8. Monitoring. The Engineer reserves the right to monitor any or all of the above testing.
- E. When directed by the Engineer, the Contractor shall sample and test any material which appears inconsistent with similar material being sampled, unless such material is voluntarily removed and replaced or deficiencies corrected by the Contractor. All sampling shall be according to standard procedures specified.
  - F. The Quality Control Plan shall indicate that appropriate action shall be taken when the process is believed to be out of tolerance. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

#### **3.10 ACCEPTANCE**

- A. Pavement will be accepted for payment based on the Engineer's approval of a Job Mix design and the placement and compaction of the asphalt concrete pavement to the specified depth and finished surface requirements and tolerances, and material testing. The Engineer reserves the right to perform any testing required in order to determine acceptance.
- B. All acceptance sampling and testing necessary to determine conformance with the requirements specified in this section will be performed by the Engineer.
- C. Any area of finished surfacing that is segregated, fails to meet surface tolerance requirements, cools to below 175 °F prior to completing compaction, or is any other way defective shall be removed and replaced with new asphalt concrete pavement. Removal and replacement of defective pavement shall be at no additional cost to the Department.
- D. Thickness will be evaluated for compliance by the Engineer to the requirements shown on the Plans. Measurements of thickness will be made by the Engineer using the cores extracted from the mat for density measurement.
- E. Smoothness. The finished surfaces of the HMA shall not vary more than 1/4 inch for the surface layer when tested with a 12-foot straightedge.
- F. Grade. The finished surface of the pavement shall not vary from the gradeline elevations and cross sections shown on the Plans by more than 0.05 foot. The finished grade will be determined by running levels at intervals of 50 feet or less longitudinally and transversely to determine the elevation of the completed pavement. The Contractor shall remove the deficient areas and replace with new material, full depth. Skin patching for correcting low areas will not be permitted.
- G. Mat density, aggregate gradation, and asphalt binder content shall meet the minimum requirements specified.

#### **3.11 SAMPLING**

- A. Asphalt Binder Content. Samples taken for the determination of asphalt binder content will be taken from behind the screed prior to initial compaction, or from the windrow, according to Alaska Test Method (ATM) 402 and 403.

If sampling is from behind the screed prior to initial compaction, then provide a WAQTC qualified technician and equipment to take plate samples. Sample in locations determined by the Engineer. Sample in the presence of the Engineer and immediately transfer possession of the sample to the Engineer.

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Two separate samples will be taken, one for acceptance testing and one held in reserve for retesting if applicable.

- B. Gradation. Samples taken for the determination of aggregate gradation will be from the same location as specified for the determination of asphalt binder content. Two separate samples will be taken, one for acceptance testing and one held in reserve for retesting if applicable.
- C. Density. The location(s) for taking core samples is determined by the Engineer's judgment. The Contractor shall provide a minimum of two cut full depth mat core samples and two full depth joint samples with a diameter of 6 inches, within 24 hours of final rolling for density acceptance testing. The samples shall be neatly cut by a core drill at the randomly selected location designated by the Engineer according to the procedures contained in ATM 413. All voids left by sampling shall be backfilled with new asphalt concrete material and compacted within 24 hours of sampling.

Cores for mat density shall not be taken closer than 1-foot from a transverse or longitudinal joint.

- D. Cores. For longitudinal joint density shall be taken directly on the joint, at locations adjacent to cores taken from the mat completing the joint. Cores shall be taken by the Contractor in the presence of the Engineer. The Engineer will take immediate possession of the samples.
- E. Asphalt Binder Grade. Sample asphalt binder at the plant from the supply line in the presence of the Engineer according to ATM 401. The Engineer will take immediate possession of the samples. Take three samples, one for acceptance testing, one for Contractor requested retesting, and one held in reserve for referee testing if requested.

#### **3.12 Testing.**

- A. Asphalt Binder Content. Asphalt binder content will be determined by ATM 405 or ATM 406, by total weight of mix.
- B. Gradation. Cold feed or dry batched aggregate gradations will be tested according to ATM 304 and evaluated for acceptance according to Subsection 401-5.2. Asphalt concrete mix and core sample gradations will be determined according to ATM 408 from extracted aggregate, or aggregate remaining after the ignition oven ATM 406 has burned off the asphalt binder.
- C. Density. Core samples will be tested according to ATM 410, and evaluated for acceptance.
- D. Asphalt Binder Grade. Asphalt binder will be tested for conformance to the requirements specified.

#### **3.13 WASTE HANDLING**

- A. Except for material to be recycled, remove excavated materials from Project site and legally dispose of them.

**END OF SECTION 32 12 16**

**SECTION 32 31 00 – FENCING**

**PART 1 GENERAL**

**1.1 SUMMARY**

A. Section includes:

1. Chain link fence
2. Chain link gates

B. Related requirements

1. Section 01 71 23 – Construction Surveying
2. Section 03 30 00 – Cast-in-Place Concrete
3. Section 31 20 00 – Earthwork

C. Applicable Standards

1. The latest revision of the following standards of the American Society for Testing and Materials (ASTM) and the Chain Link Fence Manufacturer's Institute (CLFMI) are hereby made a part of the Specifications:

ASTM A 90	Tests for Weight of Coating on Zinc-Coated (Galvanized) Iron or Steel Articles.
ASTM A 116	Specification for Zinc-Coated (Galvanized) Steel Woven Wire Fence Fabric.
ASTM A 121	Specification for Zinc-Coated (Galvanized) Steel Barbed Wire.
ASTM A 123	Specification for Zinc (Hot- Dip Galvanized) Coatings on Iron and Steel Products.
ASTM A 392	Specification for Zinc-Coated Steel Chain-Link Fence Fabric.
ASTM F 567	Specification for Installation of Chain Link Fence.
ASTM A 570	Specification for Hot-Rolled Carbon Steel Sheet and Strip, Structural Quality.
ASTM A 572	Specification for High-Strength Low-Alloy Columbium-Vanadium Steels of Structural Quality.
ASTM A 585	Specification for Aluminum Coated Steel Barbed Wire.
ASTM A 824	Specification for Metallic-Coated Steel Marcellled Tension Wire Use with Chain Link Fence.

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ASTM F 669	Specification for Strength Requirements of Metal Posts and Rails for Industrial Chain Link Fence.
ASTM F 668	Specification for Poly (Vinyl Chloride) (PVC) Coated Steel Chain Link Fence Fabric.
ASTM F 900	Specification for Industrial and Commercial Swing Gates.
ASTM F 1083	Specification for Pipe, Steel, Hot-Dipped Zinc Coated (Galvanized) Welded, For Fence Structures.
ASTM F 1234	Specification for Protective Coatings on Steel Framework for Fences.
CMFMI PM	Product Manual

### **1.2 SUBMITTALS**

- A. Product Data: Submit product data for fabric, posts, accessories, fittings, and hardware.
- B. Shop Drawings: Show components, materials, dimensions, sizes, weights, and finishes of components. Include plans, gate elevations, sections, details of post anchorage, attachment, bracing, and other required installation and operational clearances.
- C. Concrete Mix Design: Submit proposed mix design for concrete for review prior to commencement of work. Include product data for concrete admixtures.
- D. Assurance/Control Submittals:
  - 1. Certificates: Manufacturer's certificate certifying that Products meet or exceed specified requirements.
  - 2. Qualification Documentation: Submit documentation of experience indicating compliance with specified qualification requirements.

### **1.3 WARRANTY**

- A. Special Warranty: Installer agrees to repair or replace components of chain link fences and gates that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period: Five years from date of Substantial Completion.

## **PART 2 PRODUCTS**

### **2.1 CHAIN LINK FENCE MATERIALS**

- A. Conform to CLFMI Product Manual.
- B. Match existing fencing scheduled to remain.
- C. Chain Link Fence Fabric: Fencing fabric in one piece heights measure between top and bottom of outer edge of selva ge knuckle or twist, 9-gauge, 2-inch mesh, and hot-dip galvanized at a rate of 1.2 ounces per square foot when tested.

D. Steel Framing:

1. Type I: ASTM F 1083 Schedule 40, standard weight galvanized steel pipe, welded construction, minimum yield strength of 25 ksi; coating conforming to ASTM F 1234 Type A on pipe exterior and interior.
2. Type II: ASTM F 669, cold-formed and welded galvanized steel pipe with minimum yield strength of 50 ksi; coating conforming to ASTM F 1234 Type B on pipe exterior and interior.

**2.2 CHAIN LINK FENCE ACCESSORIES**

- A. Tension Wire: 7 gage steel, metallic-coated coil spring wire, in accordance with ASTM A 824.
- B. Wire Ties: 11 gage galvanized steel.
- C. Post Brace Assembly: Manufacturer's standard adjustable brace at end and gate posts and at both sides of corner and pull posts, with horizontal brace located at mid height of fabric. Use same materials as steel framing for brace, and truss to line posts with 0.375 inch diameter rod and adjustable tightener.
- D. Post Tops: Galvanized steel, weather tight closure cap for tubular posts, one cap for each post. Furnish cap with openings to permit passage of tension wire, where required.
- E. Barbed Wire:
  1. Barbed Wire Supporting Arms: Manufacturer's standard barbed wire supporting arms conforming to ASTM F 626, metal and finish to match fence framework, with provision for anchorage to posts and attaching three rows of barbed wire to each arm. Supporting arms may be either attached to posts or integral with post top weather cap and must be capable of withstanding 250 lb. downward pull at outermost end. Provide following type:
    - a. Single vertical arm for three strands barbed wire, one for each post.
  2. Steel Barbed Wire: Two strand 12.5 gage steel wire with 14-gage, 4-point barbs spaced not more than 5 inches o.c.; metallic coated to match fabric.
    - a. Galvanized Steel Barbed Wire: Comply with ASTM A 121.

**2.3 CHAIN LINK FENCE GATES**

- A. Cantilever Slide Gate: Thirty-foot aluminum cantilever slide gate with four (4) posts and double track system, as shown in the plans, including ball bearing hanger sheaves, framing and supports, guides, stays, bracing, and accessories required.

**2.4 CHAIN LINK FENCE FINISHES**

- A. Galvanize as follows:
  1. Fabric: Not less than 1.2 oz zinc per square foot.
  2. Framing: Not less than 1.8 oz zinc per square foot

## **2.5 CONCRETE MIXTURES**

- A. The minimum mix requirement for fence and gate post concrete shall be as set forth in Section 03 30 00 below:

## **PART 3 EXECUTION**

### **3.1 CHAIN LINK FENCE AND GATE INSTALLATION**

- A. Install fence in accordance with ASTM F 567 unless otherwise indicated on the drawings.
- B. Install gates in accordance with ASTM F 900 unless otherwise indicated on the drawings.
- C. Space line posts 10 feet 0 inches on center maximum, unless otherwise indicated on Drawings.
- D. Line Posts: Drive to depth shown on the plans.
- E. Corner, Brace, and Gate Posts:
  - 1. Drill or hand excavate.
  - 2. Excavate each post hole to dimensions shown on the plans.
  - 3. Excavate approximately 4 inches lower than post bottom, set post bottom to depth shown on the plans.
  - 4. Hold post in position while placing, consolidating, and finishing concrete.
- F. Center Rails: Provide center rails where indicated. Install in one piece between posts and flush with post on fabric side, using offset fittings where necessary.
- G. Brace Assemblies: Install braces so posts are plumb with rod in tension.
- H. Tension Wire: Install tension wires through post cap loops before stretching fabric. Provide one continuous length of tension wire between pull posts. Apply sufficient tension to avoid excess sag between the posts. Tie or otherwise fasten tension wires to end, gate, corner, or pull posts by methods approved by the Engineer. Fasten fabric to tension wire using 11 gage galvanized steel hog rings spaces 24 inches on center.
- I. Pull fabric taut and tie to posts, rails, and tension wires. Install fabric on security side of fence, and anchor to framework so fabric remains in tension after pulling force is released.
- J. Stretcher Bars: To secure end, corner, pull, and gate posts, thread through or clamp to fabric 4 inches on center and secure to posts with metal bands spaced 15 inches on center.
- K. Tie Wires:
  - 1. Use U shaped wire conforming with diameter of pipe to which attached, clasping pipe and fabric firmly with ends twisted two full turns. Bend wire ends to minimize hazards to persons or clothing.



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2. Tie fabric to line posts with wire ties spaced 12 inches on center. Tie fabric to rails and braces with wire ties spaced 24 inches on center. Manufacturer's standard procedure will be accepted if of equal strength and durability.
- L. Fasteners: Install nuts for tension bands and hardware bolts on side of fence opposite fabric side. Peen ends of bolts or score threads to prevent removal of nuts.
- M. Gates: Install gates plumb, level, and secure for full opening without interference. Install ground set items in concrete for anchorage. Adjust hardware for smooth operation.
- N. Barbed Wire: Pull wire taut and install securely to extension arms and secure to end post or terminal arms in accordance with manufacturer's instructions.
- O. Barbed Tape: Install barbed tape in configurations indicated in accordance with manufacturer's recommendations and fasten securely to fencing to prevent movement or displacement.

### **3.2 CHAIN LINK FENCE AND GATE CONSTRUCTION**

- A. Site Tolerances:
  1. Maximum Variation from Plumb: 1/4 inch.
  2. Maximum Offset from True Position: 1 inch.
  3. Locate fencing components within site boundaries. Do not infringe adjacent property lines.
  4. Distance from Ground: as identified in the drawings.

**END OF SECTION 32 31 00**

**SECTION 32 31 13 - HEAVY DUTY CANTILEVER SLIDE GATE OPERATING SYSTEM**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. The work in this section shall include furnishing all labor, materials, equipment and appliances necessary to complete all Heavy Duty Gate Operating System required for this project in strict accordance with this specification section and drawings. The gate and operator shall be specifically designed to complement each other as a system and be provided by a single manufacturer.

**1.2 REFERENCES**

- A. UL 325 Gate Operator Requirements.
- B. ASTM F2200 – Standard Specification for Automated Vehicular Gate Construction.
- C. ASTM F 1184 – Standard Specification for Industrial and Commercial Horizontal Slide Gates, Type II, Class 2.
- D. American Welding Society AWS D1.2 Structural Welding Code.

**1.3 SUBMITTAL**

- A. Product Data:
  - 1. Provide manufacturer's catalog cuts with printed specifications and installation instructions.
  - 2. Deliver two copies of operation and maintenance data covering the installed products. Manual to include parts list showing manufacturer's names and part numbers for the gate operator.
- B. Shop Drawings:
  - 1. Supply shop drawings showing the relationship of operating systems with gate components, including details of all major components.
  - 2. Include complete details of gate construction, gate height and post spacing dimensions.
- C. Certification of Performance Criteria:
  - 1. Manufacturer of gate system shall provide certification stating the gate system includes the following material components that provide superior performance and longevity.
    - a. Gate track system shall be keyed to interlock into gate frame member. When interlocked with and welded to the "keyed" frame top member, gate track forms a composite structure.

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- b. Gate truck assemblies shall be tested for continuous duty and shall have precision ground and hardened components. Bearings shall be pre-lubricated and contain shock resistant outer races and captured seals.
  - c. Gate truck assemblies shall be supported by a minimum 5/8" plated steel bolt with self-aligning capability, rated to support a 2,000 # reaction load.
  - d. Hanger brackets shall be hot dipped galvanized steel with a minimum 3/8" thickness that is also gusseted for additional strength.
  - e. Gate is to be designed to meet specified ASCE-7 wind load requirements with the gate in the closed and latched condition only.
- D. Certifications:
  - 1. Gate in compliance with ASTM F 2200, Standard Specification for Automated Vehicular Gate Construction.
  - 2. The gate operator shall be in compliance with UL 325 as evidenced by UL listing label attached to gate operator.
  - 3. Gate manufacturer shall provide independent certification as to the use of a documented Welding Procedure Specification and Procedure Qualification Record to insure conformance to the AWS D1.2 welding code. Upon request, Individual Certificates of Welder Qualification documenting successful completion of the requirements of the AWS D1.2 code shall also be provided.
  - 4. Manufacturer shall supply gate design performance certification as per this section.

### **1.4 SPARE PARTS**

- A. Provide one spare HID proximity card reader for the Gate System.

## **PART 2 PRODUCTS**

### **2.1 CANTILEVER SLIDE GATE SYSTEM MANUFACTURERS**

- A. The cantilever sliding gate operating system shall be manufactured by LiftMaster or equal as approved.
- B. Approved substitution – All other systems must be submitted in accordance with substitution requirements as set forth in the general provisions of the specification manual.

### **2.2 VEHICULAR SLIDE GATE OPERATOR**

- A. The slide gate operator shall open and close cantilever gates to provide convenience and security. Shall function with accessories including: radio controls, electro-mechanical locks, single and three button control stations, digital keypads, sensing loops and proximity card readers. The operator utilizes 120 Volt AC single phase power. Control voltage in each case is 5 Volt DC.
- B. The gate operator includes a controller with integrated radio receiver, plug-in loop detector, proximity card reader, surge protection, and easy to read labeling standard.

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C. Capacity:

1. The gate operator shall be rated to operate a gate weighing up to 2100 lbs.

D. The gate operator shall be UL 325 compliant for Class I, II, III, and IV.

E. Design Criteria:

1. Operation shall be by means of a 1.5 horsepower single phase instant reversing motor, transferring power to a four inch diameter pulley, to a right angle oil bath gear reducer using another four inch diameter pulley and V-belt. Power is then transferred through a sliding collar disconnect system to the output drive shaft equipped with a #50 drive sprocket and roller chain which attaches to the gate with heavy-duty gate attachment brackets. Intermediate chain supports with anti-catch design shall also be supplied.
2. The operator shall open the gate at a rate of approximately 12 inches per second.
3. The #50 chain shall be coated with "Armor Coat" corrosive resistant chain coating. Corrosive resistance exceeds nickel plating.

F. Components:

1. Standard mechanical components shall include as a minimum.
  - a. NEMA 3R weatherproof steel cover which is fully removable and lockable.
  - b. Heavy-duty, plated frame with mounting legs for pad mounting standard.
  - c. Pedestal or posts to raise operator from ground level and protect from high water.
  - d. 20:1 right-angle oil bath gear reducer.
  - e. Arctic package with integral accessory heater rated for -40 degrees.
  - f. One inch solid steel output drive shaft.
  - g. Spring loaded manual disconnect.
  - h. Steel "critter" plate to prevent entry of ground pests.
2. Standard electrical components shall include as a minimum:
  - a. 1.5 HP motor with thermal overload protection in 120 VAC single phase.
  - b. Solid state logic controls featuring 15 diagnostic L.E.D. indicators and auto-close timer (1 second to 9 minutes).
  - c. Inherent, fully adjustable motor over-current sensing to detect obstructions via precision 24 turn potentiometer, with separate adjustments for opening and closing directions.
  - d. Controller housed in zinc plated control box with separate box provided for connection of field power.

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- e. Power On/Off switch.
  - f. Contacts for opening, closing and reversing accessories, as well as contact and non-contact obstruction sensing devices. 24 VAC and 24 VDC available on terminal strip to power accessory devices, provided by non-circuit board mounted transformer with minimum 40VA rating.
  - g. Four adjustable limits with precision snap-action type limit switches to control gate position, mounted inside a separate four switch limit box.
  - h. Master/slave or stand-alone capable with dip switch selection. Three wire twisted pair shielded cable required.
- G. Access Control:
  - 1. Entrapment Devices:
    - a. Photoelectric through beams / photo eyes shall be installed to span the clear opening and gate path at the tail section.
  - 2. Optional accessories, contact, non-contact, and control devices:
    - a. Control devices include pushbuttons, radio controls, keypads, and key switches.
    - b. Contact and non-contact devices include photoelectric sensors, vehicle detectors, proximity sensors, and contact edges.
    - c. Accessories include flashing strobe lights, and cycle counters.
  - 3. Proximity Card Controls
    - a. Continental Access Supertwo HID iClass Package CA-2PACK-I with the following: CICP1300 Super Two Controller, (2) CICRR10SE iClass Card readers, CA32905U00100 CA 3000 five user software, & (50) CICC2080 iClass clamshell contactless smart cards.
    - b. Integrate new access controls with existing CA4K software for operation.
- H. Factory Inspection and Testing
  - 1. Manufacturer shall test each operator at factory to assure smooth, quiet operation.
  - 2. Manufacturer shall test all control inputs to ensure proper function.

### **2.3 WARRANTY**

- A. The cantilever slide gate and operator system shall be warranted by the manufacturer against manufacturing defects for a period of (2) two years from date of sale. The truck assembly shall be warranted against manufacturing defects by the manufacturer for a period of (5) five years from date of sale.

### **PART 3 EXECUTION**

#### **3.1 SITE INSPECTION**

- A. Examine final grades and installation conditions.
- B. Do not begin work until all unsatisfactory conditions are corrected.

#### **3.2 INSTALLATION**

- A. Install equipment of this section in strict accordance with the company's printed instructions unless otherwise shown on the contract drawings.
- B. The gate and installation shall conform to ASTM F 1184 standards for aluminum cantilever slide gates, Type II, Class 2.
- C. The gate system is to comply with ASTM F2200 and UL 325.
- D. Obstruction Sensing Systems:
  - 1. The inherent motor current sensors are part of the gate operator system and may not be removed or bypassed.
  - 2. The installing contractor shall be responsible to ensure that appropriate external secondary entrapment protection devices be installed for the specific site conditions to protect against all potential entrapment zones. Proper operation of these safety devices shall be verified and training as to the operation and maintenance of these devices for the users and owners shall be documented.

#### **3.3 SYSTEM ACCEPTANCE & VALIDATION**

- A. Acceptance Test:
  - 1. Test each system function.
  - 2. Supply all equipment necessary for system adjustment and testing.
- B. Test and Explain Safety Features:
  - 1. Each system feature and device is a separate component of the gate system.
  - 2. Read and follow all instructions for each component.
  - 3. Ensure that all instructions for mechanical components, safety devices and the gate operator are available for everyone who will be using the gate system.
  - 4. The warning signs shipped with the gate operator must be installed in prominent position on both sides of the gate.
- C. System Validation:
  - 1. The complete system shall be adjusted to assure it is performing properly.

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2. The system shall be operated for a sufficient period of time to determine that the system is in proper working order.
3. Ensure the owner is clear with regard to the safety points concerning the basic operational guidelines of the safety features of the gate operator system. These safety points are listed in the operator manual and must be read prior to system use.
4. Installer and customer shall complete Operated Gate System Installation Checklist (see operator manual).

**END OF SECTION 32 31 13**

## **SECTION 32 91 19.13 – TOPSOIL PLACEMENT AND GRADING**

### **PART 1 GENERAL**

#### **1.1 SUMMARY**

- A. Section includes furnishing and placing topsoil.
- B. Related Requirements
  - 1. Section 31 20 00 – Earthwork
  - 2. Section 32 92 00 – Seeding

#### **1.2 SUBMITTALS**

- A. Submit soil test report on soils proposed for use under this section. Include pH, nitrogen, phosphorus, potassium, gradation, and organic content by volume.
- B. The Contractor shall notify the Project Representative of the location from which he proposes to furnish topsoil at least 14 days prior to delivery of topsoil to the Project from the location. The topsoil and its source may be inspected and tested separately by the Owner before approval will be granted for its use. The Owner may test topsoil at any time during planting operations. Should topsoil not meet standards of approved submittal, Contractor must adjust topsoil or remove existing and replace.

### **PART 2 PRODUCTS**

#### **2.1 TOPSOIL**

- A. Topsoil furnished shall consist of a natural friable surface soil without admixtures of undesirable subsoil, refuse, or foreign materials. It shall be free from roots, hard clay, coarse gravel, stones larger than 1 inch in diameter, noxious weeds, tall grasses, brush, sticks, stubble, or other litter. It shall be free-draining and non-toxic.
- B. Topsoil Composition:
  - 1. Organic Materials: Not less than 40% or more than 60% by volume (15 – 20% by weight)
  - 2. Silt: Not less than 20% by volume (50 – 60% by weight)
  - 3. Sand: Not less than 20% or more than 30% by volume (20 – 30% by weight)

#### **2.2 FERTILIZER AND LIMESTONE**

- A. The application rate of the fertilizer and limestone per 1,000 square feet of ground area of topsoil shall be determined by the Project Representative, based on soil analysis tests so that the total natural and applied chemical constituents are as follows:
  - 1. Nitrogen 21 – 35 PPM
  - 2. Phosphoric Acid 11 – 20 PPM



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- 3. Potassium 76 – 150 PPM
- 4. Limestone Sufficient to attain a pH of 6.0 – 7.0

**2.3 FILL MATERIAL**

- A. On-site usable fill material may be used to create landforms as indicated on the Plans. Material shall be free of man-made debris, large tree stumps, and other materials that may cause settling through decay. All fill shall be shaped to the lines and grades as shown and compacted to a firm and unyielding condition.

**PART 3 EXECUTION**

**3.1 SUBSOIL PREPARATION**

- A. Eliminate uneven areas and low spots. Remove all subsoil contaminated with petroleum products.
- B. Scarify sub-grade to a depth of 6 inches where topsoil is scheduled. Scarify in areas where equipment used for hauling and spreading topsoil has compacted subsoil.

**3.2 PLACING TOPSOIL**

- A. Place topsoil in areas where seeding is scheduled.
- B. Use topsoil in relatively dry state. Place during dry weather.
- C. Place and rake topsoil to eliminate depressions and irregularities such that the finish grade is smooth and even and drains in accordance with the plans.
- D. Roll placed topsoil with a water-filled roller with a weight of 100 -150 lbs designed for use in the compacting of topsoil.
- E. All areas as noted on the Plans shall receive a minimum of 4 inches of topsoil after compaction.

**END OF SECTION 32 91 19.13**

## **SECTION 32 92 19.16 – HYDRAULIC SEEDING**

### **PART 1 GENERAL**

#### **1.1 SUMMARY**

- A. Section includes establishing a perennial stand of grass, by seeding, in the areas indicated on the Plans.
- B. Related Requirements
  - 1. Section 32 91 19.13 – Topsoil Placement and Grading

#### **1.2 REGULATORY REQUIREMENTS**

- A. Comply with all requirements of the State of Alaska Department of Environmental Conservation concerning application of herbicides, pesticides, and insecticides.

#### **1.3 QUALITY ASSURANCE**

- A. Provide seed mixture in containers showing percentage of seed mix, year of production, net weight, date of packaging, and location of packaging.
- B. Provide fresh seed of the latest crop meeting the minimum purity and germination requirements.

#### **1.4 TEST AND SUBMITTALS**

- A. Comply with testing requirements of Section 32 91 19.13 Topsoil Placement and Grading.

#### **1.5 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver grass seed mixture in sealed containers. Seed in damaged packaging is not acceptable.
- B. Furnish standard products in manufacturer's standard containers bearing original labels showing quantity, analysis and name of source.
- C. Store products in such a manner that they are protected from weather or other conditions that would damage or impair the effectiveness of the product.

#### **1.6 INSPECTION**

- A. A final acceptance inspection will be conducted by the Owner at the conclusion of the 60 day establishment period. Conditions governing final acceptance are that a healthy and uniform stand of grass be achieved, free of weeds, disease and showing no signs of a chlorotic condition. The cost of any replacement seeding shall be borne by the Contractor.

## **PART 2 PRODUCTS**

### **2.1 SEED MIXTURE**

<u>Seed Type</u>	<u>% By Wt.</u>	<u>Min % Purity</u>	<u>Min % Germination</u>
Alene Bluegrass	45	90	85
Merion Bluegrass	45	90	85
Annual Rye	10	90	85

Application Rate: 5 pounds per 1,000 square feet.

### **2.2 SOIL MATERIAL**

- A. Topsoil as specified in Section 32 91 19.13 Topsoil Placement and Grading.

### **2.3 ACCESSORIES**

- A. Fertilizer: Fertilizer shall be a brand recommended for grass, with 50% of the elements derived from organic sources, of proportion necessary to eliminate any deficiencies of topsoil as indicated in analysis. Provide a dry 8-32-16 fertilizer for establishment of lawn areas.
- B. Water: Clean fresh and free of substances or matter which could inhibit vigorous growth of grass.
- C. Lime: Provide Dolomitic limestone at the rate of 50 lbs. per 1,000 sf, or as required to adjust the soil pH to a measured level of between 6.0 and 7.0.
- D. Mulch: Dried shredded peat moss; or cellulose wood or paper fiber such as "Astromulch," "Silvafibre," "Conwed," or approved equal.

## **PART 3 EXECUTION**

### **3.1 INSPECTION**

- A. Verify that prepared soil base is ready to receive the work of this Section.
- B. Beginning of installation means acceptance of existing site conditions.

### **3.2 FERTILIZER AND LIMESTONE**

- A. Apply fertilizer in accordance with manufacturer's instructions at a rate of 12 lbs. per 1,000 sf.
- B. Apply after smooth raking of topsoil and prior to roller compaction.
- C. Apply fertilizer to turf again, 45 days following germination of seed crop of planting. If 45-day period occurs after August 15, apply a second application between May 1 and June 1 of the following year.
- D. Lightly water to aid the dissipation of fertilizer.
- E. If required, apply Dolomitic limestone. Work limestone into soil to a depth of 2 inches minimum. Do not apply more than 50 lbs. per 1,000 sf at one time.

### **3.3 HYDROSEEDING**

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- A. Seeding by hydraulic methods shall consist of furnishing and placing a slurry made of seed, fertilizer, dried peat moss or cellulose wood fiber and water.
- B. The dried peat moss or cellulose wood fiber shall be added to the water slurry in the hydraulic seeder after the proportionate amounts of seed and fertilizer have been added. The slurry mixture shall then be combined and applied in such a manner that the rate of application will result in an even distribution of all materials.
- C. Hydraulic seeding equipment shall be capable of maintaining a continuous agitation so that a homogeneous mixture can be applied through a spray nozzle. The pump shall be capable of producing sufficient pressure to maintain a continuous, non-fluctuating spray capable of reaching the extremities of the seeding area with the pump unit located on the paved areas. Sufficient hose shall be provided to reach areas not practical to seed from the nozzle unit situated on paved areas.

#### **3.4 SEED PROTECTION**

- A. Identify seeded areas with stakes, string, and fluorescent ribbon around area periphery. Set string height to 36 inches. Space stakes at 60-inch intervals.
- B. Protect seeded areas from damage from all traffic, whether people, animals, on or off road vehicles, or any other causes which may damage newly seeded and maintained surfaces. Maintain a minimum coverage of 90%. Surfaces damaged shall be repaired by regrading, reseeding (including all specified amendments), as directed by the Project Representative, at no additional cost to the Owner. Maintain seeded areas in a satisfactory condition until Final Acceptance of the Work.

#### **3.5 CLEANUP**

- A. Project area shall be left clean and neat at the end of each working day.
- B. Wash clean all building and paving surfaces that were affected by seed installation.

**END OF SECTION 32 92 19.16**

## **SECTION 33 10 00 – WATER UTILITY**

### **PART 1 GENERAL**

#### **1.1 DESCRIPTION OF WORK**

A. Section includes:

1. Water service lines, including tapping main, connecting, pipe, fittings, key boxes, and valve boxes at the location and depth required by the Contract Documents.

B. Related requirements:

1. Section 31 20 00 Earthwork for trench excavation and backfill, and pipe bedding.

C. Utility Coordination:

1. The Contractor is to notify the Utility Company a minimum of three business days in advance of any work performed or any required or needed inspection.
2. Mainline taps are to be done by the Contractor. The mainline tap must be accomplished with a drilling machine approved for use on the pipe material being tapped, capable of drilling through the tapping saddle and corporation stop and pipe wall.
3. The Contractor shall bear the expenses incurred, if a water main within and directly adjacent to the project site should be damaged during construction. The Utility Company, at its option, will allow the Contractor to make repairs, or the Utility Company will make repairs; however, Contractor shall bear the cost of all material, labor, and other expenses associated with the repair.
4. The Contractor is not authorized to operate the Utility Company water distribution system. Only the Utility Company personnel are authorized to manipulate the existing pipe system.

#### **1.2 REFERENCES**

- A. Alaska Department of Environmental Conservation (ADEC) Regulations 18 AAC 80.
- B. American Water Works Association (AWWA).
- C. American National Standards Institute (ANSI).
- D. Uniform Plumbing Code, latest edition.

#### **1.3 SUBMITTALS**

- A. Product Data: For each type of product include manufacturer's standard drawings or catalog cuts and installation instructions for each type of product indicated. Submittals for water service lines should include, but is not limited to the following information:
  1. Pipe

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2. Corporation stop
  3. Curb stop
  4. Key box, including rod and connecting pin
  5. Flare nuts
  6. Corrosion protection items
  7. Thaw wire
  8. Tapping saddle
- B. Test Reports: Provide the following test and inspection reports:
1. Bacteriological Disinfection. Test results from commercial laboratory verifying disinfection.
  2. Reports. Other tests and inspection reports, as specified.
- C. Certificates:
1. NSF 61 certification for all products in contact with potable water.

## **PART 2 PRODUCTS**

### **2.1 PIPE AND FITTINGS**

- A. Copper Service Pipe: 1-inch coated copper pipe must be soft-drawn Type K, seamless, annealed copper pipe suitable for use as underground service water connections for general plumbing purposes and ASTM B88 compliant with an approved coating system. Use minimum number of fittings as practical.
- Approved coatings include factory applied minimum twenty six (26) mil thick polyethylene or a field applied coating.
- Fittings used with copper pipe are to be rated high pressure (150 psi) per AWWA C800. Brass components in contact with potable water are to comply with Public Law 111-380 (No Lead Rule). Fittings are to accept flared copper pipe or have NPT threads for threading into other fittings.
- Copper pipe thrust restraint systems are the use of flared fittings and silver solder brazed joints.
- B. Key Box: Cast or ductile iron, telescoping, with an arch pattern base and furnished with a lid. Operating rod and connection pin constructed of stainless steel alloy type 304 or 316. Connection pin shall be a minimum of 3/16" by two inches (2") long and inserted completely through cast connection head that is welded to the operating rod. Bent plate connection heads are not allowed.

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- C. Curb Stop: Conforming to AWWA C800, rated for 150 psi working water pressure, with waste port, NSF 61 certified, copper flare connections, conforming to “no lead” standard for parts in contact with potable water. For one inch (1”) services, the flare nut on the Utility side of the curb stop shall have an integral wire connector for an anode connection. For services greater than one inch (>1”), a bronze direct burial compression pipe clamp shall be used in conjunction with a flare nut.
- D. Corporation Stop: PTFE coated brass ball valve, rated for 300 psi water pressure, conforming to AWWA C800, NSF 61 certified, and conforming to “no lead” standard. Inlet end shall have the AWWA/CC taper; outlet end shall have copper flare straight connection. For one-inch (1”) services, provide an integral wire connector; for larger than one-inch (>1”), provide a bronze direct burial compression pipe clamp with thaw nut. Mueller B25000- 07 valve and thaw nut, AY MacDonald 74701BA 1 NL corp stop with anode connection, or equal.
- E. Thaw Wire: Insulated No. 2 AWG stranded copper conductor rated for 600V. Insulation shall be HMWPE or approved for use in buried low temperature service. Split bolts or mechanical bolt connection of the wires are not allowed.
- F. Tapping Saddle: Romac 306, Powerseal 3412S or approved equal.
- G. Anodes: Prepackaged magnesium style anodes weighing twenty (20) pounds. Anode composition is to be in accordance with ASTM B843-2003 Table 1, Grade HP, M1C. Anodes are to be packaged in a low resistive backfill consisting of seventy-five percent (75%) gypsum, twenty percent (20%) bentonite, and five percent (5%) sodium sulfate.

Anodes shall be provided with #10 AWG stranded copper, single-conductor cable with HMWPE insulation. Lead wire cable shall be rated for six hundred (600) volts and designed for direct burial applications.

Equipment and materials used to bond the #10 AWG HMWPE to the pipeline is of the “CADWELD” type as manufactured by ERICO Products, Inc. of Cleveland, Ohio, or approved equal. Thermite weld caps, designed to protect the CADWELD bonds from corrosion, is to be Royston “Handy Cap 2” or approved equal.

## **PART 3 EXECUTION**

### **3.1 WATER SERVICE LINE INSTALLATION**

- A. Materials Delivery: Pipe and appurtenances are to be handled in such a manner to ensure delivery to the trench in a sound, undamaged condition. Particular care is to be taken not to damage the pipe, pipe coating, or lining. Before, after and during installation the engineer is to be provided an opportunity to examine the pipe and appurtenances for damage and defects. Damaged or defective pipe may be rejected. Rejected pipe must be removed from the project and replaced with acceptable material at no additional cost.

The pipe is not to be strung out along the shoulders of the road for long distances if it causes inconvenience to the public. The amount of pipe strung at the job site is at the discretion of the Engineer.

Rubber gaskets are to be protected from extended exposure to direct sunlight. Gaskets are to be installed into the piping when the gasket and pipe are above freezing temperature and the gasket is pliable.
- B. Install pipe and fittings according to these Specifications or the manufacturer's recommendations. Lay pipe to the grades and lines shown on the Plans.
- C. Copper pipe may be joined with the use of silver brazing copper couplers, flared fittings and by swedging and silver brazing. Solder must be lead free silver solder. All joints are to be

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outside of the rights-of-ways and/or Utility Company easements, unless given prior approval by the Utility Company.

- D. The trench bottom is to be graded to provide uniform support for the pipe barrel. Water is to be kept out of the trench by pumping, if necessary, until the jointing is completed. When Work is not in progress, open ends of the pipe, fittings, and valves are to be securely plugged so that no trench water, earth or other substances will enter the pipes or fittings.
- E. The Contractor is to familiarize themselves as to the depth of the water main for the project through Contract Documents, gathering field data and record data. Excavate whatever substances encountered to the depth required for the connections. Expose the main to be tapped for a minimum distance of two feet (2') on either side of the proposed tap location and below the pipe for proper clearance of the tapping saddle.
- F. Lay water connections at ninety degrees (90°) to the street line. Water service piping is to have a minimum of ten foot (10') of bury from the point of connection to a point five feet (5') inside the building footing. Where the main line has less than ten foot of bury, the service must be immediately lowered to achieve the required bury depth and insulated where there is less than ten foot of bury. Water services are not to be within a horizontal distance of ten feet (10') or have less than eighteen inches (18") of vertical separation at crossings to a sewer or footing drain. Services must not cross property lines.
- G. Trenches are to be OSHA compliant and have a minimum of two and one-half feet (2.5') wide bottom for a single copper water service. The service is to be centered in the ditch and the thaw wire laid at the edge.
- H. Key boxes shall be of an acceptable construction as shown in the Drawing details and the requirements of the Specifications. Key boxes are to be installed where shown.
- I. Key and valve boxes are to be installed plumb, be centered over the water line valve, have an unobstructed access way, and be wrapped with eight mils (8-mils) thick polyethylene encasement. Key and valve boxes must not be in contact with other utility lines, such as but not limited to gas, electric, telephone or cable.
- J. A continuity wire is to be attached to the corporation stop on one inch (1") connections with a flare tube nut with integral wire connector. The continuity wire is to be attached to the saddle on the main for one and one-half (1 1/2") and two inch (2") connections.
- K. Exercise due care in backfilling to keep key box and continuity wire vertical and in place. Re-excavate and repair any displacement.
- L. Damage to a factory applied coating on copper pipe is to be repaired with an approved field applied coating system.
- M. Anodes are to be installed eighteen to thirty-six inches (18" to 36") from the sidewall of the pipe, to a centerline depth in line with the approximate horizontal plane of the pipe's bottom dead center. Anodes are to be placed on alternating sides of the pipeline and a frequency of no less than one anode per every pipe section (joint) that is greater than nine feet in length. One anode may not protect more than twenty-seven feet (27') of pipe segments. One anode on all fittings within a twenty-foot (20') radius as long as all fittings are electrically connected to the anode.

The #10 AWG HMWPE lead wires must be attached to the top dead center of the pipe. Lead wire connections to the pipe are to utilize exothermic weld connection methodology and follow the manufacturer's instructions for use. Lead wire connections to fittings are to be done with a stainless steel metal plate with two holes through the plate. One hole is to be placed



## **Kenai Municipal Airport Sand Storage Building**

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and sized 1/8" larger than the fitting bolt to allow the fitting bolt to pass through the hole. The second hole is to be 5/16" in diameter to allow connection of the anode lead wire with a 1/4" diameter by 1" long stainless steel bolt with a nut and locking washer. The anode lead wire is to be fitted with a 5/16" diameter wire ring terminal. Were a connector plate is used, the Contractor must ensure a metal to metal connection is made to all metallic parts being protected by the anode.

Extreme care shall be taken not to damage the anodes or direct buried lead wires during backfill procedures.

### **3.2 FLUSHING AND TESTING**

- A. Perform flushing and hydrostatic testing in the presence of the Project Representative. Flushing and testing are to be completed separately and sequentially, starting with the flushing, hydrostatic testing, disinfection, and continuity. Provide, install, and remove fittings, pipes, pumps, hoses, gauges, and other items necessary.
- B. Open bore flush new service line through an unrestricted outlet. Flush water to achieve a minimum velocity of 3 feet per second and the minimum water quantity flushed shall be equal to 3-times the volume of water in the pipe being flushed.
- C. Hydrostatically test the new water service to 150 pounds per square inch (150 psi) for 30 minutes. Pumping will be terminated and disconnected upon starting the test. Test pressure at the start of the test is be maintained for the duration of the test period. Any loss of pressure will be considered a failed pressure test.

### **3.3 DISINFECTION**

- A. Perform pipe disinfection in accordance with the requirements if ANSI/AWWA C-651. Submit disinfection plan to the Engineer for review and approval.

### **3.4 RECORD INFORMATION**

- A. Record the as-built vertical and horizontal locations of the water service corporation stop, curb stop, anodes, and service pipe, including bottom of pipe elevations at the main, property line, building footing, and changes in slope.

**END OF SECTION 33 10 00**

## **SECTION 33 34 00 – ONSITE WASTEWATER DISPOSAL**

### **PART 1 GENERAL**

#### **1.1 SUMMARY**

- A. Section includes construction of a condensate wastewater disposal system.
- B. Related Requirements
  - 1. Section 31 20 00 Earthwork for trench excavation and backfill, and pipe bedding.

#### **1.2 REFERENCES**

- A. Alaska Department of Environmental Conservation (ADEC) Regulations 18 AAC 72.
- B. Uniform Plumbing Code, latest edition.

#### **1.3 SUBMITTALS**

- A. Product Data: For each type of product include manufacturer's standard drawings or catalog cuts and installation instructions for each type of product indicated.

### **PART 2 PRODUCTS**

#### **2.1 PIPE AND FITTINGS**

- A. Polyvinyl Chloride Pipe (PVC):
  - 1. Leach field pipe, fittings and monitoring tubes shall be 4" diameter PVC 3034. Laterals shall be perforated.
- B. Insulated Pipe
  - 1. Insulated Pipe shall consist of a three component assembly as follows:
    - a. SDR 26 HDPE pipe, AWWA C906, manufactured from PE4710 compounds that meet or exceed ASTM D3350 Cell Classification 445574.
    - b. Insulation of urethane foam.
    - c. Outer shell of dual wall HDPE pipe, ADS N-12 or approved equal. Half-shell kits shall receive black, heat shrinkable wrap or sleeve with closure seal, CanusaWrap, or equal.
  - 2. Insulation shall be low-density, rigid, closed-cell urethane foam with a nominal thickness as shown on the Drawings. Urethane foam shall exhibit the following properties and characteristics meeting ASTM D2341 cell classification 550674970034 or shall comply with a new ASTM cell classification that exceeds these properties:

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Maximum K-factor (ASTM C177)	0.155 btu-in/hr-ft <sup>2</sup> -°F
Core Density Range (ASTM D1622)	2.5 - 3.5 lbs/ft <sup>3</sup> minimum
Minimum Compressive Strength (ASTM D1621) ( <i>Foam sample to be tested parallel and perpendicular to the axis to the pipe</i> )	35 psi
Minimum Closed Cell Content (ASTM D2856)	90% (porosity)
Maximum Water Absorption (ASTM D2842)	0.05 psf (22.7 g/ft <sup>2</sup> )
Maximum Water Vapor Permeability (ASTM C355)	5.0 psf (2,267.96 g/ft <sup>2</sup> )
Dimensional Stability (ASTM D2126, Maximum linear change)	1% (at -20 °F) and 3% (at +100 °F)

3. Exposed urethane foam faces at pipe and fitting ends shall be coated to protect against physical abuse, UV attack during shipping and storage, and against water intrusion in service. The coating shall be suitable for direct application over urethane foam with no deleterious effects to the foam or coating. The coating shall be formulated for long-term service and retained flexibility over extended periods of exposure to sunlight, harsh weather, and saltwater spray. The strength of the adhesive bond of the coating of the foam shall be greater than the tensile strength of the coating. In the event the coating is nicked or an edge is rolled up in handling, the coating that has been dislodged shall tear free from the coating still adhering to the foam rather than pull the balance of the coating off as a sheet. The exposed ends of the pipe shall have the wax removed in order to allow the coating to adhere to the pipe. The coating shall be applied and cured in accordance with the manufacturer's recommendations and good practice.
4. The coating material shall be NoKorode "Lion Seal" or approved equal and exhibit the following properties:

Minimum Service Temperature Range	-50 to +150 °F
Maximum Water Vapor Permeance (ASTM E398 or E96)	1.0 perm
Dry Film Thickness Range (actual dry film thickness)	15 to 63 mils

5. After coating, the plane of the exposed foam face shall be perpendicular to the centerline axis of the outer jacket.
6. Insulated Pipe shall be supplied in the longest lengths practicable to minimize joints.
7. Inner pipe shall extend beyond the outer pipe sufficient to allow fusion welding to the adjacent pipe.
8. Insulated Pipe shall be fabricated such that the offset of the centerline of the outer jacket and inner core pipe is not more than ¼-inch at the pipe ends and 3/8-inch along the remainder of the pipe.

## Kenai Municipal Airport Sand Storage Building

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9. The foaming operation shall be designed and operated in a manner to result in void-free insulation. Foam shall be placed into the pipe by a single injection application.
10. The inner core pipe shall be bonded to the urethane foam insulation in such a manner as to produce foam-to-foam separation when a sample is tested in shear.

### 2.2 JOINTS

- A. HDPE Pipe Jointing. Joints shall be in accordance with Plastic Pipe Institute (PPI) TR-33 Generic Butt Fusion Procedures. Electrofusion couplings may be used only where the use of butt fusion is not practicable or where indicated. Electrofusion couplings shall be in accordance with AWWA C906 and shall be same pressure rating as pipe.
- B. Insulated Pipe Jointing. Follow jointing procedures for HDPE pipe. Install insulated half shell kit over exposed piping and seal outer insulation face with heat-shrink sleeve or roll with closure seal, CanusaWrap, or equal.
- C. PVC Pipe Jointing. PVC joints shall be push-on, gasketed, or glued.

### 2.3 LEACH FIELD

- A. Sand Liner: Use material meeting the following for sand liner material where shown on the drawings:

SAND LINER

U.S. Std. Sieve Designation	Cumulative Percent Passing by Weight
No. 10	85-100
No. 20	60-90
No.40	25-50
No. 60	0-15
No. 200	<5

1. The sand may not have more than 45% (of the total) passing any one sieve and retained on the next consecutive sieve of those shown in Table I above.
- B. Sewer Rock: Use washed, screened, sound rock, 0.75" to 1.5" diameter, with less than 3% passing the #200 sieve.
- C. Filter Fabric: Use non-woven fabric Tytar 3401, Mirafi 140 N or approved equal.

## PART 3 EXECUTION

### 3.1 CONSTRUCTION REQUIREMENTS

- A. Furnish and install all incidental parts not shown on the Contract Drawings or specified in this Section that are necessary for a complete system.
- B. Installation shall be in accordance with the Alaska Department of Environmental Conservation, Division of Environmental Health "Installer's Manual for Conventional Onsite Domestic Wastewater Treatment and Disposal Systems" latest edition.
- C. Grade of finished surfaces to provide positive drainage away from the septic improvements.

### 3.2 EARTHWORK

## **Kenai Municipal Airport Sand Storage Building**

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- A. Protect subgrades from softening, undermining, washout and damage by rain or water accumulation. If necessary, install and maintain a dewatering system to keep subgrades dry.
- B. Excavation
  - 1. Excavate material only within the limits on the Contract Drawings or as directed. Prevent disturbing material and vegetation outside of the slope limits.
    - a. Avoid compacting the bottom of the leach field excavation.
  - 2. If the bottom of the leach field excavation is glazed or smeared by digging equipment, it must be roughened by hand-raking prior to placement of sand liner, if required.
- C. Promptly begin backfill operations, but not before completing the following:
  - 1. As-building locations of pipes for record documents.
    - a. Inspecting and testing pipes.
    - b. Removing trash and debris.
    - c. Removing temporary shoring, bracing, and sheeting.
- D. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes.
- E. Compact backfill to the density requirements shown, as measured in accordance with ASTM D 1557.

### **3.3 PIPE INSTALLATION**

- A. Inspect each pipe and fitting before and after installation; replace those found defective and remove from site.
- B. Pipe and accessories shall be carefully lowered into the trench. Pipeline materials shall not be dropped or dumped into the trench.
- C. The full length of each section of pipe shall rest solidly upon the pipe bed. Pipe that has the grade or joint disturbed after laying shall be taken up and re-laid.
- D. Pipe shall not be laid in water or when trench conditions are unsuitable for work. Water shall be kept out of the trench until joints are complete.
- E. Pipe laying shall in all cases proceed upgrade with the spigot ends of pipe pointing in the direction of the flow. Each pipe shall be laid true to line and grade and in such a manner as to form a close concentric joint with the adjoining pipe. The alignment of the installed pipe shall appear straight to visual observation.
- F. Each section of pipe shall be handled carefully and placed accurately; the spigot end shall be fully inserted. Care shall be exercised to avoid over-insertion.
- G. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions and use lubricants, cements, and other installation materials as required. Maintain swab or drag line, and pull past each joint as it is completed.

## **Kenai Municipal Airport Sand Storage Building**

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- H. At all times, when Work is not in progress, open ends of pipe and fittings shall be securely and satisfactorily closed so that no undesirable substance will enter the pipe or fittings.

### **3.4 FILTER FABRIC**

- A. Smooth top surface of sewer rock before placing filter fabric.
- B. Lay filter fabric parallel with long axis of trench. Overlap sections by a minimum of 3 feet. If filter fabric is torn, overlay new filter fabric with a minimum 3-foot overlap around the edges of the torn area. Ensure that the patch remains in place with material is placed over the affected area.
- C. When placing cover material on filter fabric, maintain a minimum of 12 inches of material at all times between the fabric and construction equipment.

### **3.5 FIELD QUALITY CONTROL**

- A. General:
  - 1. Use care when backfilling pipe such that line displacement, crushing, or other damage does not occur.
  - 2. Repair all crushed, broken, cracked or otherwise damaged piping.
  - 3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
  - 4. Reinspect and repeat procedure until results are satisfactory.

**END OF SECTION 33 34 00**

## **SECTION 33 42 00 - STORMWATER SYSTEM**

### **PART 1 GENERAL**

#### **1.1 SUMMARY**

- A. Section Includes:
  - 1. Rain leader drain system.
- B. Related Requirements:
  - 1. Section 31 10 00 – Site Clearing
  - 2. Section 31 20 00 – Earthwork

#### **1.2 SUBMITTALS**

- A. Product Data and Certificates: For each type of product indicated.
- B. Shop Drawings:
  - 1. Infiltration Basin: Include plans, elevations, sections, details, frames, and covers.
- C. Field quality-control reports.

#### **1.3 QUALITY ASSURANCE**

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

### **PART 2 PRODUCTS**

#### **2.1 RAIN LEADER INFILTRATION BASIN**

- A. Pipe: Match existing materials. Install new fittings and piping as necessary.
- B. Class 1 Riprap: See Section 31 20 00
- C. Field Inlet and Frame: Gray Iron meeting AASHTO M-306. Frame and inlet cover shall be furnished with machined horizontal bearing surfaces such that the cover or grate do not rock when rotated to any position in the frame. Castings shall conform to those shown on the drawings.
- D. Manholes: Manholes shall be constructed of precast, reinforced concrete meeting the requirements of ASTM C-478. Barrel sections shall be set and sealed by use of a pre-molded plastic gasket joint sealant as manufactured by Henry Co., Ram-Nek Sealant division, meeting AASHTO M-198.
- E. Filter Fabric: Use non-woven fabric. Typar 3401, Mirafi 140N, or approved equal.
- F. Thaw Pipes: Use threaded galvanized steel pipe and fittings.

**PART 3 EXECUTION**

**3.1 EARTHWORK**

- A. Excavation, trenching, and backfilling are specified in Section 31 20 00 "Earthwork."

**3.2 PIPING INSTALLATION**

- A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take into account design considerations. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.
- B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings in accordance with manufacturer's written instructions for use of lubricants, cements, and other installation requirements.
- C. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.
- D. Install gravity-flow, nonpressure drainage piping in accordance with the following:
  - 1. Install piping pitched down in direction of flow.
  - 2. Install piping with 18-inch minimum cover.
  - 3. Install corrugated metal piping in accordance with ASTM A798.

**3.3 PIPE JOINT CONSTRUCTION**

- A. Join storm drain piping in accordance with the following:
  - 1. Rain leader piping joints shall be made in accordance Manufacturer's recommendations.

**3.4 MANHOLE INSTALLATION**

- A. General: Install manholes, complete with appurtenances and accessories indicated.
- B. Install precast concrete manhole sections with sealants in accordance with ASTM C891.
- C. Where specific manhole construction is not indicated, follow manhole manufacturer's written instructions.
- D. Set tops of frames and covers flush with adjacent grades.

**3.5 FIELD QUALITY CONTROL**

- A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.



**Kenai Municipal Airport**  
**Sand Storage Building**

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- B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.
- C. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

**3.6 CLEANING**

- A. Clean interior of piping of dirt and superfluous materials.

**END OF SECTION 33 42 00**



## **GEOTECHNICAL REPORT**

For

**Kenai Municipal Airport Sand Storage Building  
Kenai, Alaska**

Prepared for:  
**City of Kenai**

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## ABBREVIATIONS

AK DOT&PF.....	Alaska Department of Transportation and Public Facilities
ASTM.....	American Society for Testing and Materials
bgs.....	Below the existing ground surface
Client.....	City of Kenai
HDL.....	HDL Engineering Consultants, LLC
I.D.....	Inside diameter
IBC.....	International Building Code
NFS.....	Non-frost Susceptible
OSHA.....	Occupational Safety and Health Administration
O.D.....	Outside diameter
psf.....	Pounds per square foot
Report.....	Geotechnical Engineering Report
Site.....	Kenai Municipal Airport in Kenai, AK
USACE.....	United States Army Corps of Engineers
USGS.....	United States Geological Survey
USCS.....	Unified Soil Classification System

# **GEOTECHNICAL ENGINEERING REPORT KENAI MUNICIPAL AIRPORT SAND STORAGE BUILDING KENAI, ALASKA**

## **1.0 INTRODUCTION**

In accordance with the request and authorization of the City of Kenai (Client), HDL Engineering Consultants, LLC (HDL) conducted a geotechnical engineering evaluation to support design of a proposed sand storage building at the Kenai Municipal Airport in Kenai, Alaska (Site). The proposed development consists of a one story pre-engineered building with adjacent paved driving surfaces. This Geotechnical Engineering Report (Report) provides the findings, conclusions, and recommendations that HDL derived from the geotechnical evaluation. This Report is subject to the limitations provided in Appendix A.

### **1.1 Purpose and Scope of Services**

HDL's objectives for this project was to develop geotechnical engineering recommendations for site work, foundations, and paved surfaces for the proposed development. To achieve our objectives, HDL:

- Coordinated a geotechnical subsurface exploration program that consisted of four (4) borings to 16.5 feet deep near the proposed structure, and four (4) borings to 6.5 feet deep near the adjacent paved driving areas;
- Classified soil samples recovered from the borings based on field observations and prepared boring logs using our visual classifications;
- Conducted laboratory tests on select samples to determine the particle size distribution, moisture content, and organic content;
- Performed geotechnical engineering analyses and developed geotechnical engineering recommendations; and,
- Prepared this Report, which summarizes HDL's findings from the geotechnical evaluation and provides conceptual geotechnical recommendations for the proposed project.

### **1.2 Summary**

This section provides a summary of the geotechnical findings and recommendations for the convenience of the non-technical reader. Read the summary in complete context with the remaining Report.

1. Borings performed near the proposed building generally encountered an organic mat at the ground surface underlain by poorly graded sand with varying amounts of silt and

gravel extending to the boring termination depth. A layer of silt was encountered beneath the organic mat in HDL-03 and extended to a depth of 2.5 feet below the existing ground surface (bgs).

2. Borings performed in undeveloped portions of the proposed paved surfaces generally encountered an organic mat at the ground surface underlain by poorly graded sand with varying amounts of silt and gravel extending to the boring termination depth. No organic mat was encountered in HDL-06 and HDL-07. A layer of silt was encountered in HDL-07 at a depth of 2.5 feet bgs and extended to a depth of 5.5 feet bgs. Varying amounts of organics were found in the sand layers.
3. Structural Fill placed less than 12 inches below the proposed footings and less than 6 inches below the building slab should be granular and consist of a reasonably well graded mixture of sand and gravel meeting the requirements of Alaska Department of Transportation and Public Facilities (AKDOT&PF) Standard Specifications for Airport Construction, Section P-154 for Subbase Course. These soils should also be low- to non-frost susceptible (F1 to NFS) gravel or non-frost susceptible sand (NFS).
4. Fill placed more than 12 inches below the proposed footings, more than 6 inches below the building slab, and below the pavement structural section should consist of soil meeting the AKDOT&PF Standard Specifications for Airport Construction, Section P-152 for Suitable Material.
5. Moderately to highly frost susceptible soils (F2-F4) were encountered in the shallow subsurface near the expected structural section and foundation bearing grade. If left in place, these soils will increase the risk of frost related issues at the Site. The risk of frost related issues can be reduced by removing and replacing the frost susceptible soils throughout the Site. At a minimum, these soils should be removed from within the structural section and where present at the foundation bearing grade.
6. Shallow insulated spread footing foundations can be used to support the proposed improvements. An allowable bearing capacity of 3,500 pounds per square foot (psf) may be used for design of foundations that bear a minimum of 1.5 feet below the final grade. Foundations should be constructed immediately after subgrade preparation to protect the soil bearing surface.
7. For shallow foundation designs, total settlement is estimated to be approximately 1 inch and differential settlement is estimated to be about one-half the total.

## **2.0 BACKGROUND**

The proposed development is located at 515 North Willow Street at the Kenai Municipal Airport in Kenai, Alaska. Figure 1, Vicinity Map, provides a map of the site location.



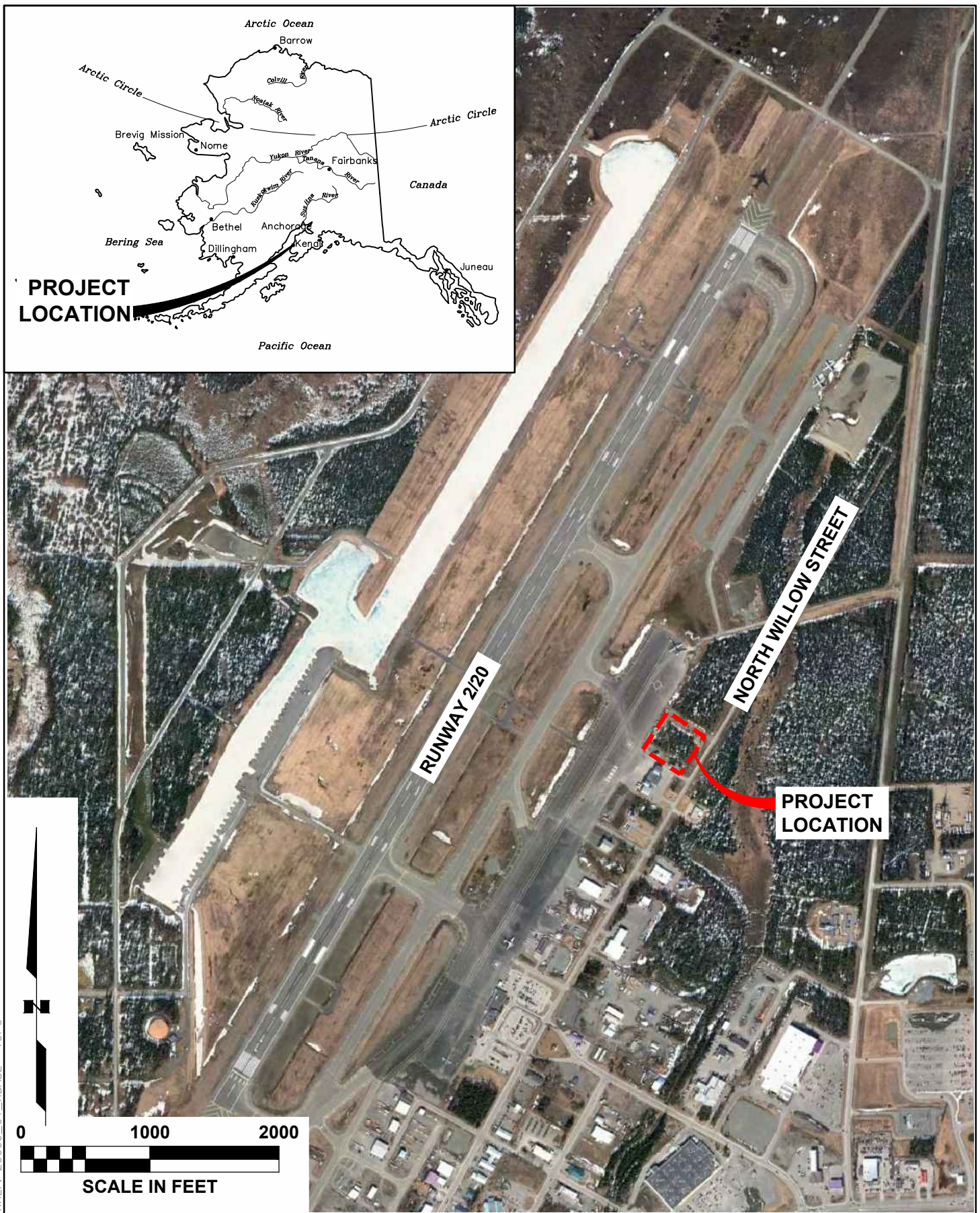


Figure 1  
**VICINITY MAP**  
**KENAI MUNICIPAL AIRPORT SAND STORAGE BUILDING**  
**KENAI, AK**



## **2.1 Existing Conditions**

The Site is currently vacant with the majority of the site covered with trees and vegetation. No structures or pavement were present at the Site at the time of drilling. Water and sewer mains are located along North Willow Street and there are currently no connections to the Site. An underground electric utility and an underground gas line cross the Site. The Kenai Municipal Airport Maintenance & Operations Building is South of the Site.

## **2.2 Proposed Development**

The proposed development consists of a single story, pre-engineered metal building measuring approximately 5,600 square feet. The building will have two bays, one for sand storage and the other for heavy equipment storage. The structure will be heated to account for the potential effects of seasonal frost action. Reinforced concrete cantilevered retaining walls will be constructed to separate the two bays and contain the stockpile of sand. Water service will be extended from the existing water main line on North Willow Street. Areas adjacent to the building will be paved to allow equipment and vehicle access. HDL assumes that the site grade will be raised to match the grade of the adjacent buildings.

## **3.0 SETTING**

The following sections provide information about the geologic and climatic setting for the Site.

### **3.1 General Geology**

The project area is located within the Nikishka Lowlands which is part of the Kenai Lowlands, a physiographic subprovince bordered on the west by Cook Inlet, on the north by the Turnagain arm, and on the east by the Kenai Mountains. The Nikishka Lowland is characterized by morainal topography, numerous lakes and rivers, as well as extensive areas of muskeg and swamp. The topography and Quarternary deposits within the Nikishka Lowland is a function of repeated Pleistocene glaciations, which at one point resulted in most of the Nikishka Lowland being submerged beneath a large lake near the peak of the Naptowne Glaciation. The broad-floored, terraced, and largely abandoned drainage channels present in the region suggest a sudden release of proglacial lake waters accompanying the drainage of a proglacial lake (Karlstrom, 1964).

The project is located in an area where the capacity of the near surface soils to transmit water is estimated to be moderately high to high. An estimated saturated hydraulic conductivity of 1.98 inches per hour is provided by the United States Department of Agriculture – Natural Resources Conservation Service for soils in the area.

The project is located in a region of moderate seismicity and large-scale earthquakes may cause ground ruptures in some areas. Based on the United States Geologic Survey (USGS) earthquake catalog, there were 134 events above Richter Magnitude 5 within 100 miles of the Site from 1898 through 2019, of which 15 were above Richter Magnitude 6. The 1964 Great Alaska Earthquake affected this area as well and had a Richter Magnitude of 8.4.

### 3.2 Climatology

The project area is located in a transitional climatic zone varying between continental and maritime climates. The zone is characterized by pronounced diurnal and annual temperature variation, moderate annual precipitation, and moderate surface winds. Climatology data was gathered for the City of Kenai, which has an average annual temperature of 34°F. The average high temperature in July is 62°F, while the average low temperature in January is 5°F. Average annual precipitation is 19 inches, and average annual snowfall is 61 inches (Shulski et. al, 2007).

## 4.0 SUBSURFACE EXPLORATION

HDL performed subsurface explorations at the Site on April 30, 2020 to evaluate the subsurface conditions. The subsurface evaluation consisted of four (4) borings drilled to a depth of 16.5 feet bgs and four (4) borings drilled to a depth of 6.5 feet bgs. An experienced HDL engineering assistant was present during drilling to locate the test holes, collect samples, log subsurface conditions, and observe groundwater depths, where encountered.

HDL described the recovered soils in the field in general accordance with ASTM International Standard (ASTM) D2488 and delivered select samples to HDL's laboratory for testing. Soil descriptions were confirmed or modified according to the Unified Soil Classifications System (USCS, ASTM D2487), as summarized in Appendix B, based on the laboratory test results. HDL assigned frost design classifications, as appropriate, in general accordance with the Frost Design Soil Classification provided in Appendix B using the AK DOT&PF methodology. Descriptions for organic soils were in general accordance with the Peat and Organic Soil Classification System, presented in Appendix B. HDL described frozen soils in general accordance with the Description and Classification of Frozen Soils, presented in Appendix B.

Four (4) borings, designated HDL-01 through HDL-04, were drilled near the proposed building. Four (4) borings, designated HDL-05 through HDL-08, were drilled near the proposed paved driving areas. The borings were drilled with a track mounted Geoprobe 6620DT drill rig with an auto-hammer with a 3.25-inch inside diameter (I.D.) hollow stem auger and a 3-inch outside diameter (O.D.) split spoon sampler. Split-spoon sampling was conducted using the Modified Penetration Test Procedure. In the Modified Penetration Test, samples are recovered by driving a 3-inch O.D. split-spoon sampler into the bottom of the advancing hole with blows of a 340-lb hammer free-falling 30 inches onto the drill rod. The number of blows required to advance the sampler the last 12 inches of an 18-inch sampler is termed the Penetration Resistance, which was recorded for each sample depth. The values give a measure of the relative density (compactness) or consistency (stiffness) of thawed cohesionless and cohesive soils, respectively. The boring logs are included in Appendix C.

HDL performed the fieldwork in general accordance with the procedures outlined in the AK DOT&PF "Alaska Geotechnical Procedures Manual". We located the borings in the field using tape and line of sight measurements from existing structures. Figure 2, Borehole Location Map, shows the approximate boring locations.



## 5.0 LABORATORY TESTING

HDL conducted laboratory testing of the soil samples at our re:Source (formerly AMRL) accredited and United States Army Corps of Engineers (USACE) validated laboratory. These tests verified or modified the field classifications and provided additional data to support the geologic interpretation. HDL conducted the following tests on select samples.

- Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass (ASTM D2216)
- Particle-Size Analysis of Soils (ASTM D422)
- Moisture, Ash, and Organic Matter of Peat and other Organic Soils (ASTM D2974)

The boring logs and grain size distribution curves provided in Appendix C present the results of the laboratory testing.

## 6.0 SUBSURFACE CONDITIONS

In general, the subsurface conditions encountered in the borings consisted of a thin organic mat overlying poorly graded sand with varying amounts of silt, gravel, and organics. Layers of silt with varying amounts of sand were encountered in HDL-03 and HDL-07. The following sections summarize the subsurface conditions encountered and the boring logs in Appendix C provide detailed information. Figure 3 provides a summary of the measured moisture contents.

### 6.1 Organic Mat

An organic mat was encountered in HDL-01 through HDL-05 and HDL-08. The organic mat was approximately 0.3 feet to 0.5 feet thick in the borings. Detailed information may be found on the logs presented in Appendix C.

### 6.2 Poorly Graded Sand

Poorly graded sand with varying amounts of silt, gravel, and organics, was encountered beneath the organic mat in borings HDL-01, HDL-02, and HDL-04 through HDL-08 and beneath the silt in HDL-03. The poorly graded sand layer generally extended to the boring termination depth. The poorly graded sand generally ranged from non-frost susceptible to highly frost susceptible (NFS to F3). Table 1 summarizes the laboratory results for this stratum.

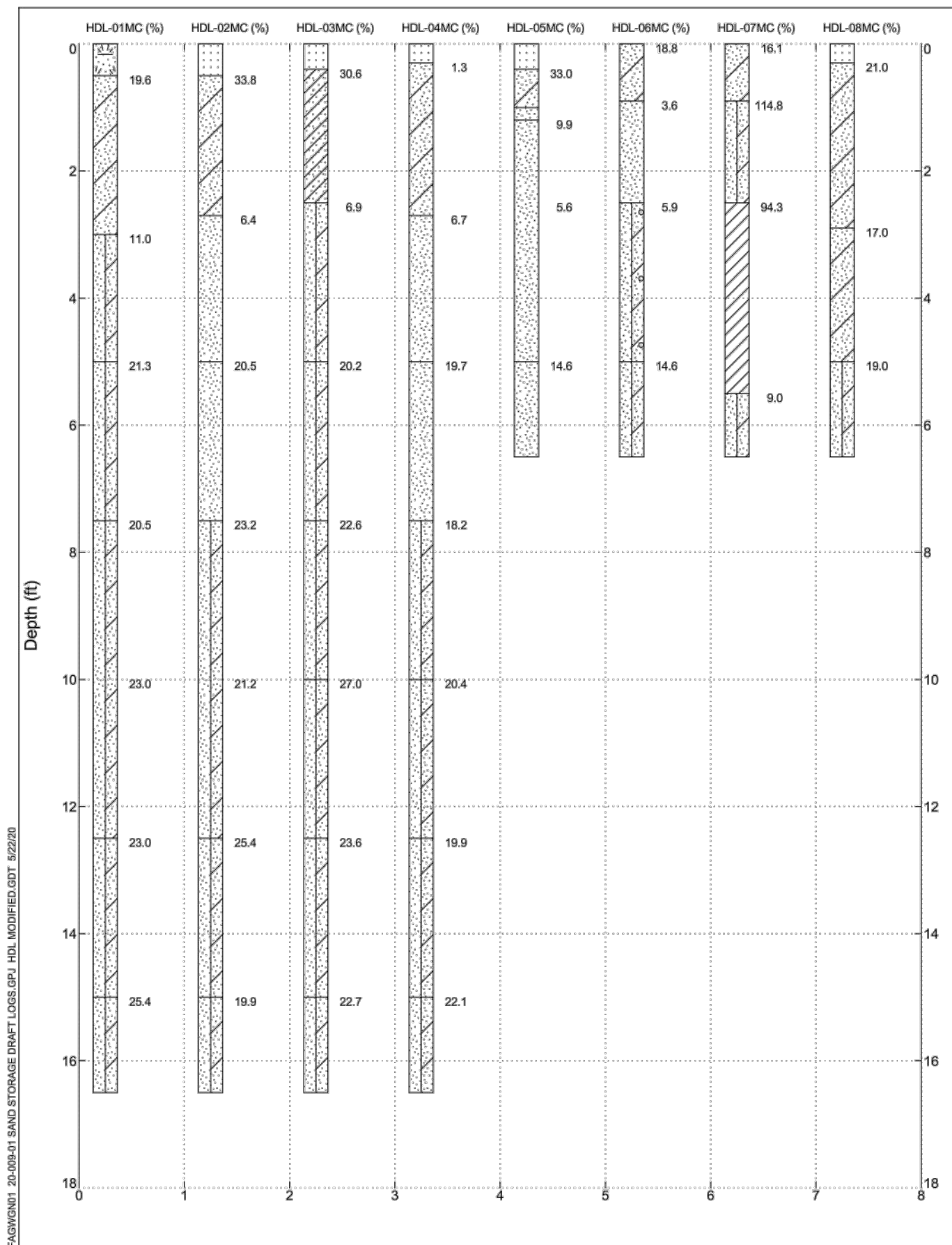


Figure 3  
**MOISTURE CONTENT SUMMARY**  
**KENAI MUNICIPAL AIRPORT SAND STORAGE BUILDING**  
**KENAI, AK**

**Table 1 – Poorly Graded Sand Laboratory Results Summary**

Test Hole	Depth	Grain Size Distribution			Organic Content
	(ft)	% Gr	%Sa	%P200	(%)
HDL-01	0.5	1.3	69.9	28.8	--
HDL-01	3.0	3.3	88.4	8.3	--
HDL-02	2.7	5.2	91.3	3.5	--
HDL-04	0.3	1.0	51.5	47.5	--
HDL-04	2.7	3.8	95.2	1.0	--
HDL-05	2.5	3.5	93.4	3.1	--
HDL-06	0.0	8.4	66.9	24.7	3.8
HDL-06	2.5	37.4	54.6	8.0	--
HDL-07	0.0	10.5	56.6	32.9	2.7
HDL-08	0.3	10.7	53.3	35.9	3.1

-- Not Tested

### 6.3 Silt

Silt was encountered beneath the organic mat in HDL-03 and extended to a depth of 2.5 feet bgs. Silt was also encountered in HDL-07 at a depth of 2.5 feet bgs and was approximately 2.5-feet thick. Table 2 summarizes the laboratory results for this stratum.

**Table 2 – Silt Laboratory Results Summary**

Test Hole	Depth	Grain Size Distribution			Organic Content
	(ft)	% Gr	%Sa	%P200	(%)
HDL-03	0.4	1.2	28.8	70.0	--
HDL-07	2.5	1.4	26.7	71.9	28.4

-- Not Tested

### 6.4 Frozen Ground

Seasonally frozen soil was encountered in HDL-05 and HDL-07 at depths of 0.4 feet bgs and 2.5 feet bgs, respectively. The frozen soil classification was described as well bonded with no excess ice (Nbn).

### 6.5 Groundwater

Free groundwater was encountered in borings HDL-01 through HDL-04 at depths ranging from 7.5 to 10.6 feet bgs. Groundwater levels at the site may fluctuate depending on the season, temperature, and precipitation. Groundwater levels during construction may be higher or lower than those encountered.

## **7.0 ENGINEERING ANALYSIS & RECOMMENDATIONS**

There are several components to the geotechnical analysis and recommendations. These include site preparation and structural fill, settlement, frost susceptibility, and seismic considerations. The following sections provide geotechnical recommendations for site work, foundation, and pavement design.

### **7.1 Site Work**

The following sections provide a summary of geotechnical considerations for the Site development.

#### **7.1.1 Site Preparation and Structural Fill**

HDL recommends the Site be cleared and grubbed prior to the onset of construction. If soft or unstable soils or other deleterious materials are encountered during construction, the materials should be removed and replaced with compacted fill. We recommend that the exposed subgrade be proof-rolled to provide a level, firm, uniform surface prior to the placement of fill. The bottom of all footing excavations should be compacted to a density of at least 95 percent of the maximum density as determined by the Modified Proctor compaction procedure (ASTM D1557). Excavations should be dewatered and protected from adjacent runoff. The subgrade soils may become difficult to compact due to natural moisture or if they are exposed to additional rainfall or runoff.

Structural Fill placed less than 12 inches below the proposed footings and less than 6 inches below the building slab should be granular and consist of a reasonably well graded mixture of sand and gravel meeting the requirements of Alaska Department of Transportation and Public Facilities (AK DOT&PF) Standard Specifications for Airport Construction, Section P-154 for Subbase Course. These soils should also be low- to non-frost susceptible (F1 to NFS) gravel or non-frost susceptible sand (NFS). The onsite soils generally do not meet these requirements.

Fill placed more than 12 inches below the proposed footings, more than 6 inches below the building slab, and below the pavement structural section should consist of soil meeting the AK DOT&PF Standard Specifications for Airport Construction, Section P-152 for Suitable Material. Some of the onsite soils generally meet these requirements.

Fill should be placed in lifts not to exceed 10 to 12 inches loose thickness, and compacted to a density of at least 95 percent of the maximum dry density as determined by ASTM D1557. During fill placement, we also recommend that large cobbles or boulders with dimensions in excess of 2/3 the lift thickness be removed.

Highly frost susceptible soils were encountered in the shallow subsurface. If left in place, these soils will increase the risk of frost related issues at the Site. The risk of frost related issues can be reduced by removing and replacing these soils throughout the Site. At a minimum, highly frost susceptible soils should not be present within the recommended structural section, within 12 inches of the foundation bearing grade, and within 6 inches of the building slab. The risk of settlement beneath the building slab can be reduced by replacing the upper 12 inches of soil with compacted Structural Fill.



## **7.2 Paved Driving Area**

HDL understands that the areas surrounding the proposed building will be paved to support light vehicle traffic and heavy equipment traffic. We assume that the subgrade below the structural section will be firm and unyielding. Asphalt concrete pavements are typically used in Alaska based on material availability and cost. The minimum recommended structural section for paved areas is as follows:

3 inches – Asphalt Pavement  
4 inches – Crushed Aggregate Base Course (D-1)  
29 inches – Subbase Course

The Crushed Aggregate Base Course (D-1) and Subbase Course should meet the requirements of Section P-209 and Section P-154 of the most recent version of AK DOT&PF Standard Specifications for Airport Construction, respectively. The D-1 and Subbase Course should be spread in thin, moisture conditioned layers and compacted to at least 95 percent of the maximum dry density as determined by ASTM D1557. All subgrades and final grades should be rolled to provide smooth, firm and non-yielding surfaces.

The recommended structural section is typical for the area and application, but do not provide full frost protection and seasonal movement of the pavement should be expected. This movement may reduce the life of the pavement. The life of the pavement can be increased by increasing the thickness of the structural section.

## **7.3 Concrete Apron**

HDL understands that a reinforced concrete apron slab will be constructed on the northwest side of the proposed building. We assume that the subgrade below the structural section will be firm and unyielding. The minimum recommended structural section for the concrete apron is as follows:

8 inches – Reinforced Concrete  
4 inches – Crushed Aggregate Base Course (D-1)  
24 inches – Subbase Course

The recommended structural section is typical for the area and application, but do not provide full frost protection and seasonal movement of the pavement should be expected. This movement may reduce the life of the pavement. The life of the pavement can be increased by increasing the thickness of the structural section.

## **7.4 Seismic Analysis**

The site characterization criteria found in the 2018 International Building Code (IBC) should be used for design. The seismic design criteria are found in Chapter 16, Section 1613 of the IBC. The IBC requires that the site characterization be determined by soil and rock parameters. Based on the subsurface conditions encountered, we recommend the site be considered Seismic Site Class “D”. The maximum considered earthquake ground motion spectral response accelerations for



short period and for one-second peaks were obtained utilizing the Seismic Design Maps created by Structural Engineers Association of California and California's Office of Statewide Health Planning and Development. Seismic Design Maps is a web interface that uses USGS web services to retrieve seismic design data; results of which are summarized in Table 3, Seismic Design Criteria. The calculated values were verified using Section 1613.2 of the 2018 IBC.

**Table 3 – Seismic Design Criteria**

<b>IBC 2018 Seismic Design Criteria</b>	<b>Value</b>
Spectral Response at Short Periods, $S_s$	1.50
Spectral Response at 1-Second Period, $S_1$	0.60
Site Class	D
Site Coefficient $F_a$	1.00
Site Coefficient $F_v$	1.70
Site Adjusted Spectral Response at Short Periods, $S_{MS}$	1.50
Site Adjusted Spectral Response at 1-second Periods, $S_{M1}$	1.02

## 7.5 Foundations

Design of a structure's foundation must consider the bearing capacity of the supporting soils, the effects of seasonal frost action, and the expected total and differential settlements. The foundation system must also consider the risk of failure and the cost of construction.

Assuming the proposed building will meet the assumptions outlined in this report and based on conditions encountered, insulated shallow spread footing foundations designed in accordance with ASCE 32 guidelines can be used to support the proposed improvements. The insulated foundations should bear a minimum of 18 inches below finished grade and be a minimum of 16 inches wide. Refer to ASCE 32 for further recommendations regarding design and construction of the insulated foundation.

Foundations should be constructed immediately after subgrade preparation to protect the soil bearing surface. In addition, foundation excavations should be backfilled as soon as possible after foundation construction.

### 7.5.1 Insulation

Insulation should be placed horizontally along the exterior of the building and extend a minimum of 4 feet beyond the building. The insulation should be 4-inches thick and consist of hydrophobic rigid foam board insulation. Insulation should also be placed vertically along the exterior of the foundations and be 2-inches thick. The insulation board should meet AASHTO M 230, Type VI, except that extrusion is not required and the maximum water absorption should not exceed 0.3% by volume, as determined by ASTM C272. Compressive strength at yield of 10% deformation should not be less than 40 pounds per square inch (psi). Thermal resistance (R-value) should not be less than 4.5 ( $^{\circ}\text{F}\cdot\text{ft}^2\cdot\text{hr}/\text{Btu}$ ) per inch at 75°F as determined by ASTM C177.

All joints shall be butted tight. Prior to placing the insulation, the subbase should be smooth, compacted, unyielding, and free of snow, ice, deleterious material, debris, and rocks exceeding 3-inches in diameter. The insulation should be covered by a minimum of 12 inches of soil to reduce the potential for damage. The contractor should be responsible for ensuring the equipment used does not damage the insulation during construction.

### **7.5.2 Allowable Bearing Pressures**

The proposed building foundations should bear upon compacted structural fill. If the soils beneath the proposed foundations are consistent with the requirements provided in this report, an allowable soil bearing capacity of 3,500 psf may be used for design of foundations that bear a minimum of 18 inches below final grade. The above bearing value may be increased by one-third for seismic or wind loading conditions.

### **7.5.3 Settlement**

The total settlements that will develop are dependent upon the actual loads that are applied, the dimensions of the foundations, the density of the supporting soil, and the care with which structural fills are placed and compacted. For shallow foundations designed as recommended above, we estimate that total settlements of approximately 1-inch could be realized and that differential settlements will be about one-half the total. Any soft or deleterious soils left in place will increase the potential settlement.

### **7.6 Drainage and Dewatering**

Groundwater was encountered during drilling. Based on the borings conducted, groundwater is not likely to be encountered during typical foundation, but may be encountered during utility construction. The groundwater level will likely vary from that encountered during drilling. If groundwater is present in excavations, the soils will be prone to collapse and construction may be difficult.

HDL recommends the site be graded to promote positive drainage away from the structures and compaction of the near surface soils to reduce permeability.

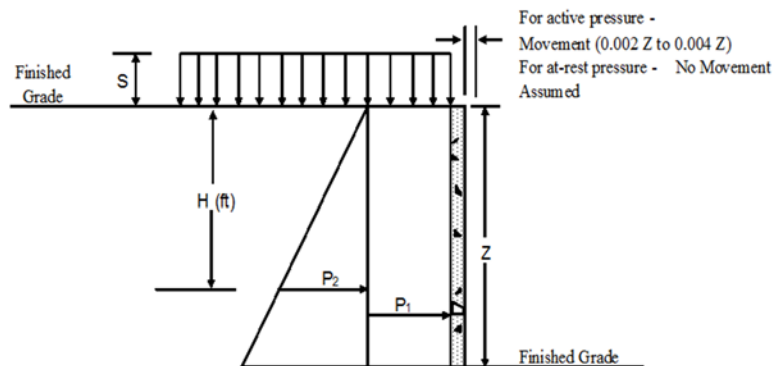
### **7.7 Frost Susceptibility**

Kenai is in a region of mild to moderate freeze and thaw cycles. Non-frost susceptible to highly frost susceptible (NFS to F4) soils were encountered within the shallow subsurface at the Site. Leaving the highly frost susceptible soils in place increases the risk of frost related issues. Removing and replacing the highly frost susceptible soils reduces the risk of frost related issues. Foundations should be embedded a minimum of 18 inches below finished grade.

### **7.8 Lateral Earth Pressure**

Reinforced concrete retaining walls will be used to contain the stockpile of sand in the sand storage bay of the proposed building. Retaining walls with unbalanced backfill levels on opposite sides should be designed for earth pressures at least equal to those indicated in the following

table. Earth pressures will be influenced by structural design of the walls, conditions of wall restraint, methods of construction and/or compaction and the strength of the materials being restrained. Active earth pressure is commonly used for design of freestanding cantilever retaining walls and assumes wall movement. The "at rest" condition assumes no wall rotation. The recommended design lateral earth pressures are for cast-in-place concrete walls only and do not include a factor of safety or any provision for possible hydrostatic pressure on the walls.



**Table 4 - Lateral Earth Pressures**

EARTH PRESSURE CONDITIONS	COEFFICIENT FOR BACKFILL TYPE	EQUIVALENT FLUID PRESSURE (pcf)	SURCHARGE PRESSURE, $P_1$ (psf)	EARTH PRESSURE, $P_2$ (psf)
Active ( $K_a$ )	Fill – 0.34	39.1	$(0.34)S$	$(39.1)H$
At-Rest ( $K_o$ )	Fill – 0.50	57.5	$(0.50)S$	$(57.5)H$
Passive ( $K_p$ )	Fill – 3.0	345	---	---

Conditions applicable to the above recommendations include:

- For active earth pressure, wall must rotate about base, with top lateral movements 0.002 Z to 0.004 Z, where Z is wall height
- For passive earth pressure, wall must move horizontally to mobilize resistance
- Uniform surcharge, where S is surcharge pressure
- Sand stockpile backfill weight a maximum of 115 pcf
- Horizontal backfill, compacted to at least 95% of the ASTM D1557 maximum dry density
- Loading from heavy compaction equipment not included
- No groundwater acting on wall
- No safety factor included
- Ignore passive pressure in frost zone

Backfill placed against walls should consist of granular soils. For the granular values to be valid, the granular backfill should extend out from the base of the wall at an angle of at least 45 and 60 degrees from vertical for the active and passive cases, respectively. Additional design considerations are required where these conditions are not met. To calculate the resistance to sliding, a value of 0.55 could be used as the allowable coefficient of friction between the cast-in-place footing and the underlying soil.

These pressures do not include the influence of surcharge loads during construction, traffic, equipment or floor loading, which should be added.

## **7.9 Construction Considerations**

### **7.9.1 Excavations and Shoring**

It is assumed that temporary excavations will be needed to support the foundation construction. We recommend that the trench side slopes, trench bottom conditions, and dewatering efforts be made the responsibility of the contractor as he is present on a day to day basis and can adjust his efforts to obtain the needed stability and meet the applicable Alaska and Federal Occupational Safety and Health Administration (OSHA) safety regulations. Deviation from the OSHA stipulations requires the approval of a licensed Professional Geotechnical Engineer.

Shoring may be required if unstable soils are encountered. Additional loads from adjacent equipment, hydrostatic pressure, and structures must also be accounted for in the pressure distribution for shoring design.

Dewatering most likely will not be necessary for foundation construction based on the measured groundwater level. However, groundwater levels are variable and can fluctuate. The need for dewatering will depend on the time of year for construction and the depth of the trench. Heavy precipitation may cause soils to become saturated and less stable. Surface water should be directed away from the excavations.

### **7.9.2 Moisture Sensitivity**

Kenai typically experiences rain during the construction season, especially towards the end of the summer. The contractor should phase construction to minimize exposure of the exposed subgrade. The onsite soils will be sensitive to moisture and may become difficult to compact if exposed to additional moisture. If the contractor chooses to reuse the existing soils, additional effort may be required during construction.

## **8.0 REFERENCES**

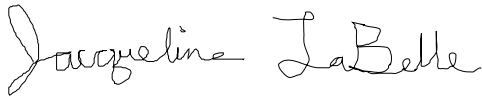
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Karlstrom, Thor Nels Vincent. Quaternary Geology of the Kenai Lowland and Glacial History of the Cook Inlet Region, Alaska. Washington D.C. U.S. Department of the Interior. 1964. Print.

## 9.0 CLOSURE

This Report has been prepared at the request and authorization of City of Kenai and is subject to the Limitations provided in Appendix A. Please feel free to contact Jeremy Dvorak at [jdvorak@hdlalaska.com](mailto:jdvorak@hdlalaska.com) or (907)564-2120 for questions or clarifications.

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Geotechnical Engineer



## **APPENDIX A**

Limitations (2 pages)

## **GEOTECHNICAL LIMITATIONS**

### Use of Report

1. HDL Engineering Consultants, LLC (HDL) prepared this report on behalf of, and for the exclusive use of our Client for the stated purpose(s) and location(s) identified in the Proposal for Services and/or Report. Use of this report, in whole or in part, at other locations, or for other purposes, may lead to inappropriate conclusions; and we do not accept any responsibility for the consequences of such use(s). Further, reliance by any party not expressly identified in the agreement, for any use, without our prior written permission, shall be at that party's sole risk, and without any liability to HDL.
2. If substantial time has elapsed between submission of this report and the start of work at the site, or if conditions have changed because of natural causes or construction operations at or adjacent to the site, we recommend that HDL be retained to review this report to determine the applicability of the conclusions considering the time lapse or changed conditions.

### Standard of Care

3. HDL's findings and conclusions are based on the work conducted as part of the Scope of Services set forth in the Proposal for Services and/or Report, and reflect our professional judgment. These findings and conclusions must be considered not as scientific or engineering certainties, but rather as our professional opinions concerning the limited data gathered during the course of our work. If conditions other than those described in this report are found at the subject location(s), or the design has been altered in any way, HDL shall be so notified and afforded the opportunity to revise the report, as appropriate, to reflect the unanticipated changed conditions.
4. HDL's services were performed using the degree of skill and care ordinarily exercised by qualified professionals performing the same type of services, at the same time, under similar conditions, at the same or a similar property. No warranty, expressed or implied, is made.

### Subsurface Conditions

5. The generalized soil profile(s) provided in our Report are based on widely-spaced subsurface explorations and are intended only to convey trends in subsurface conditions. The boundaries between strata are approximate and idealized, and were based on our assessment of subsurface conditions. The composition of strata, and the transitions between strata, may be more variable and more complex than indicated. For more specific information on soil conditions at a specific location refer to the exploration logs.
6. Unanticipated soil conditions are commonly encountered and cannot be fully determined by merely taking soil samples or advancing borings. Such unexpected conditions frequently require additional expenditure to attain a properly constructed project. Therefore, some contingency fund is recommended to accommodate such potential extra costs.
7. In preparing this report, HDL relied on certain information provided by the Client, state

and local officials, and other parties referenced therein which were made available to HDL at the time of our evaluation. HDL did not attempt to independently verify the accuracy or completeness of all information reviewed or received during the course of this evaluation.

8. Water level readings have been made in test holes (as described in the Report) and monitoring wells at the specified times and under the stated conditions. These data have been reviewed and interpretations have been made in this Report. Fluctuations in the level of the groundwater occur due to temporal or spatial variations in areal recharge rates, soil heterogeneities, the presence of subsurface utilities, and/or natural or artificially induced perturbations. The water encountered in the course of the work may differ from that indicated in the Report.
9. HDL's services did not include an assessment of the presence of oil or hazardous materials at the property. Consequently, we did not consider the potential impacts (if any) that contaminants in soil or groundwater may have on construction activities, or the use of structures on the property.
10. Recommendations for foundation drainage, waterproofing, and moisture control address the conventional geotechnical engineering aspects of seepage control. These recommendations may not preclude an environment that allows the infestation of mold or other biological pollutants.

#### Compliance with Codes and Regulations

11. We used reasonable care in identifying and interpreting applicable codes and regulations. These codes and regulations are subject to various, and possibly contradictory, interpretations. Compliance with codes and regulations by other parties is beyond our control.

#### Additional Services

12. HDL recommends that we be retained to provide services during any future: site observations, design, implementation activities, construction and/or property development/redevelopment. This will allow us the opportunity to: i) observe conditions and compliance with our design concepts and opinions; ii) allow for changes in the event that conditions are other than anticipated; iii) provide modifications to our design; and iv) assess the consequences of changes in technologies and/or regulations.



## **APPENDIX B**

Boring Log Key (1 page)

Frost Design Classification System (1 page)

Peat and Organic Soil Classification System (1 page)

Description and Classification of Frozen Soils (1 page)

# BORING LOG KEY

Summary of the Unified Soil Classification System (from ASTM International Standard D2487) <sup>A</sup>				Soil Classification	
				Group Symbol	Group Name <sup>B</sup>
Coarse-grained Soils  (More than 50% retained on No. 200 sieve)	Gravels  (More than 50% of coarse fraction retained on No. 4 sieve)	Gravels with < 5% fines <sup>C</sup>	$C_u \geq 4$ and $1 \leq C_c \leq 3^D$	GW	Well-graded gravel <sup>E</sup>
			$C_u < 4$ and/or $[C_c < 1$ or $C_c > 3]^D$	GP	Poorly graded gravel <sup>E</sup>
		Gravels with > 12% fines <sup>C</sup>	Fines classify as ML or MH	GM	Silty gravel <sup>E,F,G</sup>
			Fines classify as CL or CH	GC	Clayey gravel <sup>E,F,G</sup>
	Sands  (50% or more of coarse fraction passes No. 4 sieve)	Sands with < 5% fines <sup>H</sup>	$C_u \geq 6$ and $1 \leq C_c \leq 3^D$	SW	Well-graded sand <sup>I</sup>
			$C_u < 6$ and/or $[C_c < 1$ or $C_c > 3]^D$	SP	Poorly graded sand <sup>I</sup>
		Sands with > 12% fines <sup>H</sup>	Fines classify as ML or MH	SM	Silty sand <sup>F,G,I</sup>
			Fines classify as CL or CH	SC	Clayey sand <sup>F,G,I</sup>
Fine-grained Soils  (More than 50% passes the No. 200 sieve)	Silts and Clays ( $LL < 50$ )	Inorganic	$PI > 7$ and plots on or above "A" line <sup>J</sup>	CL	Lean clay <sup>K,L,M</sup>
			$PI < 4$ or plots below "A" line <sup>J</sup>	ML	Silt <sup>K,L,M</sup>
		Organic	LL - Oven dried/LL - Not dried $< 0.75$	OL	Organic clay/silt <sup>K,L,M,N/O</sup>
	Silts and Clays ( $LL \geq 50$ )	Inorganic	PI plots on or above "A" line	CH	Fat clay <sup>K,L,M</sup>
			PI plots below "A" line	MH	Elastic silt <sup>K,L,M</sup>
		Organic	LL - Oven dried/LL - Not dried $< 0.75$	OH	Organic clay/silt <sup>K,L,M,P/Q</sup>
Highly Organic Soils	Primarily organic matter, dark in color, and organic odor			PT	Peat

## NOTES:

Visual soil descriptions performed in accordance with ASTM D2488

Lowercase USCS abbreviation indicates field classification

Uppercase USCS abbreviation indicates laboratory classification

<sup>A</sup>Based on the material passing the 3-in. (75-mm) sieve

<sup>B</sup>If field sample contained cobble or boulders, or both, add "with cobbles or boulders, or both" to group name

<sup>C</sup>Gravels with 5 to 12% fines require dual symbols:

GW-GM well-graded gravel with silt

GW-GC Well-graded gravel with clay

GP-GM poorly graded gravel with silt

GP-GC poorly graded gravel with clay

<sup>D</sup>  $C_u = D_{60}/D_{10}$ ,  $C_c = (D_{30})^2 / (D_{10} \times D_{60})$

<sup>E</sup>If soil contains  $\geq 15\%$  sand, add "with sand" to group name

<sup>F</sup>If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM

<sup>G</sup>If fines are organic, add "with organic fines" to group name

<sup>H</sup>Sands with 5 to 12% fines require dual symbols:

SW-SM well-graded sand with silt

SW-SC well-graded sand with clay

SP-SM poorly graded sand with silt

SP-SC poorly graded sand with clay

<sup>I</sup>If soil contains  $\geq 15\%$  gravel, add "with gravel" to group name

<sup>J</sup>If Atterberg limits plot in hatched area, soil is a CL-ML, silty clay

<sup>K</sup>If soil contains 15 to  $< 30\%$  plus No. 200, add "with sand" or "with gravel", whichever is predominant

<sup>L</sup>If soil contains  $\geq 30\%$  plus No. 200, predominantly sand, add "sandy" to group name

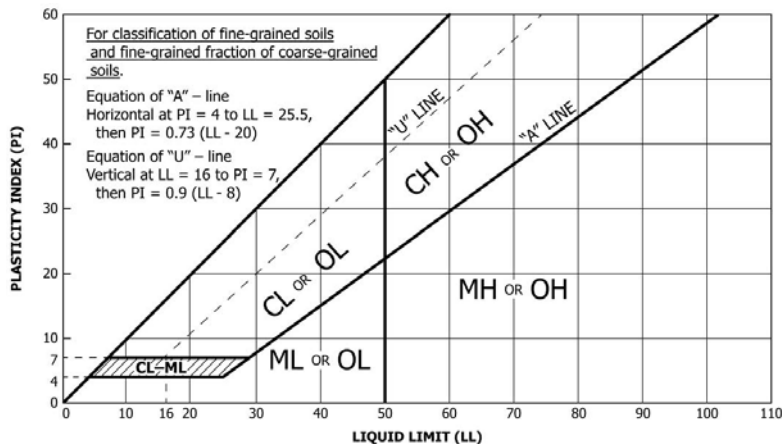
<sup>M</sup>If soil contains  $\geq 30\%$  plus No. 200, predominantly gravel, add "gravelly" to group name

<sup>N</sup> $PI \geq 4$  and plots on or above "A" line

<sup>O</sup> $PI < 4$  or plots below "A" line

<sup>P</sup>PI plots on or above "A" line

<sup>Q</sup>PI plots below "A" line



GRAIN SIZE		
Size Class	Inches	mm
Boulders	>12 inches	>300
Cobbles	3 to 12	75 - 300
Gravel		
Coarse	3/4 - 3	19.0 - 75
Fine	3/16 - 3/4	4.76 - 19.0
Sand		
Coarse	1/16 - 3/16	2.0 - 4.76
Medium	1/64 - 1/16	0.42 - 2.0
Fine	1/256 - 1/64	0.074 - 0.42
Silt and Clay	<1/256	<0.074

SAMPLE TYPES	
Symbol	Description
SS	Split Spoon
MSS	Modified Split Spoon
G	Grab
ST	Shelby Tube
GP	Push Sample
C	Core

SOIL CONSISTENCY		
Description	N-Value	Pocket Pen.
Very Soft	<2	<0.25
Soft	2 - 4	0.25 - 0.5
Medium	4 - 8	0.5 - 1.0
Stiff	8 - 15	1.0 - 2.0
Very Stiff	15 - 30	2.0 - 4.0
Hard	>30	>4.0

RELATIVE SOIL DENSITY	
Description	N-Value
Very Loose	0 - 4
Loose	5 - 10
Medium Dense	11 - 30
Dense	31 - 50
Very Dense	>50

COMPONENT PROPORTION (Visual)	
Term	Range
Trace	0 - 5%
Little	5 - 15%
Some	15 - 30%
And	30 - 50%

# FROST DESIGN SOIL CLASSIFICATION

## US Army Corps of Engineers (USACE) Methodology

The following frost design soil classification was developed by the USACE for describing the potential frost susceptibility of soils. The standard is published in USACE, EM 1110-3-138, "Pavement Criteria for Seasonal Frost Conditions," April 1984.

FROST GROUP	GENERAL SOIL TYPE	% FINER THAN 0.02 mm BY WEIGHT	TYPICAL USCS SOIL CLASS
NFS <sup>(1)</sup>	(a) Gravels Crushed Stone Crushed Rock	0-1.5	GW, GP
	(b) Sands	0-3	SW, SP
PFS <sup>(2)</sup>	(a) Gravels Crushed Stone Crushed Rock	1.5 -3	GW, GP
	(b) Sands	3-10	SW, SP
S1	Gravelly Soils	3-6	GW, GP, GW-GM, GP-GM, GW-GC, GP-GC
S2	Sandy Soils	3-6	SW, SP, SW-SM, SP-SM, SW-SC, SP-SC
F1	Gravelly Soils	6-10	GM, GC, GW-GM, GP-GM, GW-GC, GP-GC
F2	(a) Gravelly Soils	10-20	GW, GP, GW-GM, GP-GM, GW-GC, GP-GC
	(b) Sands	6-15	SM, SW-SM, SP-SM, SC, SW-SC, SP-SC, SM-SC
F3	(a) Gravelly Soils	Over 20	GM, GC, GM-GC
	(b) Sands, except very fine silty sands	Over 15	SM, SC, SM-SC
	(c) Clays, PI>12	--	CL, CH
F4	(a) Silts	--	ML, MH, ML-CL
	(b) Very fine silty sands	Over 15	SM, SC, SM-SC
	(c) Clays, PI<12	--	CL, ML-CL
	(d) Varied clays or other fine-grained banded sediments	--	CL or CH layered with ML, MH, ML-CL, SM, SC, or SM-SC

(1) Non-frost susceptible

(2) Possibly frost susceptible, requires lab test for void ratio to determine frost design soil classification. Gravel with void ratio > 0.25 would be NFS; Gravel with void ratio < 0.25 would be S1; Sands with void ratio > 0.30 would be NFS; Sands with void ratio < 0.30 would be S2 or F2

## Alaska Department of Transportation and Public Facilities (DOT&PF) Methodology

As shown above, the USACE standard is based in part on the percentage of material finer than 0.02 mm ( $P_{0.02}$ ). The DOT&PF modifies the USACE standard by referencing the percentage of material finer than the #200 sieve, which is 0.075 mm, ( $P_{200}$ ) rather than 0.02 mm. As reported in the Alaska Flexible Pavement Guide, the  $P_{200}$  value is typically twice that of the  $P_{0.02}$ ; therefore, DOT&PF considers material with less than 6% by weight passing the #200, non-frost susceptible (NFS).

## Municipality of Anchorage (MOA) Methodology

The MOA uses a simplified method based on the USACE methodology noted above. The MOA method is detailed in the Design Criteria Manual and summarized below. Note that the MOA method uses the  $P_{0.02}$  value rather than the  $P_{200}$  value.

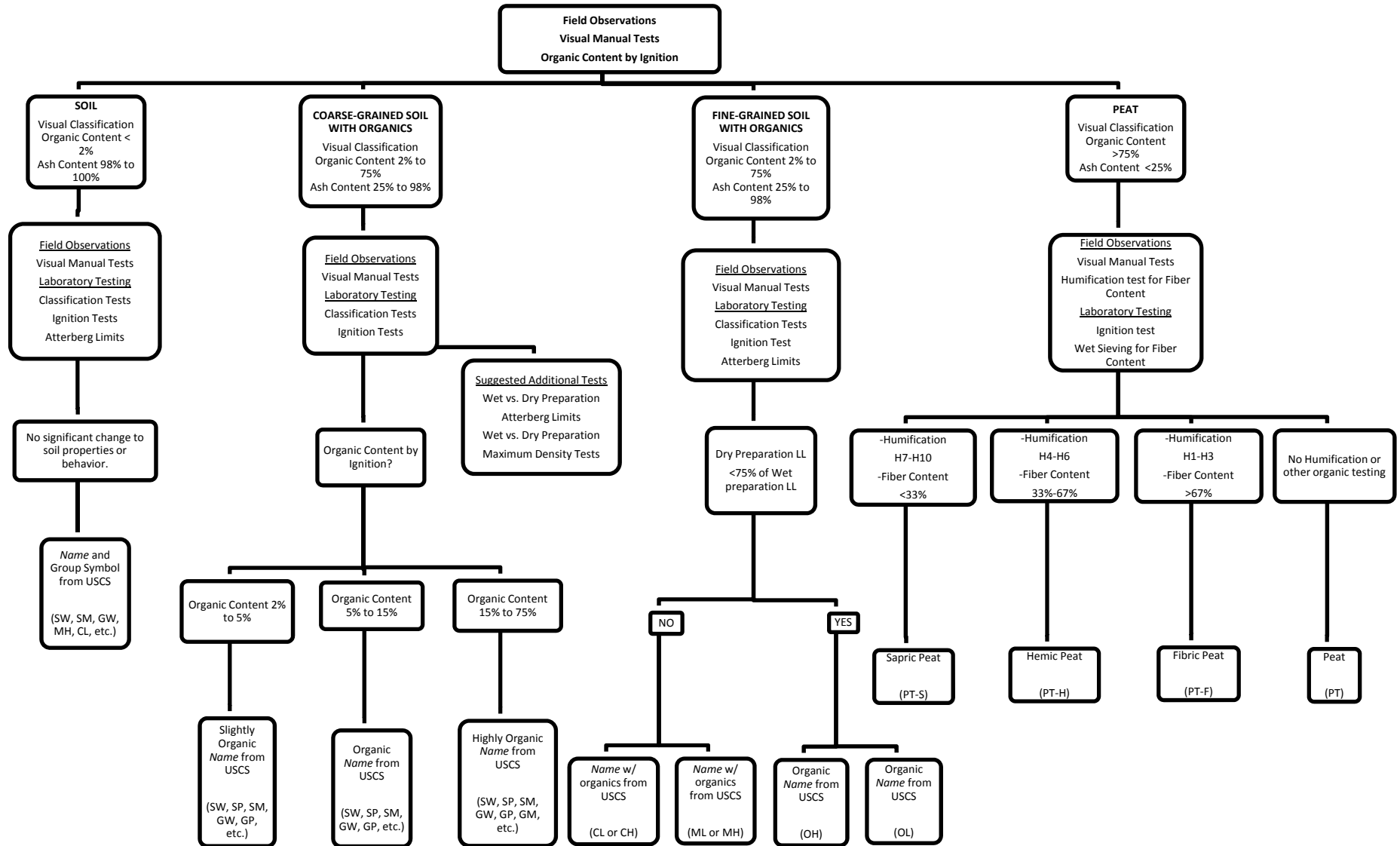
FROST GROUP	SOIL TYPE	PERCENTAGE FINER THAN 0.02 MILLIMETER BY WEIGHT	TYPICAL SOIL TYPES UNDER UNIFIED SOIL CLASSIFICATION SYSTEM
NFS	a. Gravels	0 to 3	GW, GP
	b. Sands	0 to 3	SW, SP
F-1	Gravelly soils	3 to 10	GW, GP, GW-GM, GP-GM
F-2	a. Gravelly soils	10 to 20	GM, GW-GM, GP-GM
	b. Sands	3 to 15	SW, SP, SM, SW-SM, SP
F-3	a. Gravelly soils	Over 20	GM, GC
	b. Sands, except very fine silty sands	Over 15	SM, SC
	c. Clays, PI>12	--	CL, CH
F-4	a. All silts	--	ML, MH
	b. Very fine silty sands	Over 15	SM, SC
	c. Clays, PI<12	--	CL, CL-ML
	d. Varied clays and other fine-grained, banded sediments	--	CL, CL-ML
		--	CL, CH, ML, SM

\* Municipality of Anchorage, Project Management & Engineering Department, Design Criteria Manual, January 2007.



# PEAT AND ORGANIC SOIL CLASSIFICATION SYSTEM

(Summarized from Alaska Guide for Classification of Peat and Organic Soil)



INCREASING ORGANIC CONTENT

# DESCRIPTION AND CLASSIFICATION OF FROZEN SOILS

## (Summarized from the Alaska Field Guide for Soil Classification)

PART I: <u>Description of Soil Phase</u> —Independent of Frozen State(a)									
Part II: <u>Description of Frozen Soil</u>	Major Group		Sub-Group		Field Identification	Pertinent Properties of Frozen Materials which may be measured by physical tests to supplement field identification.		Guide for Construction on Soils Subject to Freezing and Thawing	
	Description	Designation	Description	Designation				Thaw Characteristics	Criteria
	Segregated ice is not visible by eye (b)	N	Poorly Bonded or Friable	Nf	Identify by visual examination. To determine presence of excess ice, use procedure under note (c) below and hand magnifying lens as necessary. For soils not fully saturated, estimate degree of ice saturation: Medium, Low. Note presence of crystals, or of ice coating around larger particles.	In-Place Temperature	Density and Void Ratio a) In Frozen State b) After Thawing in Place	Usually Thaw-Stable	The potential intensity of ice segregation in a soil is dependent to a large degree on its void sizes and may be expressed as an empirical function of grain size as follows:
			No excess ice Well Bonded Excess Ice	Nb n e					
Part III: <u>Description of Substantial Ice Strata</u>	Segregated ice is visible by eye. (Ice 1 inch or less in thickness) (b)	V	Individual ice crystals or inclusions	Vx	For ice phase, record the following as applicable: Location                      Size Orientation                      Shape Thickness Spacing                      Pattern of arrangement Length	Water Content (Total H <sub>2</sub> O, including ice) a) Average b) Distribution	Strength a) Compressive b) Tensile c) Shear d) Adfreeze	Usually Thaw-Unstable	Most inorganic soils containing 3 percent or more of grains finer than 0.02 mm in diameter by weight are frost-susceptible. Gravels, well graded sands and silty sands, especially those approaching the theoretical maximum density curve, which contain 1.5 to 3 percent finer than 0.02 mm by weight without being frost-susceptible. However, their tendency to occur interbedded with other soils usually makes it impractical to consider them separately.  Soils classed as frost-susceptible under the above criteria are likely to develop significant ice segregation and frost heave if frozen at normal rates with free water readily available. Soils so frozen will fall into the thaw-unstable category. However, they may also be classed as thaw-stable if frozen with insufficient water to permit ice segregation.  Soils classed as non-frost-susceptible (*NFS) under the above criteria usually occur without significant ice segregation and are not exact and may be inadequate for some structure applications: exceptions may also result from minor soil variations.  In permafrost areas, ice wedges, pockets, veins, or other ice bodies may be found whose mode of origin is different from that described above. Such ice may be the result of long-time surface expansion and contraction phenomena or may be glacial or other ice which has been buried under a protective earth cover.
			Ice coatings on particles	Vc					
			Random or irregularly oriented ice formations	Vr	Hardness } Structure } per part III Below Color }				
			Stratified or distinctly oriented ice formations	Vs	Estimate volume of visible segregated ice present as percent of total sample volume				
Part III: <u>Description of Substantial Ice Strata</u>	Ice (Greater than 1 inch in thickness)	Ice	Ice with soil inclusions	Ice + Soil Type	Designate material as ICE (d) and use descriptive terms as follows, usually one item from each group, as applicable:  Hardness      Structure      Color      Admixtures	Elastic Properties Plastic Properties Thermal Properties	Ice Crystal Structure (using optional instruments.) a) Orientation of Axes b) Crystal size c) Crystal shape d) Pattern of Arrangement	Usually Thaw-Unstable	
			Ice without soil inclusions						

### DEFINITIONS:

Ice Coatings on Particles are discernible layers of ice found on or below the larger soil particles in a frozen soil mass. They are sometimes associated with hoarfrost crystals, which have grown into voids produced by the freezing action.

Ice Crystal is a very small individual ice particle visible in the face of a soil mass. Crystals may be present alone or in a combination with other ice formations.

Clear Ice is transparent and contains only a moderate number of air bubbles. (e)

Cloudy Ice is translucent, but essentially sound and non-pervious.

Porous Ice contains numerous voids, usually interconnected and usually resulting from melting at air bubbles or along crystal interfaces from presence of salt or other materials in the water, or from the freezing of saturated snow. Though porous, the mass retains its structural unity.

Candled Ice is ice which has rotted or otherwise formed long columnar crystals, very loosely bonded together.

Granular Ice is composed of coarse, more or less equidimensional, ice crystals weakly bonded together.

Ice Lenses are lenticular ice formations in soil occurring essentially parallel to each other, generally normal to the direction of heat loss and commonly in repeated layers.

Ice Segregation is the growth of ice as distinct lenses, layers, veins, and masses in soils, commonly but not always oriented normal to direction of heat loss.

Well-bonded signifies that the soil particles are strongly held together by the ice and that the frozen soil possesses relatively high resistance to chipping or breaking.

Poorly-bonded signifies that the soil particles are weakly held together by the ice and that the frozen soil consequently has poor resistance to chipping or breaking.

Friable denotes a condition in which material is easily broken up under light to moderate pressure.

Thaw-Stable frozen soils do not, on thawing, show loss of strength below normal, long-time thawed values nor produce detrimental settlement.

Thaw-Unstable frozen soils show on thawing, significant loss of strength below normal, long-time thawed values and/or significant settlement, as a direct result of the melting of the excess ice in the soil.

### NOTES:

(a) When rock is encountered, standard rock classification terminology should be used.

(b) Frozen soils in the N group may on close examination indicate presence of ice within the voids of the material by crystalline reflections or by a sheen on fractured or trimmed surfaces. However, the impression to the unaided eye is that none of the frozen water occupies space in excess of the original voids in the soil. The opposite is true of frozen soils in the V group.

(c) When visual methods may be inadequate, a simple field test to aid evaluation of volume of excess ice can be made by placing some frozen soil in a small jar, allowing it to melt and observing the quantity of supernatant water as a percent of total volume.

(d) Where special forms of ice, such as hoarfrost, can be distinguished, more explicit description should be given.

(e) Observer should be careful to avoid being misled by surface scratches or frost coating on the ice.

Modified from: Linell, K.A. and Kaplar, C.W., 1966, *Description and Classification of Frozen Soils*, Proc. International Conference on Permafrost (1963), Lafayette, IN, U.S. National Academy of Sciences, Publ. 1287, pp 481-487.



## **APPENDIX C**

Boring Logs (8 pages)

Grain Size Distribution Curves (3 pages)

# LOG OF BORING

HOLE # HDL-01

PROJECT NUMBER : 20-009-01

PROJECT : Kenai Municipal Airport Sand Storage Building

CLIENT : City of Kenai

Station / Location: Near west corner of proposed building

Equipment Type: Geoprobe 6620DT

Total Depth: 16.5 feet

Lat/Long:






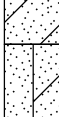





















Drilling Method: Hollow-Stem Auger

Date: 5/7/2020

Elevation:

Field Crew: GeoTek Alaska, Inc.

Geologist: J. LaBelle

Depth (Feet)	Sample Data					USCS Classification	Bonded Zone	Soil Graphic	Ground Water Data		
	Sample Type	Number	Blow Count	Sample Recovery	N-Value				Depth in (ft.)		
0									9.1		
									Time		
									Date	5/7/20	5/7/20
									Symbol	▽	
SUBSURFACE MATERIAL											
0			1						Organic Mat		0.0
1	SS	S-1	0		0	sm			Poorly-graded SAND, (sm); fine to coarse; some silt; trace gravel, fine; trace organics; brown, dry to moist, very loose, F3 P200 =28.8%, Sa =69.9%, Gr =1.3%, Moisture =19.6%		0.5
2											
3	SS	S-2	2		7	sp-sm			Poorly-graded SAND, (sp-sm); fine to coarse; little silt; trace gravel, fine; brown, dry, loose, F2 P200 =8.3%, Sa =88.4%, Gr =3.3%, Moisture =11.0%		3.0
4			3								
5			4								
6	SS	S-3	5		15				moist, medium dense Moisture =21.3%		5.0
7			7								
8	SS	S-4	3		17				wet, free water in spoon Moisture =20.5%		7.5
9			7								
10			10								
11	SS	S-5	3		14				Moisture =23.0%		
12			5								
13	SS	S-6	4		17				Moisture =23.0%		12.5
14			8								
15			9								
16	SS	S-7	7		17	sp-sm			Poorly-graded SAND, (sp-sm); fine to coarse; little silt; brown, dry, medium dense Moisture =25.4%		15.0
			8								
			9								
									Notes: Free groundwater encountered at 7.5 ft bgs during drilling.		16.5

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PROJECT NUMBER : 20-009-01

PROJECT : Kenai Municipal Airport Sand Storage Building

CLIENT : City of Kenai

Station / Location: Near north corner of proposed building

Equipment Type: Geoprobe 6620DT

Total Depth: 16.5 feet

Lat/Long:

Drilling Method: Hollow-Stem Auger

Date: 5/7/2020

Elevation:

Field Crew: GeoTek Alaska, Inc.

Geologist: J. LaBelle

Depth (Feet)	Sample Data					USCS Classification	Bonded Zone	Soil Graphic	Ground Water Data		
	Sample Type	Number	Blow Count	Sample Recovery	N-Value				Depth in (ft.)		
0			1						10.6		
			0						Time		
			0						Date	5/7/20	5/7/20
			0						Symbol	▽	
			2						SUBSURFACE MATERIAL		
0	SS	S-1	1		0	sm			Organic mat		0.0
1			0						Poorly-graded SAND, (sm); fine to coarse; with silt; little organics; brown, dry to moist, very loose		0.5
2			0						Moisture =33.8%		
3	SS	S-2	2		11	SP			Poorly-graded SAND, (SP); fine to coarse; little gravel, fine; trace silt; brownish gray, dry, medium dense, NFS		2.7
4			5						P200 =3.5%, Sa =91.3%, Gr =5.2%, Moisture =6.4%		
5			6								
6	SS	S-3	5		15				moist		5.0
7			8						Moisture =20.5%		
8			7								
9	SS	S-4	3		17	sp-sm			Poorly-graded SAND, (sp-sm); fine to coarse; little silt; trace gravel, fine to coarse; gray, wet, free water in spoon, medium dense		7.5
10			10						Moisture =23.2%		
11			7								
12	SS	S-5	3		17				Moisture =21.2%		
13			7								
14			10								
15	SS	S-6	7		7				approximately 6 inches of heave, trace organics in tip of spoon, loose		12.5
16			3						Moisture =25.4%		
17			4								
18	SS	S-7	8		19				rock in tip of spoon, medium dense		15.0
19			11						Moisture =19.9%		
20			8								
								BOH 16.5	Notes:		16.5
									Free groundwater encountered at 7.5 ft bgs during drilling.		

A USCS LOG OF TEST HOLE 20-009-01 SAND STORAGE DRAFT LOGS - COPY.GPJ HDL MODIFIED.GDT 5/29/20



PROJECT NUMBER : 20-009-01

PROJECT : Kenai Municipal Airport Sand Storage Building

CLIENT : City of Kenai

Station / Location: Near east corner of proposed building

Equipment Type: Geoprobe 6620DT

Total Depth: 16.5 feet

Lat/Long:


























Drilling Method: Hollow-Stem Auger

Date: 5/7/2020

Elevation:

Field Crew: GeoTek Alaska, Inc.

Geologist: J. LaBelle

Depth (Feet)	Sample Data					USCS Classification	Bonded Zone	Soil Graphic	Ground Water Data			
	Sample Type	Number	Blow Count	Sample Recovery	N-Value				Depth in (ft.)	7.8		
									Time			
									Date	5/7/20		5/7/20
									Symbol	▽		
SUBSURFACE MATERIAL												
0			1			ml		Organic mat	0.0			
1	SS	S-1	0		0			SILT, (ml); some sand, fine to coarse; little organics; brown, dry to moist, very loose, F4 P200 =70.0%, Sa =28.8%, Gr =1.2%, Moisture =30.6%	0.4			
2			0									
3	SS	S-2	2			sp-sm		Poorly-graded SAND, (sp-sm); fine to coarse; little silt; brownish gray, dry to moist, medium dense Moisture =6.9%	2.5			
4			4		14							
5			10									
6	SS	S-3	5					trace gravel, fine to coarse; moist Moisture =20.2%	5.0			
7			7		16							
8	SS	S-4	9					loss of gravel Moisture =22.6%	7.5			
9			3		21							
10	SS	S-5	9					trace gravel, fine to coarse; trace organics; Moisture =27.0%	10.0			
11			12									
12			3		12							
13	SS	S-6	4					approximately 6 inches of heave, loss of gravel Moisture =23.6%	12.5			
14			8		13							
15			9									
16	SS	S-7	5					approximately 1 foot of heave Moisture =22.7%	15.0			
17			10		17							
18			7									
								BOH 16.5	Notes: Free groundwater encountered at 7.5 ft bgs during boring.	16.5		

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







PROJECT NUMBER : 20-009-01

PROJECT : Kenai Municipal Airport Sand Storage Building

CLIENT : City of Kenai

Station / Location: Near south corner of proposed building  
 Equipment Type: Geoprobe 6620DT  
 Lat/Long:  
 Elevation:  
 Drilling Method: Hollow-Stem Auger  
 Field Crew: GeoTek Alaska, Inc.

Total Depth: 16.5 feet  
 Date: 5/7/2020  
 Geologist: J. LaBelle

Depth (Feet)	Sample Data					USCS Classification	Bonded Zone	Soil Graphic	Ground Water Data		
	Sample Type	Number	Blow Count	Sample Recovery	N-Value				Depth in (ft.)		
0									9		
									Time		
									Date	5/7/20	5/7/20
									Symbol	▽	
SUBSURFACE MATERIAL											
0			1			sm			Organic mat		0.0
0.3			0						Poorly-graded SAND, (sm); fine to coarse; with silt; trace organics; brown, moist, very loose, F4		0.3
1	SS	S-1	1		1				P200 =47.5%, Sa =51.5%, Gr =1.0%, Moisture =1.3%		
2											
3	SS	S-2	2			SP			Poorly-graded SAND, (SP); fine to coarse; trace silt; trace gravel, fine; brownish gray, dry to moist, medium dense, NFS		2.7
4			6		14				P200 =1.0%, Sa =95.2%, Gr =3.8%, Moisture =6.7%		
5			8								
6	SS	S-3	5						trace to little silt; gray		5.0
7			7		14				Moisture =19.7%		
8			7								
9	SS	S-4	4			sp-sm			Poorly-graded SAND, (sp-sm); fine to coarse; little silt; brownish gray, wet, free water in spoon, medium dense		7.5
10			5		11				Moisture =18.2%		
11	SS	S-5	8						trace gravel, fine; gray		10.0
12			9		17				Moisture =20.4%		
13	SS	S-6	11								
14			14		28				approximately 1 foot of heave, increase in fine sand		12.5
15			14						Moisture =19.9%		
16	SS	S-7	8						loose		15.0
			6		10				Moisture =22.1%		
			4								
								BOH 16.5	Notes:		16.5
									Free groundwater encountered at 7.5 ft bgs during drilling.		

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# LOG OF BORING

HOLE # HDL-05

PROJECT NUMBER : 20-009-01

PROJECT : Kenai Municipal Airport Sand Storage Building

CLIENT : City of Kenai

Station / Location: East portion of paved area

Lat/Long:

Elevation:

Equipment Type: Geoprobe 6620DT

Drilling Method: Hollow-Stem Auger

Field Crew: GeoTek Alaska, Inc.

Total Depth: 6.5 feet

Date: 5/7/2020

Geologist: J. LaBelle

Depth (Feet)	Sample Data						USCS Classification	Bonded Zone	Soil Graphic	Ground Water Data			
	Sample Type	Number	Blow Count	Sample Recovery	N-Value	Depth in (ft.)							
						Time							
						Date							
						Symbol							
SUBSURFACE MATERIAL													
0	SS	S-1	4		1	sm		Organic mat		0.0			
1								0.4					
								1.0					
			0			sp		Poorly-graded SAND, (sp); fine to coarse; trace silt; trace gravel, fine; brownish gray, dry to moist, NFS Moisture =9.9%		1.2			
2													
	SS	S-2	5		19	SP		(SP); medium dense P200 =3.1%, Sa =93.4%, Gr =3.5%, Moisture =5.6%		2.5			
3													
4			10										
5	SS	S-3	6		24			trace to little gravel, fine to coarse Moisture =14.6%		5.0			
6													
			14										
							BOH 6.5	Notes: No free groundwater encountered.		6.5			

A USCS LOG OF TEST HOLE 20-009-01 SAND STORAGE DRAFT LOGS - COPY.GPJ HDL MODIFIED.GDT 5/29/20

# LOG OF BORING

HOLE # HDL-06

PROJECT NUMBER : 20-009-01

PROJECT : Kenai Municipal Airport Sand Storage Building

CLIENT : City of Kenai

Station / Location: Between UREA and fuel buildings

Lat/Long:

Elevation:

Equipment Type: Geoprobe 6620DT

Drilling Method: Hollow-Stem Auger

Field Crew: GeoTek Alaska, Inc.

Total Depth: 6.5 feet

Date: 5/7/2020

Geologist: J. LaBelle

Depth (Feet)	Sample Data					USCS Classification	Bonded Zone	Soil Graphic	Ground Water Data	
	Sample Type	Number	Blow Count	Sample Recovery	N-Value				Depth in (ft.)	
0			1			sm				
1	SS	S-1	2		6	sp				
2			4							
3			5			sp-sm				
4	SS	S-2	6		12					
5			6							
6	SS	S-3	7		14	sp				
7			7							
SUBSURFACE MATERIAL										
0.0	Poorly-graded SAND, (sm); fine to coarse; some silt; little gravel, fine; trace organics; brown, dry to moist, F3 P200 =24.7%, Sa =66.9%, Gr =8.4%, Moisture =18.8%, Org =3.8%									0.0
0.9	Poorly-graded SAND, (sp); fine to coarse; little gravel, fine to coarse; trace to little silt; gray, dry, loose Moisture =3.6%									0.9
2.5	Poorly-graded SAND, (sp-sm); fine to coarse; with gravel, fine to coarse; little silt; gray, dry to moist, medium dense, F2 P200 =8.0%, Sa =54.6%, Gr =37.4%, Moisture =5.9%									2.5
5.0	Poorly-graded SAND, (sp); fine to coarse; trace to little gravel, fine to coarse; trace silt; brownish gray, moist, medium dense Moisture =14.6%									5.0
6.5	Notes: No free groundwater encountered.									6.5
						BOH 6.5				

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**PROJECT NUMBER : 20-009-01**

**PROJECT :** Kenai Municipal Airport Sand Storage Building

**CLIENT :** *City of Kenai*

Station / Location: *Northwest portion of paved area*

Equipment Type: *Geoprobe 6620DT*

Total Depth: 6.5 feet

Lat/Long:

Drilling Method: *Hollow-Stem Auger*

Date: 5/7/2020

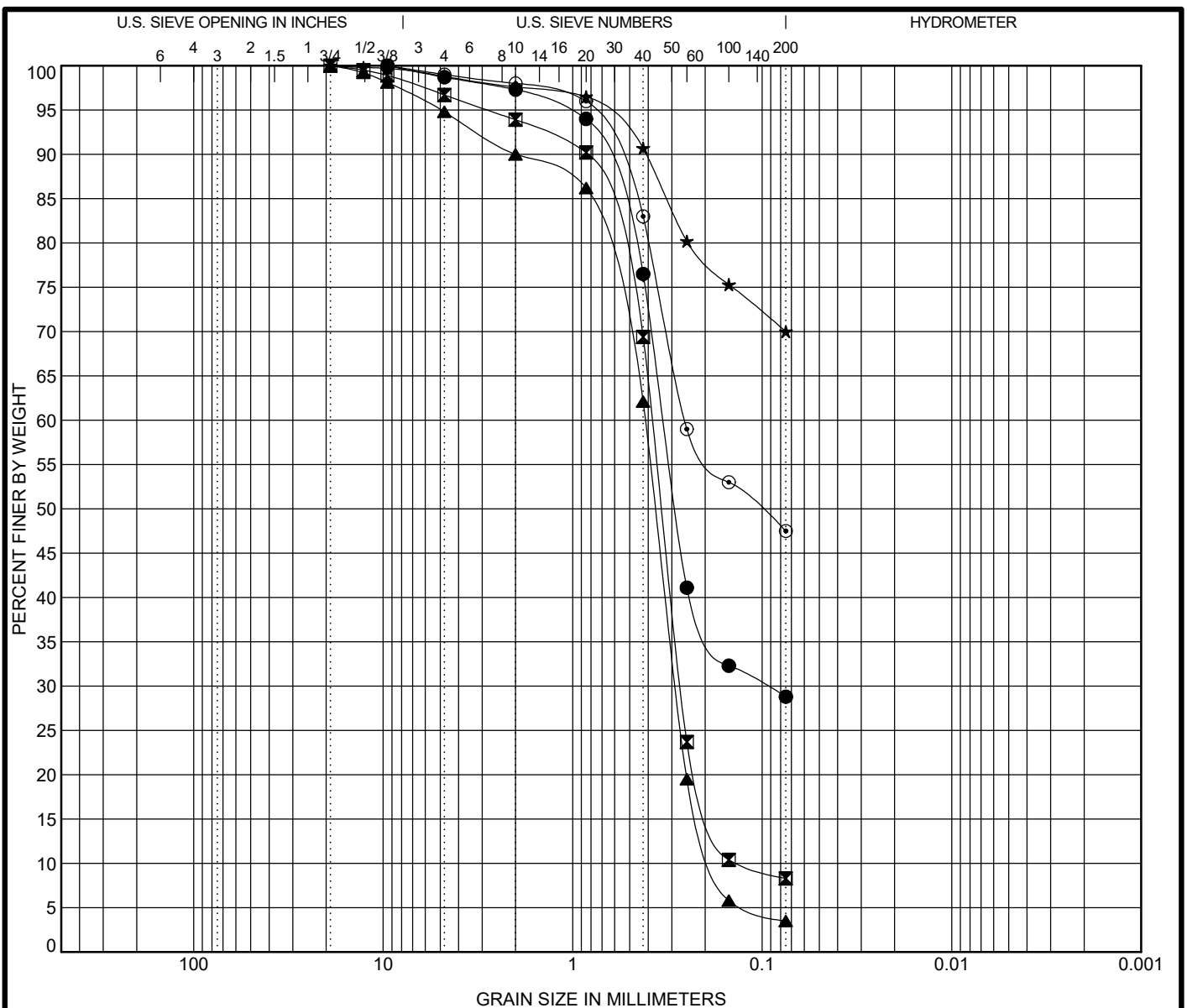
Elevation:

Field Crew: *GeoTek Alaska, Inc.*

Geologist: *J. LaBelle*

Depth (Feet)	Sample Data					USCS Classification	Bonded Zone	Soil Graphic	Ground Water Data		
	Sample Type	Number	Blow Count	Sample Recovery	N-Value				Depth in (ft.)		
									Time		
									Date		
									Symbol		
SUBSURFACE MATERIAL											
0	SS	S-1			1	sm		Organic mat		0.0	
1								0.3			
1			1								
2											
3	SS	S-2	1		5			some silt; some organics; moist, loose Moisture =17.0%		2.9	
4											
5			4			sp-sm		Poorly-graded SAND, (sp-sm); fine to coarse; little silt; gray, moist, medium dense Moisture =19.0%		5.0	
6	SS	S-3	11	24							
			13								
							BOH 6.5	Notes: No free groundwater encountered.		6.5	

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COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification			Classification					LL	PL	PI	Cc	Cu
●	HDL-01	DEPTH 0.5										
☒	HDL-01	DEPTH 3.0									1.44	2.90
▲	HDL-02	DEPTH 2.7	POORLY GRADED SAND(SP)								1.12	2.36
★	HDL-03	DEPTH 0.4										
◎	HDL-04	DEPTH 0.3										
Specimen Identification			D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay		
●	HDL-01	DEPTH 0.5	9.5	0.332	0.095		1.3	69.9	28.8			
☒	HDL-01	DEPTH 3.0	19	0.381	0.269	0.131	3.3	88.4	8.3			
▲	HDL-02	DEPTH 2.7	19	0.414	0.285	0.175	5.2	91.3	3.5			
★	HDL-03	DEPTH 0.4	19				1.2	28.8	70.0			
◎	HDL-04	DEPTH 0.3	9.5	0.256			1.0	51.5	47.5			



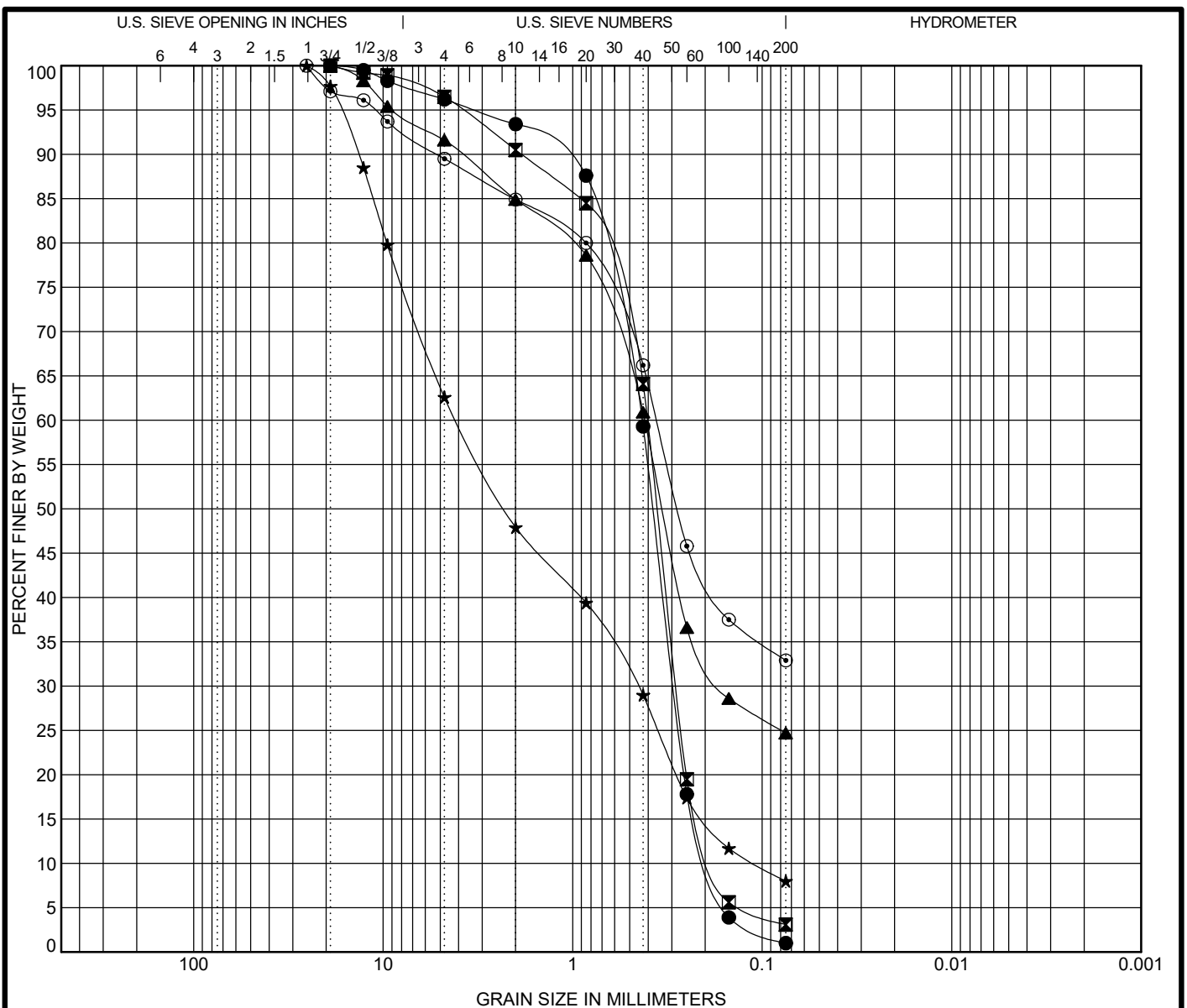
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Anchorage, AK 99503  
Telephone: 907-564-2120  
Fax: 907-564-2122

## GRAIN SIZE DISTRIBUTION

Project: Kenai Municipal Airport Sand Storage Building

Client: City of Kenai

Project Number: 20-009-01



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification			Classification			LL	PL	PI	Cc	Cu
●	HDL-04	DEPTH 2.7	POORLY GRADED SAND(SP)						1.05	2.30
⊠	HDL-05	DEPTH 2.5	POORLY GRADED SAND(SP)						1.12	2.30
▲	HDL-06	DEPTH 0.0								
★	HDL-06	DEPTH 2.5							0.46	37.37
⊙	HDL-07	DEPTH 0.0								
Specimen Identification			D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	HDL-04	DEPTH 2.7	19	0.432	0.292	0.188	3.8	95.2	1.0	
⊠	HDL-05	DEPTH 2.5	19	0.405	0.283	0.176	3.5	93.4	3.1	
▲	HDL-06	DEPTH 0.0	19	0.417	0.164		8.4	66.9	24.7	
★	HDL-06	DEPTH 2.5	25.4	4.076	0.454	0.109	37.4	54.6	8.0	
⊙	HDL-07	DEPTH 0.0	25.4	0.362			10.5	56.6	32.9	



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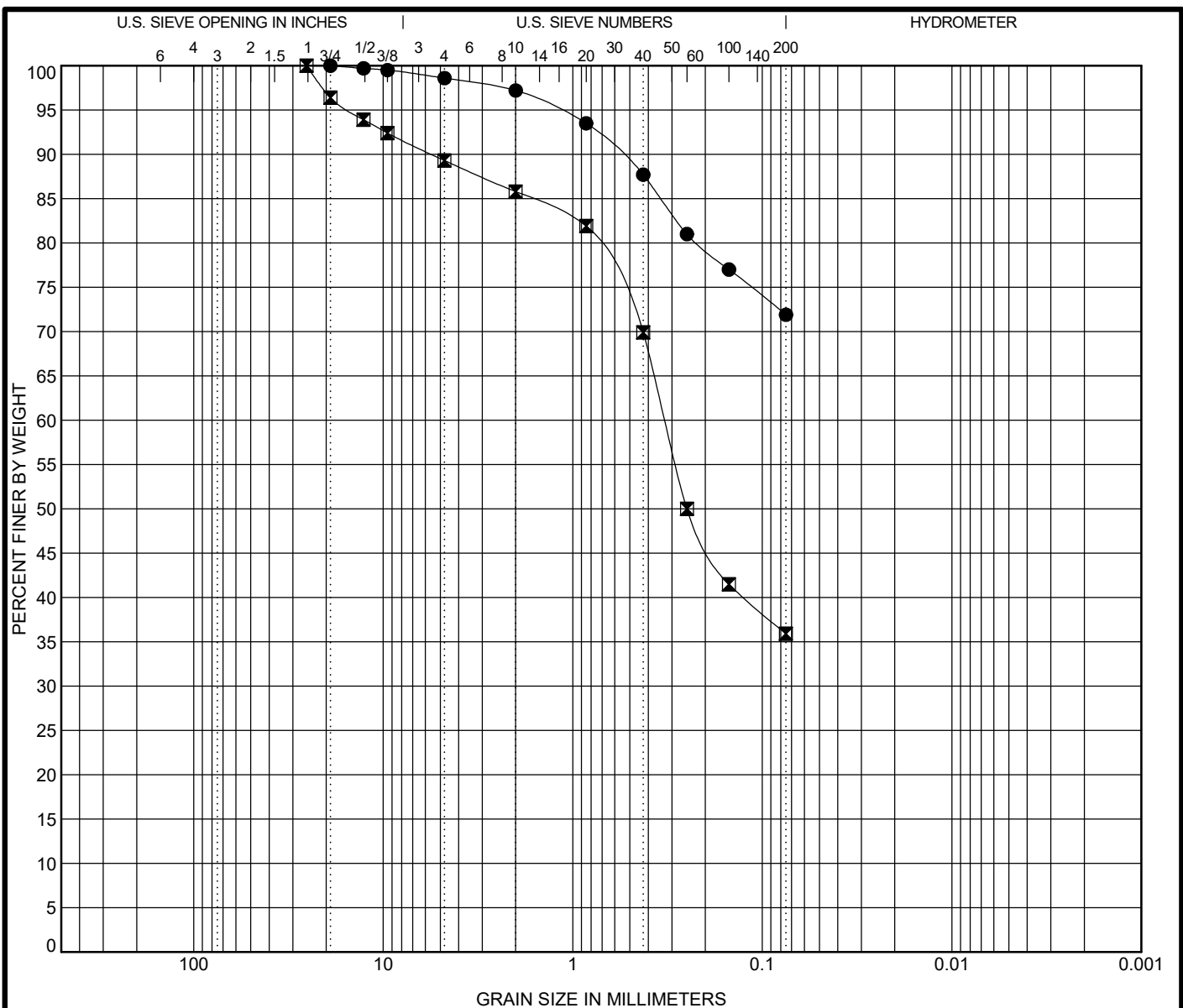
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COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification	Classification					LL	PL	PI	Cc	Cu
● HDL-07 DEPTH 2.5										
☒ HDL-08 DEPTH 0.3										
Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay		
● HDL-07 DEPTH 2.5	19				1.4	26.7	71.9			
☒ HDL-08 DEPTH 0.3	25.4	0.326			10.7	53.4	35.9			



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