



DULUTH INTERNATIONAL AIRPORT

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**DULUTH INTERNATIONAL AIRPORT
NEW PASSENGER TERMINAL
BID PACKAGE 2A
CONTRACT DOCUMENTS
ISSUED FOR BID**

FAA AIP No. - 3-27-0024-50-11
RS&H PROJ. No. – 213.1882.091
CITY OF DULUTH BID No. 11-4401

**PROJECT MANUAL
VOLUME 2 OF 4**

Date: FEBRUARY 3, 2011



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DULUTH INTERNATIONAL AIRPORT
DULUTH, MINNESOTA**

SECTION 01010 - SUMMARY OF WORK

1. GENERAL

- A. All work furnished under this Project Manual shall be installed at the following location in accordance with the Contract Documents:
 - 1. At: Duluth International Airport
New Passenger Terminal
Bid Package 2A
Duluth, Minnesota
 - 2. For: Duluth Airport Authority
4701 Grinden Drive
Duluth, MN 55811
- B. The provisions of Part 2 through 6, Part 9 and 10 of the specifications, and Division 1, General Requirements, shall apply to all work of the Contract.
- C. The Scope of Work for the Duluth International Airport, New Passenger Terminal, Bid Package 2A includes all work required for complete construction in accordance with the Contract Documents.
- D. Construction Contract: Construction will be accomplished under Multiple Prime Contracts as described in Section 01014 – Work Scope Descriptions.
- E. Coordination: Project will require close cooperation and coordination with Owner, Owner's Construction Manager (CM) and Contractor and Subcontractors. Contractor shall: consider such coordination in his work; schedule the Work with subcontractors and the Owner and Construction Manager, particularly near the end of the Project, keep the Owner and Construction Manager advised of his schedule to complete the Work.
- F. Examination of Site and Documents: In submitting a bid and in accepting a Contract award, the Contractor represents he has examined the site, existing conditions as well as the entire set of documents, in accordance with the General Conditions and agrees to be bound by all conditions of the site, existing conditions and all documents, without additional cost.
 - 1. Contractor's questions regarding this project must be directed to the Architect of record submitted through the Construction Manager. The Owner's employees are not authorized to make decisions or give direction regarding any aspect of this project.
- G. Construction Limits: Except as specifically indicated or as may be necessary to complete the work under the contract, activities of the contract shall be limited to within the limits designated on the drawings.

2. USE OF BUILDING BY OWNER

- A. Owner reserves the right to let other contracts in connection with this Project or in connection with existing buildings. Contractor shall afford other contractors reasonable opportunity for the introduction and storage of their materials and execution of their work, and shall properly connect and coordinate his work with theirs.
- B. Owner reserves the right to jointly occupy the premises with the Contractor in the performance of his duties and functions. The Owner also reserves the right to: enter into the Project and premises at all times; make installations of materials and equipment at appropriate times as the Work progresses; install equipment, furniture and furnishings when spaces are at appropriate stages of completion. Contractor shall coordinate work with the Owner and cooperate with the Owner to minimize undue interferences. Any activities required by the Contractor that may interfere with the Owner's occupation of the premises or Project during the work must be coordinated with the Owner and Construction Manager and may be required to be completed during alternate time periods.
- C. If any part, unit, phase, or the entire Project is substantially complete or ready for occupancy, the Owner may, upon notice to the Contractor, enter into and make use of the Work that is substantially complete.

3. CONTRACTOR'S USE OF PREMISES

- A. General: During the construction period the Contractor shall have full use of the premises for construction operations, including use of the site. The Contractor's use of the premises is limited only by the Owner's right to perform construction operations with its own forces or to employ separate contractors on portions of the project.
 - 1. Confine operations to areas within Contract limits indicated. Portions of the site beyond areas in which construction operations are indicated are not to be disturbed.
 - 2. Keep driveways and entrances serving the premises clear and available to the Owner at all times. Do not use these areas for parking or storage of materials. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on site.
- B. Site Storage Areas: As determined by Construction Manager. The Construction Manager shall establish and govern the use of available space.
- C. Site Protection: Protect existing trees and other plantings which are not to be removed and all features of adjacent buildings, paved surfaces which are to remain and are susceptible to damage from ordinary operations of the Contractor, trucking or other activity.
- D. Restoration: All improvements on or about the site and adjacent property which are not shown to be altered, removed or otherwise changed, and which have been damaged or disturbed by any work or operations under this contract, shall be restored to the conditions which existed previous to starting work. All existing buildings, structures, or other features shall be protected from damage by any operation in connection with the Project. The Contractor shall replace or repair, at

his own expense (and to the satisfaction of the Owner), all damage to existing buildings, sidewalks, curbs, drives, fencing, lawns, plants, trees, shrubbery and other property resulting from work of this Contract, from whatever cause.

4. CONSTRUCTION SCHEDULE

A. Refer to Section 01041 – Schedules.

END OF SECTION 01010

**NEW PASSENGER TERMINAL
DULUTH INTERNATIONAL AIRPORT
DULUTH, MINNESOTA**

**SECTION 01027 - APPLICATIONS
FOR PAYMENT**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements governing the Contractor's Applications for Payment.
 - 1. Coordinate the Schedule of Values and Applications for Payment with the Contractor's Construction Schedule, Submittal Schedule, and List of Subcontracts.
- B. Related Sections: The following Sections contain requirements that relate to this Section.
 - 1. Schedules: The Contractor's Construction Schedule and Submittal Schedule are specified in Division 1 Section 01300 - SUBMITTALS.

1.3 SCHEDULE OF VALUES

- A. Coordination: Coordinate preparation of the Schedule of Values with preparation of the Contractor's Construction Schedule.
 - 1. Correlate line items in the Schedule of Values with other required administrative schedules and forms, including:
 - a. Contractor's Construction Schedule.
 - b. Application for Payment forms, including Continuation Sheets.
 - c. List of subcontractors.
 - d. Schedule of allowances.
 - e. Schedule of alternates.
 - f. Schedule of submittals.
 - 2. Submit 3 copies of the Schedule of Values to the Construction Manager for approval at the earliest possible date but no later than 21 days before the date scheduled for submittal of the initial Applications for Payment.
 - 3. Subschedules: Where Work is separated into phases requiring separately phased payments, provide subschedules showing values correlated with each phase of payment.
- B. Format and Content: Use the Project Manual Table of Contents as a guide to establish the format for the Schedule of Values.
 - 1. Identification: Include the following Project identification on the Schedule of Values:
 - a. Project name and location.
 - b. Name of the Architect.
 - c. Project number.

- d. Contractor's name and address.
 - e. Date of submittal.
2. Arrange the Schedule of Values in tabular form with separate columns to indicate the following for each item listed:
 - a. Related Specification Section or Division.
 - b. Description of Work / generic name of the item.
 - c. Name of subcontractor.
 - d. Name of manufacturer or fabricator.
 - e. Name of supplier.
 - f. Change Orders (numbers) that affect value.
 - g. Dollar value.
 - h. Percentage of Contract Sum to nearest one hundredth percent, adjusted to total 100 percent.
 3. Provide a breakdown of the Contract Sum in sufficient detail, acceptable to the Architect, to facilitate continued evaluation of Applications for Payment and progress reports. Break principal subcontract amounts down into several line items.
 4. Round amounts to nearest whole dollar; the 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.
 - a. Differentiate between items stored on-site and items stored off-site. Include requirements for insurance and bonded warehousing, if required.
 6. Provide separate line items on the Schedule of Values for initial cost of the materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
 7. Margins of Cost: Show line items for indirect costs and margins on actual costs only when such items are listed individually in Applications for Payment. Each item in the Schedule of Values and Applications for Payment shall be complete. Include the total cost and proportionate share of general overhead and profit margin 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 the Contractor's option.
 8. Schedule Updating: Update and resubmit the Schedule of Values prior to the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

1.4 APPLICATIONS FOR PAYMENT

- A. Each Application for Payment shall be consistent with previous applications and payments as certified by the Construction Manager and paid for by the Owner.
 1. The initial Application for Payment, the Application for Payment at time of Substantial Completion, and the final Application for Payment involve additional requirements.

- B. **Payment Application Times:** Payment applications are due to the Construction Manager on the 1st day of each month. The period of construction work covered by each payment request is the period indicated in the Owner-Contractor agreement or, if none is indicated therein, starting the day following the end of the preceding period. Pay application meetings, which all Prime Contractors are required to attend, occur on the 3rd Thursday of each month. Refer to General Conditions and other Contract Documents for other dates related to payment application times.
- C. **Payment Application Forms:** Use AIA Document G702 and Continuation Sheets G703 as the form for Applications for Payment.
- D. **Application Preparation:** Complete every entry on the form. Include notarization and execution by a person authorized to sign legal documents on behalf of the Contractor. The Architect will return incomplete applications without action.
 - 1. Entries shall match data on the Schedule of Values and the Contractor's Construction Schedule. Use updated schedules if revisions were made.
 - 2. Include amounts of Change Orders and Construction Change Directives issued prior to the last day of the construction period covered by the application.
- E. **Report of DBE Activity:** With each Application for Payment, submit a Report of DBE Activity for the construction period covered by the application for payment.
- F. **Transmittal:** Submit five (5) signed and notarized original copies of each Application for Payment to the Construction Manager by a method ensuring receipt within 24 hours. One copy shall be complete, including waivers of lien and similar attachments, when required.
 - 1. Transmit each copy with a transmittal form listing attachments and recording appropriate information related to the application, in a manner acceptable to the Construction Manager.
 - 2. Each Application for Payment must be submitted directly to the Construction Manager's office at 8625 Rendova Street N.E., P.O. Box 158, Circle Pines, MN 55014 for processing. Do not submit to jobsites or branch offices.
- G. **Waivers of Mechanics Lien:** With each Application for Payment, submit waivers of mechanics liens from every entity who may lawfully be entitled to file a mechanics lien arising out of the Contract, including but not limited to subcontractors, and suppliers, for the construction period covered by the previous application.
 - 1. Submit partial waivers on each item for the amount requested, prior to deduction for retainage, on each item.
 - 2. When an application shows completion of an item, submit final or full waivers.
 - 3. The Owner reserves the right to designate which entities involved in the Work must submit waivers.
 - 4. **Waiver Delays:** Submit each Application for Payment with the Contractor's waiver of mechanics lien for the period of construction covered by the application.
 - a. Submit final Applications for Payment with or preceded by final waivers from every entity involved with performance of the Work covered by the application that is lawfully entitled to a lien.
 - 5. **Waiver Forms:** Submit waivers of lien on forms and executed in a manner acceptable to Owner.

- H. Initial Application for Payment: Administrative actions and submittals, that must precede or coincide with submittal of the first Application for Payment, include the following:
1. List of subcontractors.
 2. List of principal suppliers and fabricators.
 3. Schedule of Values.
 4. Contractor's Construction Schedule (preliminary if not final).
 5. Schedule of principal products.
 6. Schedule of unit prices.
 7. Submittal Schedule (preliminary if not final).
 8. List of Contractor's staff assignments.
 9. List of Contractor's principal consultants.
 10. Copies of building permits.
 11. Copies of authorizations and licenses from governing authorities for performance of the Work.
 12. Certificates of insurance and insurance policies.
 13. Performance and payment bonds.
 14. Data needed to acquire the Owner's insurance.
 15. Initial settlement survey and damage report, if required.
- I. Application for Payment at Substantial Completion: Following issuance of the Certificate of Substantial Completion, submit an Application for Payment.
1. This application shall reflect any Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.
 2. Administrative actions and submittals that shall precede or coincide with this application include:
 - a. Occupancy permits and similar approvals or certifications by governing authorities, assuring Owners full access and use of the completed work.
 - b. Warranties (guarantees) and maintenance agreements.
 - c. Test / adjust / balance records.
 - d. Maintenance instructions.
 - e. Meter readings.
 - f. Start-up performance reports.
 - g. Change-over information related to Owner's occupancy, use, operation, and maintenance.
 - h. Final cleaning.
 - i. Application for reduction of retainage and consent of surety.
 - j. Advice on shifting insurance coverages, including proof of extended coverages as required.
 - k. Final progress photographs.
 - l. List of incomplete Work recognized to be completed by the Contractor, as exceptions to Architect's Certificate of Substantial Completion.
- J. Final Payment Application: Administrative actions and submittals that must precede or coincide with submittal of the final Application for Payment include the following:
1. Completion of Project closeout requirements.
 2. Completion of items specified for payment application at time of Substantial Completion (regardless of whether such application was made).

3. Assurance, satisfactory to Owner, that unsettled claims will be settled and that work not actually completed or accepted will be completed without undue delay.
4. Transmittal of required Project construction records to the Owner.
5. Certified property survey.
6. Proof, satisfactory to Owner, that taxes, fees, and similar obligations of the Contractor have been paid.
7. Removal of temporary facilities and services.
8. Removal of surplus materials, rubbish, and similar elements.
9. Change of door locks and other Contractor access to Owner's property.
10. Consent of Surety for Final Payment.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 01027

**CONTRACTOR / DESIGN BUILDER'S
REPORT OF DBE ACTIVITY**

(Required with each Pay Application)

Duluth International Airport - New Passenger Terminal

FAA AIP Project Number:

Mn/DOT SP Project Numbers

KACC Project Number 20225 / Reynolds, Smith & Hills Project Number 213-1882-091

Accompanies Application for Payment No. **Covering period ending** _____

Contractor

Name:

Address:

Telephone No.: _____ **E-mail Address:** _____

The Original Contract Amount was _____

The net Amount of Change Orders to date is _____

The Current Contract Amount is _____

The DBE Goal has been established as _____ **percent of original contract amount**

The current DBE Goal is therefore calculated as (amount) _____

The DBE Subcontractors who worked on this project during this pay period and the value of the work performed by each is as listed below:

<u>NAME</u>	<u>DESCRIPTION OF WORK</u>	<u>AMOUNT</u>
1	_____	_____
2	_____	_____
3	_____	_____
4	_____	_____
5	_____	_____
6	_____	_____
7	_____	_____
8	_____	_____

The total value of work performed by DBEs during this pay period is _____

The accumulative value of work performed by DBEs prior to this period is \$ _____ -

The current total value of work performed by DBEs, including this period, is \$ _____ -

(The current total value of work performed by DBEs) + (The current Contract Amount) = _____

Contractor's strategy for meeting DBE Goal (when applicable) _____

**NEW PASSENGER TERMINAL
DULUTH INTERNATIONAL AIRPORT
DULUTH, MINNESOTA**

**SECTION 01035 - MODIFICATION
PROCEDURES**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements for handling and processing contract supplements and modifications.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Division 1, Section 01027 "Applications For Payment" for administrative procedures governing Applications for Payment.
 - 2. Division 1, Section 01300 "Submittals" for requirements for the Contractor's Construction Schedule.
 - 3. Division 1, Section 01631 "Products and Substitutions" for administrative procedures for handling requests for substitutions made after award of the Contract.

1.3 CONTRACT DOCUMENT SUPPLEMENTS

- A. Clarification / Supplemental Instructions (C-): Shall provide further detail to requirements inferred in the Contract Documents or authorize minor changes in the work, not involving an adjustment to the Contract Sum or Contract Time, and will be issued by the Architect with supplemental or revised drawings and specifications, if necessary. Clarifications / Supplemental Instructions issued by the Architect-Engineer shall become binding and a part of the Contract as minor changes in the work unless the Contractor notifies the Architect-Engineer within 21 days that the instructions result in changes that affect the Contract Cost or Contract Time.
- B. Request for Information / Supplemental Instructions (RFI-): Shall be initiated by the Contractor when necessary for performance of the work. The Architect's reply will constitute further detail to requirements if inferred in the Contract Documents or interpretations of the requirements. Requests for information must describe all document references that pertain to the issue and any conflicts and must include the contractor's interpretation or proposed action that would be made if there was not a process to obtain the information from the Architect. Requests for information that do not include this, or that request information already included in the contract documents without conflict, will be returned without action (RWA). The Architect will record the time expended to process such requests and notify the Contractor of the charges. The owner shall deduct any such compensation due the Architect from the Contractor's monthly periodic pay requests in accordance with the compensation terms for cost, overhead and profit in the Owner / Architect agreement. Use forms provided by the Architect. The Contractor shall maintain a sequentially numbered log of all such requests.

- C. Contractor Corrective Action Proposals (CCA-): Shall be initiated by the Contractor when deviation from the contract requirements has been constructed. The Contractor shall provide a fully detailed proposal for his corrective or remedial work. The Architect's reply will indicate approval of the proposed action as detailed, approval with certain modifications, or rejection of the proposal. Use forms provided by the Architect. The Contractor shall maintain a sequentially numbered log of all such proposals. Upon notification of a deviation and request for a CCA the Contractor shall submit one promptly. Should this not occur in a timely fashion which, in the judgment of the Architect, will allow time for processing and correction ahead of other advancing elements of work, the Architect will initiate a CCA giving direction for correction. If the Architect initiates the CCA or must provide significant direction to a Contractor initiated CCA, due to a lack of a fully detailed proposal, the Architect will record the time expended and notify the Contractor of the charges. The owner shall deduct any such compensation due the Architect from the Contractor's monthly periodic pay requests in accordance with the compensation terms for cost, overhead and profit in the Owner / Architect agreement.

1.4 PROPOSAL / CHANGE ORDER REQUESTS

- A. Request for Proposal (RFP-): The Architect will issue a detailed description of proposed changes in the Work that will require adjustment to the Contract Sum or Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
1. Proposal requests issued by the Architect are for information only. Do not consider them as an instruction either to stop work in progress or to execute the proposed change.
 2. Unless otherwise indicated in the proposal request, within 20 days of receipt of a proposal request, submit an estimate of cost necessary to execute the change to the Architect for the Owner's review.
 - a. Include a list of quantities of products to be purchased and unit costs, along with the total amount of purchases to be made. Where requested, furnish survey data to substantiate quantities.
 - b. Itemize labor charges by time and category.
 - c. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 - d. Indicate overhead and profit charges.
 - e. Include a statement indicating the effect the proposed change in the work will have on the Contract Time.
- B. Contractor-Initiated Change Order Requests (RCO-): When latent or unforeseen conditions require modifications to the Contract, the Contractor may propose changes by submitting a request for a change to the Architect.
1. Include a statement outlining the 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 Contract Time.
 2. Include a list of quantities of products to be purchased and unit costs along with the total amount of purchases to be made. Where requested, furnish survey data to substantiate quantities.
 3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.

4. Comply with requirements in Section 01631 - PRODUCTS AND SUBSTITUTIONS if the proposed change requires substitution of one product or system for a product or system specified.
5. Change Order Request Form: Use forms provided by the Architect. The Contractor shall maintain a sequential log of all Requests for Change Orders.

1.5 ALLOWANCES

- A. Allowance Adjustment: For allowance-cost adjustment, base each Change Order Proposal on the difference between the actual purchase amount and the allowance, multiplied by the final measurement of work-in-place. Where applicable, include reasonable allowances for cutting losses, tolerances, mixing wastes, normal product imperfections, and similar margins.
 1. Include installation costs in the purchase amount only where indicated as part of the allowance.
 2. When requested, prepare explanations and documentation to substantiate the margins claimed.
 3. The Owner reserves the right to establish the actual quantity of work-in-place by independent quantity survey, measure, or count.
- B. Submit claims for increased costs because of a change in scope or nature of the allowance described in the Contract Documents, whether for the purchase order amount or the Contractor's handling, labor, installation, overhead, and profit. Submit claims within 20 days of receipt of the Change Order or Construction Change Directive authorizing work to proceed. The Owner will reject claims submitted later than 20 days.
 1. Do not include the Contractor's or subcontractor's indirect expense in the Change Order cost amount unless it is clearly shown that the nature or extent of work has changed from what could have been foreseen from information in Contract Documents.
 2. No change to the Contractor's indirect expense is permitted for selection of higher or lower-priced materials or systems of the same scope and nature as originally indicated.

1.6 CONSTRUCTION CHANGE DIRECTIVE

- A. Construction Change Directive: When the Owner and the Contractor are not in total agreement on the terms of a Change Order Proposal Request, the Architect may issue a Construction Change Directive on AIA Form G714. The Construction Change Directive instructs the Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
 1. The Construction Change Directive will contain a complete description of the change in the work and designate the method to be followed to determine change in the Contract Sum or Contract Time.
- B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.
 1. After completion of the change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

1.7 CHANGE ORDER PROCEDURES

- A. Upon the Owner's approval of a Change Order Proposal Request, the Architect will issue a Change Order for signatures of the Owner and the Contractor on AIA Form G701, as provided in the Conditions of the Contract.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 01035

**NEW PASSENGER TERMINAL
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SECTION 01040 – COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This section includes administrative and supervisory requirements necessary for coordinating construction operations including, but not necessarily limited to, the following:
 - 1. General project coordination procedures.
 - 2. Coordination Drawings.
 - 3. Administrative and supervisory personnel.
 - 4. Cleaning and protection.
- B. Related Sections: Refer to other Division 1 sections for coordination requirements regarding field engineering services, project meetings, Contractor's construction schedule, general installation and contract closeout.

1.3 COORDINATION

- A. Coordinate construction operations included in various sections of these Specifications to assure efficient and orderly installation of each part of the work. Coordinate construction operations included under different sections that are dependent upon each other for proper installation, connection, and operation.
 - 1. Schedule construction operations in the 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 assure maximum accessibility for required maintenance, service, and repair.
 - 3. Make provisions to accommodate items scheduled for later installation.
- B. Where necessary, prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and attendance at meetings.
 - 1. Prepare similar memoranda for the Owner and separate contractors where coordination of their work is required.
- C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and assure orderly progress of the work. Such administrative activities include, but are not limited to, the following:
 - 1. Preparation of schedules.
 - 2. Installation and removal of temporary facilities.
 - 3. Delivery and processing of submittals.
 - 4. Progress meetings.

5. Project closeout activities.

1.4 SUBMITTALS

- A. Coordination Drawings: Prepare coordination drawings as careful coordination is needed for installation of products and materials fabricated by separate entities. Prepare coordination drawings where limited space availability necessitates maximum utilization of space for efficient installation of different components.
 - 1. Show the relationship of components shown on separate Shop Drawings.
 - 2. Indicate required installation sequences.
 - 3. Comply with requirements contained in Section 01300 - SUBMITTALS.
 - 4. Refer to Divisions 15 and 16 for additional requirements.
- B. Staff Names: Within fifteen (15) days of commencement of construction operations, submit a list of the Contractor's principal staff assignments, including the superintendent and other personnel in attendance at the Project Site. Identify individuals and their duties and responsibilities. List their addresses and telephone numbers.
 - 1. Post copies of the list in the Project meeting room, the temporary field office, and each temporary telephone.
- C. Subcontractor / Supplier Names: Within fifteen (15) days of commencement of construction operations, submit a listing of Contractor's principal subcontractors and suppliers, naming persons and listing their addresses and phone numbers.

1.5 SITE USE PLAN

- A. Within ten (10) working days of Contract award, the Contractor shall develop and submit for Owner's approval a site use plan. This plan shall clearly describe the proposed temporary facilities, staging areas, ramps and major traffic ways, hazardous material storage, provisions for site services, safety and security. Changes to the site plan shall be submitted for review and approval five (5) working days prior to effecting the changes.

1.6 TRADESPERSONS AND WORKMANSHIP STANDARDS

- A. General: Instigate and maintain procedures to ensure that persons performing work at site are skilled and knowledgeable in methods and craftsmanship needed to produce required quality levels for workmanship in completed work. Remove and replace work which does not comply with workmanship standards as specified and as recognized in the construction industry for applications indicated. Remove and replace other work damaged or deteriorated by faulty workmanship or its replacement.
- B. Availability of Tradespersons: At each progress or coordination meeting, review availability of tradespersons and projected needs to accomplish work as scheduled. Require each entity employing personnel to report on events which might affect progress of work. Where possible, consider alternatives and take actions to avoid disputes and delays.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 GENERAL COORDINATION PROVISIONS

- A. Inspection of Conditions: Require the Installer of each major component to inspect both the substrate and conditions under which work is to be performed. Do not proceed until unsatisfactory conditions have been corrected in an acceptable manner.
- B. Coordinate temporary enclosures with required inspections and tests to minimize the necessity of uncovering completed construction for that purpose.
- C. Manufacturer's Instructions: Comply with manufacturer's installation instructions and recommendations, to the extent that those instructions and recommendations are more explicit or stringent than requirements contained in Contract Documents.
- D. Inspect materials or equipment immediately upon delivery and again prior to installation. Reject damaged and defective items.
- E. Provide attachment and connection devices and methods necessary for securing work. Secure work true to line and level. Allow for expansion and building movement.
- F. Visual Effects: Provide uniform joint widths in exposed work. Arrange joints in exposed work to obtain the best visual effect. Refer questionable choices to the Architect for final decision.
- G. Recheck measurements and dimensions, before starting each installation.
- H. Install each component during conditions of temperature, humidity, exposure, forecasted weather and status of project completion that will ensure the best possible results, in coordination with entire work. Isolate each part of the completed construction from incompatible material as necessary to prevent deterioration.
- I. Mounting Heights: Where mounting heights are not indicated, install individual components at standard mounting heights recognized within the industry for the particular application indicated. Refer questionable mounting height decisions to the Architect for final decision.

3.2 CLEANING AND PROTECTION

- A. Clean and protect construction in progress and adjoining materials in place, during handling and installation. Apply protective covering where required to assure protection from damage or deterioration at Substantial Completion.
- B. Clean and maintain completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to assure operability without damaging effects.
- C. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period. Where applicable, such exposures include, but are not limited to, the following:
 - 1. Excessive static or dynamic loading.
 - 2. Excessive internal or external pressures.
 - 3. Excessively high or low temperatures.

4. Thermal shock.
5. Excessively high or low humidity.
6. Air contamination or pollution.
7. Water or ice.
8. Solvents.
9. Chemicals.
10. Light.
11. Radiation.
12. Puncture.
13. Abrasion.
14. Heavy traffic.
15. Soiling, staining, and corrosion.
16. Bacteria.
17. Rodent and insect infestation.
18. Combustion.
19. Electrical current.
20. High-speed operation.
21. Improper lubrication.
22. Unusual wear or other misuse.
23. Contact between incompatible materials.
24. Destructive testing.
25. Misalignment.
26. Excessive weathering.
27. Unprotected storage.
28. Improper shipping or handling.
29. Theft.
30. Vandalism.

3.3 ENVIRONMENTAL PROTECTION

- A. Soil Disposal and / or Borrow: Conduct all soil disposal and / or borrow work in accordance with requirements of local regulatory authorities. Dispose of all excess soil in a legal manner off site.
- B. Solid, Liquid and Gaseous Contaminants: Contractor shall be responsible for the proper disposal of all solid, liquid and gaseous contaminants in accordance with all local codes and regulations, together with the following requirements.
 1. Discharge gaseous contaminants so that they will be sufficiently diluted with fresh air to reduce the toxicity to an acceptable level.
 2. Liquid contaminants may, subject to local utility standards, be diluted with water to a level of quality acceptable in the local sewer system or shall be contained in approved vessels for disposal at approved sites.
- C. Disposal of Refuse: Remove refuse resulting from construction operations from the site. Burning on the site is not permissible.
- D. Hazardous Waste: All hazardous waste generated by the Contractor and the Contractor's subcontractors during the course of construction shall be stored, transported and disposed of in accordance with 40 CFR 260. The Contractor and his subcontractors shall be responsible for all documentation related to hazardous waste generated as a result of this Contract and that documentation shall be in accordance with 40 CFR 260.
- E. Construction Site Maintenance:

1. Store all supplies and equipment on project site so as to preclude mechanical and climatic damage. Maintain site in a neat and orderly manner.
 2. Contractor shall be responsible for maintaining the temporary structures and construction enclosure (fence) in good repair and visually pleasant. Contractor shall further provide adequate security, supplementing the existing fencing as necessary, to prevent the presence of unauthorized persons on the site and to keep gates secured when not in actual use to ensure the integrity of the barrier as well as for property security.
- F. Noise Control: Comply with all applicable state and local laws, ordinances and regulations relative to noise control.

END OF SECTION 01040

**NEW PASSENGER TERMINAL
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SECTION 01041 - SCHEDULES

GENERAL

1. RELATED DOCUMENTS

Drawings and general provisions of Contract, including General Conditions and Division 1 Specifications, apply to work of this Section.

2. COORDINATION

A. The Contractor shall coordinate scheduling with the Construction Manager. In particular, the Contractor shall provide close coordination of progress schedule, schedule of values, listing of subcontractors, schedule of submittals, progress reports and payment requests.

B. Close coordination will be required between all construction trades in order that individual areas of construction can be completed by their scheduled time. Consult the proposed construction sequence schedule for start and completion dates of individual work areas.

3. PRELIMINARY SCHEDULE

A. The Construction Manager has developed a Preliminary Schedule included at the end of this section, showing work areas of the project which directly impact the orderly use of the facility during construction. The timing of these activities has been approved by the Owner.

B. The Preliminary Schedule may not list the work completely and may vary from the drawings and specifications.

4. CONSTRUCTION SCHEDULE

A. The Construction Manager shall computerize a Precedence Diagram Method (PDM) Network using data supplied by the Contractor and all subcontractor(s). The Contractor will be responsible for his own methods and procedures and the performance of the work consistent with good practice.

B. Neither the Construction Manager nor the Owner warrants the information supplied by the Contractors is accurate or correct or that the project can be performed as scheduled based upon data supplied by the Contractors.

C. The Contractor shall be responsible for providing all data to develop and update the schedule. The Contractor shall supervise all work activities to maintain progress in accordance with the schedule.

D. The Contractor and Subcontractor shall provide their own data to the Construction Manager reflecting the actual plan of operation for the Project. Schedule input data shall include a comprehensive list of all activities of the construction phase of the project, including submittals (shop drawings,

SCHEDULES

samples, product data), procurement of material, and on-site activity (erection, installation, construction). Activities for procurement of materials shall be included to delineate between material purchasing and fabrication/delivery.

- E. The Contractor shall assign durations and sequencing to each activity. Submittal activities shall be listed with the anticipated date of submittal. Procurement activities shall be listed with the duration required for fabrication and delivery from date of purchase. The Construction Manager shall computerize a PDM network using input data supplied by the Contractor. The Construction Manager will meet with the Contractor to revise and expand the Schedule and resolve conflicts. The revised schedule shall conform to the specific plan of operation envisioned by the Contractor.

The Construction Manager will guide the Contractor in determining the level of detail to be included in the PDM Networks. The schedule shall be adequate enough to evaluate progress, cost of work in place and serve as a control technique for the Contractor's Field Superintendent.

- F. The Contractor and all subcontractors shall be obligated to perform in accordance with the Construction Schedule and to participate in updating the schedule. The Contractor shall include provisions in all subcontracts binding Subcontractors to participate in revisions of the schedule as are necessary, and to supply data throughout the project.
- G. Upon request, the Contractor shall submit to the Construction Manager purchase orders and subcontracts. Such information shall be submitted as soon as available so the Construction Manager will be aware of the progress being made by the Contractor in the placing of orders and the status of material. The Contractor shall be solely responsible for expediting the delivery of all material furnished by him and coordinating his subcontractors so construction progress shall be maintained according to Contract Schedule.

5. COMPLIANCE WITH THE CONSTRUCTION SCHEDULE

- A. If the Contractor shall fail to adhere to the Construction Schedule or to the said schedule as revised, he must promptly adopt such other or additional means and methods of construction as will make up for the time lost and will assure completion of the work in accordance with said Construction Schedule at no additional cost to the Owner, except in accordance with the provision of the contract governing such costs. If the Owner or the Construction Manager notifies the Contractor of any change in the contract or any extra work performed, or if any other conditions arise which are likely to cause delays, the Contractor shall notify the Construction Manager in writing within five (5) days of the receipt of such notice or occurrence of such condition. This notice shall document the effect, if any, of such change, or extra work, of suspension or other condition upon the Construction Schedule. No time extensions will be granted due to a delay in any activity unless the Owner deems the length of the delay exceeds the float time associated with the activity at the time the delay occurs.

6. FLOAT TIME

- A. The Contractor, in directing the compliance with Construction Schedule shall cooperate with the Owner and the Construction Manager in utilizing float time. Full control over use of total float time in the Schedule rests with the Owner and will be utilized by him in any necessary rescheduling of the Construction Schedule occasioned by design changes, field conditions, strikes, Acts of God, or unavoidable equipment and material delays. If rescheduling of any activity adversely affects the Contractor's operation, he shall advise the Construction Manager in writing no later than five (5) days after the receipt of the revised schedule or Notice of Intent to revise the schedule.

7. PRELIMINARY SCHEDULE DATES

- A. All work shall be completed as follows:
1. Start Construction: On or about June 1, 2011, but within 5 days of notice to proceed as directed by the Construction Manager.
 2. Substantial Completion: February 8, 2012.
 3. Final Completion: July 19, 2012.

END OF SECTION 01041

OVERALL PROJECT DURATION SCHEDULE																																																								
Act ID	Description	Orig Dur	Early Start	Early Finish	2010												2011												2012												2013												2014			
					J	J	A	S	O	N	D	J	J	F	M	A	M	J	J	A	S	O	N	D	J	J	F	M	A	M	J	J	A	S	O	N	D	J	J	F	M	A	M	J	J	A	S	O	N	D						
General Schedule Task																																																								
1610	Bid Package #1(Site Work & Building Shell)	280	05AUG10	01SEP11																																																				
1930	Bid Package #2A (Initial Finishes - Tug Stubs)	261	02MAY11	01MAY12																																																				
2060	Bid Packages #4 (Green Systems)(VALE)	220	01AUG11	01JUN12																																																				
2010	Bid Package #2B (Final Finishes/Equipment)	197	01SEP11	01JUN12																																																				
2020	Bid Package #3 (Extg Term Demo/Apron/J-Brdgs)	175	01MAR12	01NOV12																																																				
2260	Parking Revenue Control Canopy	89	02MAY12	04SEP12																																																				
2230	Bid Package #5 (Parking Garage 3-Story)	213	04JUN12	01APR13																																																				
2250	Bid Package #6 Rental Car Shared Facility CONRAC	194	02APR13	31DEC13																																																				
+Bid Package #1																																																								
BP-#2A Interior Finishes (Initial)																																																								
2960	Mech, Elect & Fire Protection Coord Drawings	22	02MAY11	31MAY11																																																				
3020	Award BP#2A	0	02MAY11																																																					
1800	Site Work (Tug Stubs)	20	01JUN11	28JUN11																																																				
2270	Concrete/Waterproofing (Tug Stubs/Exterior)	30	08JUN11	20JUL11																																																				
2280	Masonry Partitions	20	08JUN11	06JUL11																																																				
2530	Electrical	170	08JUN11	01FEB12																																																				
2540	Mechanical	170	08JUN11	01FEB12																																																				
2950	HVAC Floor Duct Dome Install 1st & 2nd Floors	30	08JUN11	20JUL11																																																				
2290	Steel (Tug, Canopies, Stairs/Railings)	40	29JUN11	24AUG11																																																				
Start date 25MAY10																													Date				Revision				Checked		Approved																	
Finish date 31DEC13																													13JAN11				OVERALL PROJECT				PEG																			
																													25JAN11				BID SCOPE REVISI				PEG																			
Run date 26JAN11																													26JAN11				BID PKG #2A Spec				PEG																			
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Start date	25MAY10	<div style="text-align: center;"> Kraus - Anderson Construction Co. Duluth Airport Termimal </div>	Date	Revision	Checked	Approved
Finish date	31DEC13		13JAN11	OVERALL PROJECT	PEG	
			25JAN11	BID SCOPE REVISI	PEG	
Run date	26JAN11		26JAN11	BID PKG #2A Spec	PEG	
Page number	2A					
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**NEW PASSENGER TERMINAL
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SECTION 01045 - CUTTING AND PATCHING

1. WORK INCLUDED

- A. Refer to Section 01010 and 01500 for special requirements, protection, constraints, timing of work, scheduling of work, enclosures and similar requirements relating to this Section.
- B. This Section covers cutting, demolition, removal work, patching and restoration of work as necessary to accomplish and complete all work under the Contract, including any relocation or reuse of existing materials, equipment, systems, or other work, as well as the disposition of salvaged materials or debris. This Section applies to all work under the Contract, including general construction, mechanical and electrical work.
- C. Drawings generally indicate the extent of demolition, removals, relocations and cutting. The drawings shall not be construed as indicating all required work, nor indicating all conditions or details which might be encountered to accomplish the work of this Contract. The Contractor and his subcontractors shall examine the spaces themselves to determine the actual conditions and requirements. All removals, demolition, cutting, restoration, new installations and other work shall be accomplished to transform the existing spaces and conditions to the new conditions required under the Contract, as well as to accomplish all tie-in work of new to existing.
- D. It is the intent that unless specially shown on the general construction type drawings (i.e.; architectural and structural) and schedules, or inherent in the work to be accomplished under the general construction work of the area, that the mechanical and electrical Contractors shall perform the demolition, cutting, removals, relocations, patching and restoration as will be required to accomplish the work under their contracts. All work shown or indicated on the general construction drawings and schedules shall be accomplished by the associated Contractor.
- E. Except for general demolition of entire areas, it is the intent that at each area, or space, the Contractor and each subcontractor shall make the removals, perform cutting or demolition and accomplish relocations of work normal to his trades (i.e., Mechanical Contractor removes or relocates piping, ductwork and similar; Electrical Contractor removes or relocates panelboards, conduit lighting and similar). At areas of general demolition of the entire spaces, the Mechanical and Electrical shall make removals of work normal to their trades or as may be called for, for reuse or relocation, make any relocations and cut-off, terminate, cap or otherwise discontinue services that will be abandoned or removed in the space.

2. GENERAL REQUIREMENTS

- A. Accomplish all work of cutting, removal, demolition, relocation, patching and other restoration by using only mechanics skilled in the trade. If necessary, sublet the work to skilled contractors or subcontractors.
- B. The Contractor shall coordinate all work of this Section with all subcontractors so the work will progress without interruption and minimum delays. The Contractor shall also coordinate and schedule the work with the Owner and Construction Manager where possible disturbance may occur and where relocations or other potential disruptions of the Owner's functions and services may occur. All work affecting the Owner's functions and services shall be performed at times acceptable to the Owner.

END OF SECTION 01045

**NEW PASSENGER TERMINAL
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DULUTH, MINNESOTA**

**SECTION 01050 – FIELD
ENGINEERING**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. General: This section specifies administrative and procedural requirements for field-engineering services including, but not limited to, the following:
 - 1. Land survey work.

1.3 SUBMITTALS

- A. Certificates: Submit a certificate signed by the land surveyor or professional engineer certifying the location and elevation of improvements.
- B. Final Property Survey: Submit 10 copies of the final property survey of the new terminal complex portion of the overall site.
- C. Project Record Documents: Submit a record of work performed and record survey data as required under provisions of Section 01300 - SUBMITTALS and Section 01700 - CONTRACT CLOSEOUT sections.

1.4 QUALITY ASSURANCE

- A. Surveyor Qualifications: Engage a land surveyor registered in the state where the Project is located, to perform required land-surveying services.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify layout information shown on the Drawings, in relation to the property survey and existing benchmarks, before proceeding to lay out the work. Locate and protect existing benchmarks and control points. Preserve permanent reference points during construction.
 - 1. Do not change or relocate benchmarks or control points without prior written approval. Promptly report lost or destroyed reference points or requirements to relocate reference points because of necessary changes in grades or locations.
 - 2. Promptly replace lost or destroyed Project control points. Base replacements on the original survey control points.

3. Failure to verify layout information before proceeding to lay out the work shall not be grounds for a claim for an increase in the Contract Sum or the Contract Time. The Architect will in no case assume any responsibilities related to laying out the work.
- B. Establish and maintain a minimum of four (4) permanent benchmarks on the site, referenced to data established by survey control points.
 1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
- C. Existing Utilities and Equipment: 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.
 1. Prior to construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping.

3.2 PERFORMANCE

- A. Work from lines and levels established by the property survey. Establish benchmarks and markers to set lines and levels at each story of construction and elsewhere as needed to locate each element of the Project. Calculate and measure required dimensions within indicated or recognized tolerances. Do not scale Drawings to determine dimensions.
 1. Advise entities engaged in construction activities of marked lines and levels provided for their use.
 2. As construction proceeds, check every major element for line, level, and plumb.
- B. Surveyor's Log: Maintain a surveyor's log of control and other survey work. Make this log available for reference.
 1. Record deviations from required lines and levels, and advise the Architect when deviations that exceed indicated or recognized tolerances are detected. On Project Record Drawings, record deviations that are accepted and not corrected.
 2. On completion of foundation walls, major site improvements, and other work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and site work.
- C. Site Improvements: Locate and lay out site improvements, including pavements, stakes for grading, fill and topsoil placement, utility slopes, and invert elevations by instrumentation and similar appropriate means.
- D. Building Lines and Levels: Locate and lay out batter boards for structures, building foundations, column grids and locations, floor levels, and control lines and levels required for mechanical and electrical work.
- E. Existing Utilities: Furnish information necessary to adjust, move, or relocate existing structures, utility poles, lines, services, or other appurtenances located in or affected by construction. Coordinate with local authorities having jurisdiction.
- F. Final Property Survey: Before Substantial Completion, prepare a final property survey showing significant features (real property) for the new terminal complex portion of the overall site. Include on the survey a certification, signed by the

Surveyor, that principal metes, bounds, lines, and levels of the Project are accurately positioned as shown on the survey.

END OF SECTION 01050

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SECTION 01200 - PROJECT MEETINGS

1. GENERAL

- A. This Section specifies administrative and procedural requirements for project meetings including but not limited to:
1. Pre-Construction Conference.
 2. Pre-Installation Conference.
 3. Progress Meetings.

2. PRE-CONSTRUCTION CONFERENCE

- A. Pre-Construction Conference shall be scheduled as directed by Construction Manager. Conduct the meeting to review responsibilities and personnel assignments.
- B. Attendees: Construction Manager, the Owner, Architect and their consultants, the Contractor and its superintendent, major subcontractors, manufacturers, suppliers and other concerned parties shall each be represented at the conference by persons familiar with and authorized to conclude matters relating to the Work.
- C. Agenda: Discuss items of significance that could affect progress including such topics as:
1. Construction schedule.
 2. Critical work sequencing.
 3. Designation of responsible personnel.
 4. Procedures for processing field decisions and change orders.
 5. Procedures for processing Applications for Payment.
 6. Distribution of contract documents.
 7. Submittal of shop drawings, product data and samples.
 8. Preparation of record documents.
 9. Use of the premises.
 10. Office, work and storage areas.
 11. Equipment deliveries and priorities.
 12. Safety procedures.
 13. First aid.
 14. Security.
 15. Housekeeping.
 16. Working hours.

3. PREINSTALLATION CONFERENCES

- A. The Contractor shall conduct a preinstallation conference at the Project Site before each construction activity that requires coordination with other construction.
- B. Attendees: The Installer and representatives of manufacturers and fabricators involved in or affected by the installation, and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the

- meeting. Advise the Architect at least ten (10) working days in advance of scheduled meeting dates.
- C. Do not schedule conferences until the submittals required by the Contract Documents for work associated with the construction activity requiring the conference have been approved and returned to the Contractor.
 - D. Review the progress of other construction activities and preparations for the particular activity under consideration at each preinstallation conference, including requirements for the following:
 - 1. Contract Documents.
 - 2. Options.
 - 3. Related Change Orders.
 - 4. Purchases.
 - 5. Deliveries.
 - 6. Shop Drawings, Product Data, and quality-control samples.
 - 7. Review of mockups.
 - 8. Possible conflicts.
 - 9. Compatibility problems.
 - 10. Time schedules.
 - 11. Weather limitations.
 - 12. Manufacturer's recommendations.
 - 13. Warranty requirements.
 - 14. Compatibility of materials.
 - 15. Acceptability of substrates.
 - 16. Temporary facilities.
 - 17. Space and access limitations.
 - 18. Governing regulations.
 - 19. Safety.
 - 20. Inspecting and testing requirements.
 - 21. Required performance results.
 - 22. Recording requirements.
 - 23. Protection.
 - E. The Contractor shall record the results of the meeting and distribute copies to attendees and other interested parties.
 - F. Do not proceed with the installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of work and reconvene the conference at the earliest feasible date.
4. **PROGRESS MEETINGS**
- A. Construction Manager shall conduct regular progress meetings at the Project site. Time of meeting to be scheduled by Construction Manager.
 - B. Attendees: In addition to representatives of the Owner, Construction Manager and Architect, each prime contractor, subcontractor, supplier or other entity concerned with current progress or involved in planning, coordination or performance of future activities shall be represented at these meetings by persons familiar with the Project and authorized to conclude matters relating to progress.

- C. Agenda: Review and correct or approve minutes of the previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to the current status of the Project.
1. Contractor's Construction Schedule: Review progress since the last meeting. Determine where each activity is in relation to the Contractor's Construction Schedule, whether on time or ahead or behind 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.
 2. Review the present and future needs of each entity present, including such items as:
 - a. Interface requirements.
 - b. Time.
 - c. Sequences.
 - d. Deliveries.
 - e. Off-site fabrication problems.
 - f. Access.
 - g. Site utilization.
 - h. Temporary facilities and services.
 - i. Hours of work.
 - j. Hazards and risks.
 - k. Housekeeping.
 - l. Quality and work standards.
 - m. Change orders.
 - n. Documentation of information for payment requests.
- D. Reporting: No later than three (3) days after each progress meeting date, the Construction Manager shall distribute copies of minutes of the meeting to each party present and to other parties as applicable.
1. Schedule Updating: The construction schedule shall be revised after each progress meeting where revisions to the schedule have been made or recognized. The revised schedule shall be issued to all applicable parties.

END OF SECTION 01200

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SECTION 01210 - ALLOWANCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements governing allowances.
 - 1. Certain items are specified in the Contract Documents by allowances. Allowances have been established in lieu of additional requirements and to defer selection of actual materials and equipment to a later date when additional information is available for evaluation. If necessary, additional requirements will be issued by Change Order.
- B. Types of allowances include the following:
 - 1. Lump-sum allowances.
 - 2. Unit-cost allowances.
 - 3. Quantity allowances.
 - 4. Contingency allowances.
 - 5. Testing and inspecting allowances.
- C. Related Sections include the following:
 - 1. Division 1 Section "Contract Modification Procedures" for procedures for submitting and handling Change Orders for allowances.
 - 2. Division 1 Section "Quality Requirements" for procedures governing the use of allowances for testing and inspecting.
 - 3. Divisions 2 through 16 Sections for items of Work covered by allowances.

1.3 SELECTION AND PURCHASE

- A. At the earliest practical date after award of the Contract, advise Architect of the date when final selection and purchase of each product or system described by an allowance must be completed to avoid delaying the Work.
- B. At Architect's request, obtain proposals for each allowance for use in making final selections. Include recommendations that are relevant to performing the Work.
- C. Purchase products and systems selected by Architect from the designated supplier.

1.4 SUBMITTALS

- A. Submit proposals for purchase of products or systems included in allowances, in the form specified for Change Orders.

- B. Submit invoices or delivery slips to show actual quantities of materials delivered to the site for use in fulfillment of each allowance.
- C. Coordinate and process submittals for allowance items in same manner as for other portions of the Work.

1.5 COORDINATION

- A. Coordinate allowance items with other portions of the Work. Furnish templates as required to coordinate installation.

1.6 LUMP-SUM / UNIT-COST AND QUANTITY ALLOWANCES

- A. Allowance shall include cost to Contractor of specific products and materials ordered by Owner under allowance and shall include taxes, freight, and delivery to Project site.
- B. Contractor's costs for receiving and handling at Project site, labor, installation, overhead and profit, and similar costs related to products and materials ordered by Owner under allowance shall be included as part of the Contract Sum and not part of the allowance.

1.7 TESTING AND INSPECTING ALLOWANCES

- A. Testing and inspecting allowances include the cost of engaging testing agencies, actual tests and inspections, and reporting results.
- B. The allowance does not include incidental labor required to assist the testing agency or costs for retesting if previous tests and inspections result in failure. The cost for incidental labor to assist the testing agency shall be included in the Contract Sum.
- C. Costs of services not required by the Contract Documents are not included in the allowance.
- D. At Project closeout, credit unused amounts remaining in the testing and inspecting allowance to Owner by Change Order.

1.8 UNUSED MATERIALS

- A. Return unused materials purchased under an allowance to manufacturer or supplier for credit to Owner, after installation has been completed and accepted.
 - 1. If requested by Architect, prepare unused material for storage by Owner when it is not economically practical to return the material for credit. If directed by Architect, deliver unused material to Owner's storage space. Otherwise, disposal of unused material is Contractor's responsibility.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine products covered by an allowance promptly on delivery for damage or defects. Return damaged or defective products to manufacturer for replacement.

3.2 PREPARATION

- A. Coordinate materials and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related work.

3.3 SCHEDULE OF ALLOWANCES

- A. **Allowance No. 1:** Include allowance in Work Scope 3.20A for Erosion Control practices in the amount of \$35,000.
- B. **Allowance No. 2:** Include allowance in Work Scope 4.20A for substitution of alternate CMU's in the amount of \$5,000.
- C. **Allowance No. 3:** Include allowance in Work Scope 5.20A for substitution of alternate paint coatings in the amount of \$7,500.
- D. **Allowance No. 4:** Include allowance in Work Scope 6.20A for miscellaneous blocking in the amount of \$2,500.
- E. **Allowance No. 5:** Include allowance in Work Scope 7.20A for field water testing beyond the specification requirements in the amount of \$2,000.
- F. **Allowance No. 6:** Include allowance in Work Scope 9.20A for miscellaneous non-structural framing and bracing in the amount of \$5,000.
- G. **Allowance No. 7:** Include allowance in Work Scope 10.20A for substitution of alternate partition finish materials in the amount of \$10,000.
- H. **Allowance No. 8:** Include allowance in Work Scope 13.21A for additional access control provisions in the amount of \$16,000.
- I. **Allowance No. 9:** Include allowance in Work Scope 15.20A for substitution of alternate Plumbing fixtures and HVAC equipment in the amount of \$10,000.
- J. **Allowance No. 10:** Include allowance in Work Scope 16.20A for substitution of alternate lighting fixtures and electrical devices in the amount of \$10,000.

END OF SECTION 01210

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SECTION 01230 - ALTERNATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for alternates.

1.3 DEFINITIONS

- A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the Bidding Requirements that may be added to or deducted from the Base Bid amount if Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.
 - 1. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.

1.4 PROCEDURES

- A. Coordination: Modify or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.
 - 1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.
- B. Notification: Immediately following award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated modifications to alternates.
- C. Execute accepted alternates under the same conditions as other work of the Contract.
- D. Schedule: A Schedule of Alternates is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

ALTERNATES SHALL INCLUDE:

- A. **Alternate No. 1A:** Add snowmelt system for sidewalk area north of Grinden Drive as indicated on Drawing C205.

Add the sum of: _____ Dollars (\$_____).

- B. **Alternate No. 1B:** Add snowmelt system for sidewalk area north of Grinden Drive and pedestrian crosswalks as indicated on Drawing C205.

Add the sum of: _____ Dollars (\$_____).

- C. **Alternate No. 1C:** Add snowmelt system for sidewalk area north of Grinden Drive, pedestrian crosswalks and Grinden Drive pedestrian island pavement as indicated on Drawing C205.

Add the sum of: _____ Dollars (\$_____).

- D. **Alternate No. 2A:** Delete work associated with the north pedestrian canopy located at A/A.1 Line from Work Scopes WS 3.20A, 5.20A, 15.20A & 16.20A.

Deduct the sum of: _____ Dollars (\$_____).

- E. **Alternate No. 2B:** Delete work associated with the south pedestrian canopy located at the Grinden Drive pedestrian island at AA Line from Work Scopes WS 3.20A, 5.20A, 15.20A & 16.20A.

Deduct the sum of: _____ Dollars (\$_____).

- F. **Alternate No. 3:** Delete the supply and installation of lighting fixtures specified in Section 16500 from Work Scope WS 16.20A.

Deduct the sum of: _____ Dollars (\$_____).

- G. **Alternate No. 4:** Delete the supply and installation of Overhead Coiling Doors and Overhead Coiling Grilles specified in Sections 08331 and 08334 from Work Scope WS 8.22A.

Deduct the sum of: _____ Dollars (\$_____).

- H. **Alternate No. 5:** Delete the supply and installation of Mechanical Chiller equipment specified in Section 15681 from Work Scope WS 15.20A, and associated electrical work from Work Scope WS 16.20A.

Deduct the sum of: _____ Dollars (\$_____).

- I. **Alternate No. 6:** Delete the supply and installation of Mechanical Air Distribution Devices specified in Section 15882 from Work Scope WS 15.20A, and associated electrical work from Work Scope WS 16.20A.

Deduct the sum of: _____ Dollars (\$_____).

- J. **Alternate No. 7:** Delete the supply and installation of Plumbing Fixtures, Plumbing Emergency Fixtures, Plumbing Security Fixtures and Drinking Fountains specified in Sections 15410, 15412, 15413 and 15426 from Work Scope WS 15.20A.

Deduct the sum of: _____ Dollars (\$_____).

- K. **Alternate No. 8:** Substitute standard concrete for integrally colored concrete for sidewalks as part of Work Scope WS 3.20A.

Deduct the sum of: _____ Dollars (\$_____).

- L. **Alternate No. 9:** Delete the Packaged Electrical Generator specified in Section 16231 from Work Scope WS 16.20A.

Deduct the sum of: _____ Dollars (\$_____).

- M. **Alternate No. 10:** Delete the Ornamental Metal work specified in Section 05700 from Work Scope WS 15.20A.

Deduct the sum of: _____ Dollars (\$_____).

- N. **Alternate No. 11:** Add construction of the remainder of the Tug Tunnel construction (Phase 2) to Work Scopes WS 3.20A, 5.20A, 6.20A, 7.20A, 8.20A, 9.20A and 13.20A.

Add the sum of: _____ Dollars (\$_____).

- O. **Alternate No. 12:** Delete the freestanding cast-in-place "screenwall" east of the terminal in the vicinity of Line F and its associated foundation work from Work Scope WS 3.20A.

Deduct the sum of: _____ Dollars (\$_____).

END OF SECTION 01230

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**SECTION 01270 – UNIT
PRICES**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for unit prices.
- B. Related Sections include the following:
 - 1. Division 1 Section "Contract Modification Procedures" for procedures for submitting and handling Change Orders.
 - 2. Division 1 Section "Quality Requirements" for general testing and inspecting requirements.
 - 3. See Civil Drawing Sheet C001 for a Summary of Estimated Quantities for Civil Work.

1.3 DEFINITIONS

- A. Unit price is an amount proposed by bidders, stated on the Bid Form, as a price per unit of measurement for materials or services added to or deducted from the Contract Sum by appropriate modification, if estimated quantities of Work required by the Contract Documents are increased or decreased.

1.4 PROCEDURES

- A. Unit prices include all necessary material, plus cost for delivery, installation, insurance, applicable taxes, overhead, and profit.
- B. Measurement and Payment: Refer to individual Specification Sections for work that requires establishment of unit prices. Methods of measurement and payment for unit prices are specified in those Sections.
- C. Owner reserves the right to reject Contractor's measurement of work-in-place that involves use of established unit prices and to have this work measured, at Owner's expense, by an independent surveyor acceptable to Contractor.
- D. List of Unit Prices: Refer to Section 01014 "Work Scope Descriptions" and the Bid Form Package in Volume 1 of the Project Manual.

PART 2 - PRODUCTS (Not Used)

EXECUTION (Not Used)

END OF SECTION 01270

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SECTION 01300 - SUBMITTALS

1. GENERAL

- A. This Section defines procedures for the following submittals required by the Contract Documents.

2. SCHEDULE OF SUBMITTALS - REQUIRED

- A. The following documents are required to be submitted to the Construction Manager for review at the times indicated.

1. Prior to Bidding (ten days prior to bid opening):
Request for approval of substitute material and equipment.
2. Within 10 days of Letter of Contract Award:
Performance and Payment Bonds
Insurance Certificate
Schedule of Values (based on specification sections)
List of materials and equipment
List of subcontractors
Shop drawings and required submittals
3. During Progress of Project as specified:
Samples
Test results
Application for Payment (see Specifications Section 01027)
4. Upon receipt of Substantial Completion Certificate, submit the following documents within 30 days:
Equipment and material guarantees
Operations manuals
As-built drawing notes
Completed punch lists
Final payment request accompanied by:

Affidavit of Payment of Claims	Affidavit of Release of Liens
Withholding Tax Affidavit	Consent of Surety to Final Payment

Note: No final retainage payment will be released without the receipt and approval of the above referenced documents.

3. SHOP DRAWINGS

- A. Six copies of shop drawings prepared specifically for this work shall be submitted to the Construction Manager for submittal to the Architect. Contractors are to review and stamp shop drawings or they will be returned. At least 40 square inches of space in the lower right hand corner of each sheet shall be left blank for approval stamps and notes. After the Architect has checked and approved each drawing, he will so stamp it, make such copies as he requires and return it through the Construction Manager to the Contractor who shall make and distribute such copies as he requires. In instances where minor corrections are required, they will be so noted on the drawing and it will be stamped "Make Corrections Noted" and returned to the Contractor as above. Where major corrections are required, the shop drawings will be returned to the Contractor who shall make a new drawing incorporating the required corrections and resubmit six copies of the revised drawings for approval.
- B. Shop drawings in the form of printed descriptive information shall be bound together with a title and index sheet listing each sheet in the binding. The title and index sheet shall have a blank rectangular space of at least 4" x 8" for notes and approval stamps. Six copies are to be submitted to the Construction Manager.
- C. Shop drawings and samples shall be dated and contain: Names of project, description or names of equipment, materials and items; and complete identification of locations at which materials or equipment are to be installed.
- D. Submission of shop drawings shall be accompanied by transmittal letter, containing project name, Contractor's name, number of drawings, titles and other pertinent data such as section and article numbers.

4. SAMPLES

- A. Deliver samples of materials, equipment, assemblies and components as required by specifications to Construction Manager for submittal to the Architect (or other designated location) with delivery costs prepaid. At Construction Manager's direction, remove samples after approval. Samples shall be of like kind to the products to be provided for building and shall have finish and other characteristics required by work. Samples shall indicated type of construction and quality proposed for installation in the project.
- B. Where the Contractor requires approved samples to be returned, submit the number of samples required by the Contractor plus three (3) which shall be retained by the Architect and Construction Manager.

5. LIST OF MATERIALS

- A. Within ten (10) days after the award of the contract (notice to proceed or letter of intent), the Contractor shall submit three (3) copies of a complete list of all materials, products, and equipment proposed to be used in construction to the Construction Manager for acceptance. Materials shall not be ordered until the proposed listed materials, products and equipment proposed to be used in construction are reviewed by the Architect for acceptance and the listed materials are accepted.

- B. Where two or more makes or kinds of items are named in the specifications (or additional names are called for in addendum), the Contractor shall state which particular make or kind of each item he proposes to provide. If the Contractor fails to state a preference, the Owner shall have the right to select any of the makes or kinds named without change in price.
- C. This list shall be arranged in order of specification sections. The items listed shall fully conform to project requirements and specifications. All materials are subject to the Architect's acceptance. After acceptance, there shall be no changes or substitutions.
- D. The list shall clearly identify the material, product or equipment by manufacturer and brand by listing the names, for all items, including those where only one material or product is specified. Each and all material, products and equipment shall be specifically names, not listed "as specified".

6. LIST OF SUBCONTRACTORS

- A. Within ten (10) days after the award of the contract (notice to proceed) and prior to the execution of the Contract, the Contractor shall submit three (3) copies of a complete list of all work he proposes to subcontract and the subcontractors (and major material suppliers) he proposes to use in performance of the Contract to the Construction Manager for review by the Architect, Construction Manager and Owner. The list shall include Sub-subcontractors. No subcontracts shall be executed until the proposed list of subcontractors is accepted.
- B. Reasonable objection shall be deemed to have been exercised when, in the opinion of the Architect or Owner, objections have been made based on their reasonable belief that the proposed Subcontractor, Sub-subcontractor or material supplier: (1) cannot provide materials, equipment, facilities or other products as specified or required by the Contract Documents; (2) cannot provide labor and skill necessary to accomplish the part of Work for which he is proposed, including but not limited to quality of workmanship; (3) lacks adequate and appropriate experience for the part of the Work for which he is proposed, including materials or methods required; (4) has previously failed to perform timely or satisfactorily, including in cooperation and in necessary services after project completion; (5) proposed deviations in material or methods that are unacceptable to the Architect or Owner, such as proposing materials or methods that were not specified or not listed in addenda; (6) there is reasonable doubt he can satisfactorily perform the part of the Work for which he is proposed, within the time schedule, due to size of organization or existing work load; (7) cannot demonstrate his ability through quality or representative work to perform the part of the Work for which he is being considered; (8) of questionable integrity; (9) or other similar considerations bearing on the possibility of unsatisfactory performance. If the Owner, Construction Manager or the Architect has a reasonable objection to any person or entity proposed by a substitute to whom neither the Owner, Construction Manager, nor the Architect has any reasonable objection and no increase in the Contract Sum shall be allowed as a result of any such substitution.
- C. After review of the proposed list, no change of any Subcontractor, Sub-subcontractor or supplier not objected to by the Architect, Construction Manager or Owner, shall be made, except for cause acceptable to all parties. In the event of a proposed change, the Contractor shall submit the reasons for the change, in writing,

along with the alternate proposed Subcontractor, Sub-subcontractor or material supplier. The proposed change is subject to the conditions of this Article and the requirements of the General Conditions.

7. GUARANTEES AND WARRANTIES

- A. Refer to Section 01740 - Warranties.
- B. Special Warranties: Contractor shall complete all manufacturer's warranty registrations and shall submit same to Construction Manager for transmittal to Owner.

8. INSTRUCTION MANUALS

- A. For all items of mechanical equipment and electrical apparatus, the Contractor shall obtain from the manufacturer and furnish to the Construction Manager three (3) copies of the following:
 - 1. Operating instructions.
 - 2. Parts lists (including name and address of nearest vendor or service agent).
 - 3. Maintenance instructions.
 - 4. Shop Drawings.
- B. These items are separate from and in addition to the operating placards required to be attached to or posted near the equipment.
- C. Contractor shall provide field instruction to Owner's personnel as required to fully instruct them in correct operating and maintenance procedure, for all equipment installed under this contract.
- D. Manual shall be submitted in 8-1/2" x 11" form in adequately sized three (3) ring loose leaf binders with entire contents indexed and thumb-tabbed.

9. RECORD SET OF DRAWINGS

- A. Contractor shall provide the record set of drawings to the Construction Manager at the completion of Contract.
- B. During construction, Contractor shall maintain a clean set of drawings for the sole purpose of recording changes and actual "as installed" information.
- C. As a general guide, the type of information to be recorded on the record set includes: (1) changes, deviations or revisions made, except minor or noncritical dimensions, including those made by Change Order or Supplementary Instructions; (2) omissions, including work omitted by accepted alternates; (3) dimensioned locations of major or main utility lines, such as main conduit runs, piping mains and similar work; (4) locations of control valves; (5) additions to the work; (6) changes in significant details; (7) changed footing or other elevations; (8) changes in locations of panelboards, outlets, drains, piping, opening, dampers and similar features; (9) other similar data. Refer to Section 01720 – Project Record Documents.

END OF SECTION 01300

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**SECTION 01361 - SUSTAINABLE DESIGN
REQUIREMENTS**

DULUTH, MINNESOTA

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 RELATED SECTIONS

- A. Construction Waste Management - Section 01524
- B. Construction IAQ Management - Section 01525
- C. Soil Erosion and Sedimentation Control Plan - Section 02125

1.3 SUMMARY

- A. The Owner requires the Contractor to implement practices and procedures to meet the Project's environmental performance goals, which include obtaining a LEED Silver certification based on LEED-NC, Version 2.2. Specific project features include (but are not limited to): materials and equipment that reduce the facility's energy and water consumption; recycled-content materials, locally-manufactured materials, low-emitting materials, construction waste recycling, and the implementation of a construction indoor air quality management plan. The Contractor shall ensure that the requirements related to these goals, as defined in this section and throughout the contract documents, are implemented to the fullest extent. Substitutions or other changes to the work proposed by the Contractor or their subcontractors shall not be allowed if such changes compromise the stated LEED Requirements.

1.4 DEFINITIONS

- A. Certificates of Chain-of-Custody: Certificates signed by manufacturers verifying that the wood used to make products was obtained from forests certified by a Forest Stewardship Council (FSC) accredited certification body to comply with FSC "Principles and Criteria." Certificates shall include evidence that the mill is certified for chain-of-custody by an FSC-accredited certification body.
- B. LEED: The Leadership in Energy & Environmental Design rating system developed by the United States Green Building Council (USGBC). LEED-NC, New Construction, Version 2.2, is the rating system used for this project.
- C. Green Label Plus: The Carpet & Rug Institute's testing/certification program for carpet VOC emissions. Certification numbers guarantee product is within

allowable VOC emission rates. Approved products are listed under the manufacturer's name at www.carpet-rug.com/.

D. 1.5 LEED OVERVIEW AND GENERAL REQUIREMENTS

A. OVERVIEW:

1. LEED certification is determined by a system of assigned points (credits) based on sustainable building goals being met by a project.
2. There are some prerequisites for a project to qualify for LEED certification.
3. Some prerequisites and credits depend on material selections and may not be specifically identified as LEED requirements in this document. Refer to Item 1.7, LEED Prerequisites.
4. Some prerequisites and credits depend on the Architect's design and other aspects of the project that are not part of the work of the contractor.
5. LEED New Construction (NC) v. 2.2 Reference Guide is available at www.usgbc.org/.

B. GENERAL REQUIREMENTS:

For specific contractor requirements refer to Item 1.7, LEED Prerequisites and LEED ACTION PLANS under Item 1.9, LEED SUBMITTALS.

1. Erosion and Sedimentation Control (ESC)
 - a. Refer to Items 1.7 LEED Prerequisites and 1.9 LEED Submittals (Action Plans)
 - b. Typical precautions are:
 - 1) Silt fences, hay bales, and water retention areas to prevent sediment runoff
 - 2) Graveled truck wash-off areas
 - 3) Construction fencing to prevent dust from escaping the site
 - 4) Installation and maintenance of sump pumps
 - 5) Use of mulching and seeding, sometimes on a temporary basis
 - c. Refer to Civil Engineer's documents for project specific information
 - d. The Contractor shall in part:
 - 1) Develop an Erosion and Sedimentation Control (ESC) Plan in accordance with Section 02125
 - 2) Maintain ESC measures throughout the project
 - 3) Take dated photographs of the ESC measures in place
 - 4) Log maintenance activities, inspections and repairs after major rain falls.

2. Construction Waste Management (CWM)

- a. Refer to Item 1.9 LEED Submittals (Action Plans).
 - b. CWM is the reuse of materials that otherwise would have been sent to a landfill.
 - c. The project requires that at least 50% of the construction waste be recycled.
 - d. Reused site materials such as stone, excavated soil and land-clearing debris cannot count towards the recycled percent.
 - e. The contractor shall in part:
 - 1) A Construction Waste Management Plan shall be developed in accordance with Section 01524, Construction Waste Management outlining methods, goals and strategies.
 - 2) Maintain a spreadsheet with weight, category (e.g. concrete, metal, wood, paper), percent (%) diverted from landfill, method of diversion (i.e. recycled, reused, sold), dated, name of the hauler, and site of disposal.
 - 3) Keep back-up documentation (e.g. hauler's tickets, receipts from recycling centers, sales receipts).
3. Materials with Recycled Content
- a. LEED Recycled Content is the percent of a product that comes from recycled material. The percentage by weight of constituents that have been recovered or otherwise diverted from the solid waste stream, either during the manufacturing process (pre-consumer), or after consumer use (post-consumer)
 - 1) Spills and scraps from the original manufacturing process that are combined with other constituents after a minimal amount of reprocessing for use in further production of the same product are not recycled materials.
 - 2) Discarded materials from one manufacturing process that are used as constituents in another manufacturing process are pre-consumer recycled materials.
 - b. The project requirement is that at least 10% of the value of the project materials (without labor and equipment) be from recycled materials.
 - c. The manufacturer must provide the recycled content of the product.
 - d. To determine Recycled Content:
 - 1) The recycled content is determined by weight. 100% of post-consumer recycled content contributes, and 50% of pre-consumer (also called post-industrial) content contributes.
- a) "Post-consumer" material is defined as waste material generated by households or by commercial, industrial, and institutional facilities in their role as

- end users of the product, which can no longer be used for its intended purpose.
 - b) "Pre-consumer" material is defined as material diverted from the waste stream during the manufacturing process. Excluded is reutilization of materials such as rework, regrind, or scrap generated in a process and capable of being reclaimed within the same process that generated it.
 - 2) Determine the percentage of recycled content by weight:
 - a) Determine the total weight of the material or product.
 - b) Determine the weight of the recycled content contained in the product (100% post-consumer + 50% pre-consumer).
 - c) Divide the recycled content weight by the total weight to get a percentage (%) of recycled content by weight.
 - 3) Determine the value of recycled content:
 - a) Determine the total value of the product (without labor and equipment)
 - b) Multiply the total value of the product by the percentage of recycled content to get the value of the recycled content.
 - e. The contractor shall in part:
 - 1) Maintain a spreadsheet showing the recycled materials purchased, including the material name, supplier, percentage of pre-consumer and percentage of post consumer recycled material, the weight of the material, the value of the material (without labor and equipment), and the source of the recycled content information.
 - 2) Maintain records of recycled materials, including cut sheets, published product information and cost back up.
 - 3) Submit a completed "Green Building Materials Reporting Form" (GBMRF) in accordance with Item 1.9, LEED Submittals for each product, along with back up. A blank copy of the GBMRF is included at the end of this document.
4. Regional Materials
- a. To qualify as LEED Regional Content a material must:
 - 1) Be manufactured within a 500 mile radius, AND
 - 2) Be extracted or harvested within a 500 mile radius.
 - b. The project goal is that at least 10% of the value of the project materials (without labor and equipment) be from regional materials.
 - c. The manufacturer must provide the location of manufacture and the location of extraction/harvest.
 - d. To determine Regional Content for LEED:
 - 1) Determine that the product is manufactured regionally
 - 2) Determine the percentage (%) of regional material weight:
 - a) Determine the total weight of the material or product

- b) Determine the weight of the regional harvested/extracted component
 - 3) Divide the regionally harvested weight by the total weight to get a percentage (%) of regionally manufactured and harvested material.
 - e. Determine the value of the regional content:
 - 1) Determine the total cost of the product (without labor and equipment).
 - 2) Multiply the total value of the product by the percentage (%) of regionally manufactured and harvested material content to get the value of the Regional Content.
 - f. The contractor shall in part:
 - 1) Maintain a spreadsheet showing the Regional Materials purchased, including the material name, supplier, percentage (%) of locally extracted/harvested materials (by weight), the total weight of the material, the cost of the material (without labor and equipment), and the source of the regional content information.
 - 2) Maintain records of Regional Materials, including cut sheets, published product information and cost back up.
 - 3) Submit a completed "Green Building Materials Reporting Form" (GBMRF) in accordance with Item 1.9, LEED Submittals for each product, along with back up. A blank copy of the GBMRF is included at the end of this document.
5. Low-Emitting Materials
- a. Refer to Items 1.9 LEED Submittals (Action Plans) and 1.11, Products, Sub-Item D., "VOC Limits for Low-Emitting Materials".
 - b. Carpet Systems
 - 1) Use carpets and carpet backing that meet the requirements for the Carpet and Rug Institute's Green Label Plus Program.
 - 2) Use carpet adhesives that do not have Volatile Organic Compound (VOC) contents in excess of 50 grams/liter
 - c. Adhesives, Sealants, Paints and Coatings
 - 1) Use adhesives, sealants paints and coating that have a Volatile Organic Compound (VOC) limit below certain thresholds.
 - 2) Chemical component limitations are also defined for some categories of paint and primer.
 - 3) Maintain records of adhesives, sealants, paints and coatings including the manufacturer, product name and VOC content in grams per liter or pound per gallon.
 - d. Non-Urea-formaldehyde Resins (Engineered Wood Products and Laminate Adhesives)

- 1) Do not use engineered wood, composite wood or agrifiber board that contains urea-formaldehyde glue for any permanently installed materials or assemblies.
 - 2) Do not use adhesives containing urea-formaldehyde resins for bonding veneers and other laminates to substrates, both on-site and for shop work.
 - 3) Examples of materials included in this restriction are plywood, medium density fiberboard, door cores, wheat-board, strawboard, and panel substrates.
 - 4) Maintain records of engineered wood products with manufacturer, product name and manufacturer's written statement that product does not contain urea-formaldehyde resin.
- e. Forest Stewardship Council (FSC) Certified Materials
- 1) To qualify as FSC wood material must:
 - a) Have its own FSC label and Chain of Custody (COC) Certificate (Certificates signed by manufacturers certifying that wood used to make products was obtained from forests certified by an FSC-accredited certification body to comply with FSC STD 01-001, "FSC Principles and Criteria for Forest Stewardship." Certificates shall include evidence that manufacturer is certified for Chain of Custody by an FSC-accredited certification body), OR
 - b) Be manufactured in a shop that has its own FSC Certificate out of at least 70% FSC Certified wood.
 - 2) The FSC wood content of the project can be determined by material costs (without labor and equipment), weight, or volume, but the same criteria must be applied consistently.
 - 3) The Contractor shall in part:
 - a) Maintain a spreadsheet showing the new wood materials purchased, including the material name, supplier, percentage (%) FSC Certified content, the total cost/weight/volume of the material, the cost of the material (without labor and equipment), the supplier and the COC Certificate number.
 - b) Maintain records of FSC wood, including COC Certificates, cut sheets, published product information and cost back up.
 - c) Submit a completed "Green Building Materials Reporting Form" (GBMRF) in accordance with Item 1.9, LEED Submittals for each product, along with back up. A blank copy of the GBMRF is included at the end of this document.

6. Indoor Air Quality (IAQ) During Construction
 - a. IAQ during construction addresses the reduction of pollutants in the project
 - b. Comply with Sheet Metal and Air Conditioning National Contractors' Association (SMACNA) Guidelines, as stated in Chapter 3 of the referenced "IAQ Guidelines for Occupied Buildings Under Construction". The Construction IAQ Management Plan shall be organized in accordance with the SMACNA format, and shall address measures to be implemented by the Contractor and/or Subcontractors in each of the five categories (including subsections).
 - c. The Contractor Shall in part:
 - 1) Develop an IAQ Management Plan in accordance with Section 01525, Construction IAQ Management to be implemented by the Construction Manager, and by their subcontractors throughout the duration of the project construction, under the direction of the Construction Manager, and shall be documented per the Submittal Requirements of Item 1.9, LEED Submittals.
 - 2) Take Photographs (18 Total) that document the implementation of the Construction IAQ Management Plan throughout the course of the project construction. Examples include photographs of ductwork sealing and protection, temporary ventilation measures, and conditions of on-site materials storage (to prevent moisture damage). Photographs shall include integral date stamping, and shall be submitted with brief descriptions, or a reference to project meeting minutes or similar project documents.
7. Commissioning of Building Systems
 - a. The project is required to meet the LEED requirements for Enhanced Commissioning
 - b. Coordinate and support the efforts of the Commissioning Agent.

1.6 REFERENCES, STANDARDS, AND REGULATORY REQUIREMENTS

- A. General: Comply with the applicable provisions of the referenced standards except as modified by governing codes and the Contract Documents. Where a recommendation or suggestion occurs in the referenced standards, such recommendation or suggestion shall be considered mandatory. In the event of

conflict between referenced standards, this specification or within themselves, the more stringent standard or requirement shall govern.

1. American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE)
 2. Carpet and Rug Institute (CRI)
 3. Environmental Protection Agency (EPA)
 4. Forest Stewardship Council (FSC)
 5. Green Seal (GS)
 6. Illuminating Engineering Society of North America (IESNA)
 7. Sheet Metal and Air-Conditioning National Contractor Association (SMACNA)
 8. South Coast Air Quality Management District (SQAMD)
 9. United States Green Building Council (USGBC): Leadership in Energy and Environmental Design (LEED) Green Building Rating System, Version CS-2.0.
- B. Rule 1168 – “Adhesive and Sealant Applications”, effective dated of July 1, 2005 and Rule Amendment date of January 7, 2005: South Coast Air Quality Management District (SCAQMD), State of California, www.aqmd.gov.
- C. “Green Seal Standard for Commercial Adhesives”, GS-36, requirements in effect October 19, 2000, www.greenseal.org/.
- D. “Green Seal Standard for Architectural Coating”, GS-11, plus “Green Seal Standard for Anti-Corrosive Paints”, GS-03, www.greenseal.org/.
- E. Rule 1113 “Architectural Coatings”, amended 7/9/04: South Coast Air Quality Management District (SQAMD), State of California, www.aqmd.gov.
- F. SMACNA IAQ “Guidelines for Occupied Buildings Under Construction”: Sheet Metal and Air-Conditioning National Contractor Association (SMACNA) November 1995, www.smacna.org.
- G. ANSI/ASHRAE 52.2, “Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size”. www.ashrae.org.

1.7 LEED PREREQUISITES

- A. The following LEED Prerequisites are required in order to achieve the project’s targeted LEED rating. Compliance with all applicable prerequisite criteria, as defined in this specification and the contract drawings, is mandatory.
1. Prerequisite SS 1, Construction Activity Pollution Prevention

2. The contractor and their subcontractors shall develop and implement a site Erosion and Sediment Control Plan which complies with all applicable regulatory requirements and the applicable control measures established in Chapter 3, "Sediment and Erosion Control" of the U.S. Environmental Protection Agency (EPA) document No. 832R92005, Storm Water Management for Construction Activities, September 1992.
3. Prerequisite EA 1, Fundamental Commissioning of the Building Energy Systems
4. Building systems including HVAC, lighting, electrical, domestic hot water and renewable energy systems (if applicable) shall be commissioned, with oversight provided by a third-party Commissioning Authority contracted directly to the Owner. Commissioning requirements shall be defined under Divisions 1, 15, 16 and 17.
5. Prerequisite EA 2, Minimum Energy Performance
6. The project is designed to meet or exceed the energy conservation requirements of the standard ASHRAE/IESNA 90.1-2004, "Energy Standard for Buildings except Low-Rise Residential Buildings".
7. Prerequisite EA 3, CFC Fundamental Refrigerant Management
8. Chlorofluorocarbon (CFC) refrigerants are prohibited from all HVAC&R systems installed as part of the project.
9. Prerequisite MR 1, Storage & Collection of Recyclables
10. The project includes dedicated storage/collection facilities for recyclable materials, including paper, corrugated cardboard, glass, plastics and metals.
11. The project is designed to meet or exceed the ventilation performance requirements of standard ASHRAE 62.1-2004, "Ventilation for Acceptable Indoor Air Quality", including approved Addenda.
12. Prerequisite EQ 1, Minimum IAQ Performance
13. Prerequisite EQ 2, Environmental Tobacco Smoke (ETS) Control
14. Smoking shall be prohibited in the public areas of the building and exterior designated smoking areas shall be 25 feet from entries, air intakes and operable windows. No applicable contractor/subcontractor requirements.

1.8 LEED PERFORMANCE CRITERIA FOR MATERIALS

- A. The following sub-sections, organized by CSI Division, list the required LEED performance criteria for materials used in this project. Product substitutions, if proposed by the Contractor or their subcontractors, shall not be allowed if such changes compromise the stated LEED requirements. The percentages should be

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adjusted to reflect availability of products with the greatest amount of recycled content within the S. Korean market.

1. It is the responsibility of the contractors to bring to the attention of the Architect any conflicts between the LEED Performance criteria listed in this section and any additional performance criteria or “acceptable products” listed in other sections of the contract documents (specifications or drawings). These conflicts shall be brought to the Architect’s attention for resolution prior to the purchase or installation of the materials in question. LEED criteria will not be waived unless specifically approved, in writing, by the Architect.

B. DIVISION 2 – SITE CONSTRUCTION

1. Recycled Content Materials:
 - a. While there is no minimum requirement for the use of flyash, ground granulated blast furnace (GGBF) slag, or other recycled materials within the concrete mix designs, the use of such products is encouraged where: 1) it is readily available; 2) it does not negatively impact the performance characteristics of the concrete; and 3) it does not add to the product cost. Any use of flyash, GGBF slag, or other recycled materials within the concrete mix designs shall be reported and documented in accordance with Item 1.9, LEED Submittals below. All design mixes are subject to review and approval by the project’s Structural Engineer.
 - b. Recycled materials within the concrete mix designs shall be reported and documented in accordance with Item 1.9, LEED Submittals below. All design mixes are subject to review and approval by the project’s Structural Engineer.
 - c. Steel reinforcing bar, rods, wire, and welded wire fabric shall contain a minimum of 25% combined post-industrial/post-consumer recycled content (the percentage of recycled content is based on the weight of the component materials). Certification of recycled content shall be in accordance with Item 1.9, LEED Submittals below.
2. Regionally-manufactured/Harvested Materials
 - a. The manufacturing locations for concrete and bituminous pavement materials shall be within 500 miles (by air) of the project site, and shall be documented in accordance with Item 1.9, LEED Submittals below.
 - b. The location of the nursery or other source for all landscape plantings shall be documented in accordance with Item 1.9, LEED Submittals below.

C. DIVISION 3 - CONCRETE

1. Recycled Content Materials:

- a. While there is no minimum requirement for the use of flyash, ground granulated blast furnace (GGBF) slag, or other recycled materials within the concrete mix designs, the use of such products is encouraged where: 1) it is readily available; 2) it does not negatively impact the performance characteristics of the concrete; and 3) it does not add to the product cost. Any use of flyash, GGBF slag, or other recycled materials within the concrete mix designs shall be reported and documented in accordance with Item 1.9, LEED Submittals below. All design mixes are subject to review and approval by the project's Structural Engineer.
- b. Steel reinforcing bar, rods, wire, welded wire fabric, anchors, and ties shall contain a minimum of 25% combined post-industrial/post-consumer recycled content (the percentage of recycled content is based on the weight of the component materials). Certification of recycled content shall be in accordance with Item 1.9, LEED Submittals below.

2. Regionally-manufactured/Harvested Materials

- a. The manufacturing location(s) for cast-in-place concrete shall be within 500 miles (by air) of the project site, and shall be documented in accordance with Item 1.9, LEED Submittals below.
- b. The manufacturing location(s) for steel reinforcing products shall be documented in accordance with Item 1.9, LEED Submittals below.
- c. The origin of the raw materials from which the concrete and steel reinforcing products were manufactured shall be documented in accordance with Item 1.9, LEED Submittals below.

3. Low-emission Products:

- a. Field-applied adhesives, sealants, and paints shall meet the requirements of Item 1.11, Products, Sub-Item D., "VOC Limits for Low-Emitting Materials". Only those products used on the interior of the building (inside of the weatherproofing system) are required to comply with these requirements. VOC content shall be documented in accordance with Item 1.9, LEED Submittals below.

D. DIVISION 4 – MASONRY

1. Recycled Content Materials:
 - a. Steel reinforcing bar, rods, wire, anchors, and ties shall contain a minimum of 25% combined post-industrial/post-consumer recycled content (the percentage of recycled content is based on the weight of the component materials). Certification of recycled content shall be in accordance with Item 1.9, LEED Submittals below.
2. Regionally-manufactured/Harvested Materials
 - a. The manufacturing location(s) for all concrete masonry units shall be within 500 miles (by air) of the project site, and shall be documented in accordance with Item 1.9, LEED Submittals below.
 - b. The manufacturing location(s) for dimensional stone and for steel reinforcing products shall be documented in accordance with Item 1.9, LEED Submittals below.
 - c. The origin of the raw materials from which the concrete masonry units and dimensional stone products were manufactured shall be documented in accordance with Item 1.9, LEED Submittals below.
3. Low-emission Products:
 - a. Field-applied adhesives, sealants, and paints shall meet the requirements of Item 1.11, Products, Sub-Item D., "VOC Limits for Low-Emitting Materials". Only those products used on the interior of the building (inside of the weatherproofing system) are required to comply with these requirements. VOC content shall be documented in accordance with Item 1.9, LEED Submittals below.

E. DIVISION 5 – METALS

1. Recycled Content Materials:
 - a. Structural Steel, steel deck and miscellaneous steel shall contain a minimum of 35% combined post-industrial/post consumer recycled content (the percentage of recycled content is based on the weight of the component materials). Certification of recycled content shall be in accordance with item 1.9, LEED Submittals below.
2. Regionally-manufactured/Harvested Materials
 - a. The manufacturing location(s) for all structural steel products shall be documented in accordance with Item 1.9, LEED Submittals below. For the purposes of this LEED credit, the steel fabricator can be considered the manufacturer.
 - b. The origin of the raw materials from which the structural steel and steel deck was manufactured shall be documented in accordance with Item 1.9, LEED Submittals below. For the purposes of this

LEED credit, the steel mill can be considered the source of the raw material.

3. Low-emission Products:

- a. Field-applied adhesives, sealants, and paints shall meet the requirements of Item 1.11, Products, Sub-Item D., "VOC Limits for Low-Emitting Materials". Only those products used on the interior of the building (inside of the weatherproofing system) are required to comply with these requirements. VOC content shall be documented in accordance with Item 1.9, LEED Submittals below.

F. DIVISION 6 – WOODS, PLASTICS AND COMPOSITES

1. Certified Wood:

- a. The use of "FSC Certified" products is encouraged in all wood products as listed under Item 1.11, Products. Any use of "FSC Certified" wood products (except recycled or salvaged wood) which have been harvested in accordance with the "FSC Principles and Criteria" for well-managed forests developed by the Forest Stewardship Council (FSC) shall be reported and documented in accordance with Item 1.9, LEED Submittals below.

2. Low-emission Products:

- a. All composite wood, engineered wood, or agrifiber products (e.g., plywood, particleboard, and medium-density fiberboard) shall contain no added urea-formaldehyde resins. Acceptable resins and binders include, but are not limited to, phenol formaldehyde and methyl diisocyanate (MDI). Certification of these products shall be in accordance with Item 1.9, LEED Submittals below.
- b. Field-applied adhesives, sealants, and paints shall meet the requirements of Item 1.11, Products, Sub-Item D., "VOC Limits for Low-Emitting Materials". Only those products used on the interior of the building (inside of the weatherproofing system) are required to comply with these requirements. VOC content shall be documented in accordance with Item 1.9, LEED Submittals below.

G. DIVISION 7 - THERMAL AND MOISTURE PROTECTION

1. Recycled Content Materials:

- a. The post-industrial and/or post-consumer recycled content (by weight) of fiberglass insulation products shall be reported and documented in accordance with Item 1.9, LEED Submittals below.
- b. The post-industrial and/or post-consumer recycled content (by weight) of Mineral-wool insulation products shall be reported and documented in accordance with Item 1.9, LEED Submittals below.

- c. The post-industrial and/or post-consumer recycled content (by weight) of metal wall panels shall be documented in accordance with Item 1.9, LEED Submittals below.
- d. The post-industrial and/or post-consumer recycled content (by weight) of metal roof panels shall be documented in accordance with Item 1.9, LEED Submittals below.
- e. The post-industrial and/or post-consumer recycled content (by weight) of Cementitious and/or fibrous fireproofing shall be reported and documented in accordance with Item 1.9, LEED Submittals below. Metal lath and reinforcing fabric shall contain a minimum of 25% (combined) post-industrial/post-consumer recycled content. Certification of recycled content shall be in accordance with Item 1.9, LEED Submittals below.
- f. The post-industrial and/or post-consumer recycled content (by weight) of Polystyrene Insulation products shall be reported and documented in accordance with Item 1.9, LEED Submittals below. Certification of recycled content shall be in accordance with Item 1.9, LEED Submittals below.

2. Regionally-manufactured/Harvested Materials

- a. The manufacturing location(s) for metal wall panels shall be documented in accordance with Item 1.9, LEED Submittals below. For the purposes of this LEED credit, the steel fabricator can be considered the manufacturer.
- b. The manufacturing location(s) for metal roof panels shall be documented in accordance with Item 1.9, LEED Submittals below. For the purposes of this LEED credit, the steel fabricator can be considered the manufacturer.
- c. The origin of the raw materials from which the metal wall panels were manufactured shall be documented in accordance with Item 1.9, LEED Submittals below. For the purposes of this LEED credit, the steel mill can be considered the source of the raw material.
- d. The origin of the raw materials from which the metal roof panels were manufactured shall be documented in accordance with Item 1.9, LEED Submittals below. For the purposes of this LEED credit, the steel mill can be considered the source of the raw material.
- e. Energy Star roof materials manufactured within 500 miles (by air) of the project site shall be documented in accordance with Item 1.9, LEED Submittals below.

3. Energy Star Roofing

- a. All exposed roofing products including membranes and pavers shall be ENERGY STAR® compliant and have a Solar Reflectance Index (SRI) of at least 78 when tested in accordance with ASTM E-1980. Any selected product with an SRI less than 78 requires the Architect's approval.

4. Low-emission Products:

- a. Field-applied adhesives, sealants, and paints shall meet the requirements of Item 1.11, Products, Sub-Item D., "VOC Limits for Low-Emitting Materials". Only those products used on the interior of the building (inside of the weatherproofing system) are required to comply with these requirements. VOC content shall be documented in accordance with Item 1.9, LEED Submittals below.

H. DIVISION 8 – DOORS AND WINDOWS

1. Recycled Content Materials:

- a. The post-industrial and/or post-consumer recycled content (by weight) of Aluminum curtain wall shall be reported and documented in accordance with Item 1.9, LEED Submittals below.
- b. Steel doors with recycled content shall be documented in accordance with Item 1.9 (LEED Submittals) below.

2. Regionally-manufactured/Harvested Materials

- a. Aluminum curtain wall systems manufactured within a 500 mile radius of the project shall be documented in accordance with Item 1.9, LEED Submittals below.
- b. Steel doors manufactured within a 500 mile radius of the project shall be documented in accordance with Item 1.9, LEED Submittals below.

3. Certified Wood

- a. Wood doors made from "FSC Certified" products (except recycled or salvaged wood) which have been harvested in accordance with the "FSC Principles and Criteria" for well-managed forests developed by the Forest Stewardship Council (FSC) shall be reported and documented in accordance with Item 1.9, LEED Submittals below.

4. Low-emission Products:

- a. Field-applied adhesives, sealants, and paints shall meet the requirements of Item 1.11, Products, Sub-Item D., "VOC Limits for Low-Emitting Materials". Only those products used on the interior of the building (inside of the weatherproofing system) are required to comply with these requirements. VOC content shall be documented in accordance with Item 1.9, LEED Submittals below.
- b. All composite wood, engineered wood, or agrifiber products (e.g., plywood, particleboard, and medium-density fiberboard) shall contain no added urea-formaldehyde resins. Acceptable resins and binders include, but are not limited to, phenol formaldehyde and

methyl diisocyanate (MDI). Certification of these products shall be in accordance with Item 1.9, LEED Submittals below.

I. DIVISION 9 – FINISHES

1. Recycled Content Materials:

- a. Gypsum wallboard shall contain “synthetic” gypsum produced with a minimum of 90% post-industrial recycled content, if readily available. Recycled content shall be documented in accordance with Item 1.9, LEED Submittals below.
- b. Steel studs, track, and miscellaneous framing shall contain a minimum of 25% (combined) post-industrial/post-consumer recycled content (the percentage of recycled content is based on the weight of the component materials). Recycled content shall be documented in accordance with Item 1.9, LEED Submittals below.
- c. The post-industrial and/or post-consumer recycled content (by weight) of Mineral Fiber Acoustical Ceiling Panels shall be reported and documented in accordance with Item 1.9, LEED Submittals below.
- d. Steel ceiling grid and suspension system shall have a minimum of 25% (combined) post-industrial/post-consumer recycled content (the percentage of recycled content is based on the weight of the component materials). Recycled content shall be documented in accordance with Item 1.9, LEED Submittals below.
- e. The post-industrial and/or post-consumer recycled content (by weight) of Carpet tile face fibers and/or backings shall be reported and documented in accordance with Item 1.9, LEED Submittals below.
- f. The post-industrial and/or post-consumer recycled content (by weight) of Broadloom carpet shall be reported and documented in accordance with Item 1.9, LEED Submittals below.

2. Regionally-manufactured/Harvested Materials

- a. Gypsum wallboard products manufactured within 500 miles (by air) of the project site shall be documented in accordance with Item 1.9, LEED Submittals below.
- b. The origin of the raw materials from which the gypsum wallboard was manufactured shall be documented in accordance with Item 1.9, LEED Submittals below.
- c. The manufacturing location(s) for steel studs, track, and miscellaneous framing shall be documented in accordance with

Item 1.9 LEED Submittals below. For the purposes of this LEED credit, the steel fabricator can be considered the manufacturer.

- d. Acoustical panel ceiling products manufactured within 500 miles (by air) of the project site shall be documented in accordance with Item 1.9, LEED Submittals below.
- e. The origin of the raw materials from which the miner fiber acoustical ceiling panels were manufactured shall be documented in accordance with Item 1.9, LEED Submittals below.

3. Low-emission Products:

- a. Field-applied adhesives, sealants, and paints shall meet the requirements of Item 1.11, Products, Sub-Item D., "VOC Limits for Low-Emitting Materials". Only those products used on the interior of the building (inside of the weatherproofing system) are required to comply with these requirements. VOC content shall be documented in accordance with Item 1.9, LEED Submittals below.
- b. Carpet, Carpet Backing and Carpet tiles and adhesives shall meet or surpass all criteria of the "Green Label Plus" Indoor Air Quality Test Program established by the Carpet and Rug Institute (CRI) of Dalton, Georgia.

J. DIVISION 10 – SPECIALTIES

1. Recycled Content Materials:

- a. The post-industrial and/or post-consumer recycled content (by weight) of Plastic toilet partitions shall be reported and documented in accordance with Item 1.9, LEED Submittals below.

2. Low-emission Products:

- a. Field-applied adhesives, sealants, and paints shall meet the requirements of Item 1.11, Products, Sub-Item D., "VOC Limits for Low-Emitting Materials". Only those products used on the interior of the building (inside of the weatherproofing system) are required to comply with these requirements. VOC content shall be documented in accordance with Item 1.9, LEED Submittals below.

K. DIVISION 11 – EQUIPMENT

1. Low-emission Products:

- a. Field-applied adhesives, sealants, and paints shall meet the requirements of Item 1.11, Products, Sub-Item D., "VOC Limits for Low-Emitting Materials". Only those products used on the interior of

the building (inside of the weatherproofing system) are required to comply with these requirements. VOC content shall be documented in accordance with Item 1.9, LEED Submittals below.

L. DIVISION 12 – FURNISHINGS

1. Low-emission Products:

- a. Field-applied adhesives, sealants, and paints shall meet the requirements of Item 1.11, Products, Sub-Item D., “VOC Limits for Low-Emitting Materials”. Only those products used on the interior of the building (inside of the weatherproofing system) are required to comply with these requirements. VOC content shall be documented in accordance with Item 1.9, LEED Submittals below.
- b. All composite wood, engineered wood, or agrifiber products (e.g., plywood, particleboard, and medium-density fiberboard) shall contain no added urea-formaldehyde resins. Acceptable resins and binders include, but are not limited to, phenol formaldehyde and methyl diisocyanate (MDI). Certification of these products shall be in accordance with Item 1.9, LEED Submittals.

M. DIVISION 13 – SPECIAL CONSTRUCTION

1. Low-emission Products:

- a. All composite wood, engineered wood, or agrifiber products (e.g., plywood, particleboard, medium density fiberboard) in fixed audience seating shall contain no added urea-formaldehyde resins. Acceptable resins and binders include, but are not limited to, phenol formaldehyde and methyl diisocyanate (MDI). Certification of these products shall be in accordance with Item 1.9, LEED Submittals below.
- b. Field-applied adhesives, sealants, and paints shall meet the requirements of Item 1.11, Products, Sub-Item D., “VOC Limits for Low-Emitting Materials”. Only those products used on the interior of the building (inside of the weatherproofing system) are required to comply with these requirements. VOC content shall be documented in accordance with Item 1.9, LEED Submittals below.

N. DIVISION 14 – CONVEYING SYSTEMS

1. Low-emission Products:

- a. Field-applied adhesives, sealants, and paints shall meet the requirements of Item 1.11, Products, Sub-Item D., “VOC Limits for

Low-Emitting Materials”. Only those products used on the interior of the building (inside of the weatherproofing system) are required to comply with these requirements. VOC content shall be documented in accordance with Item 1.9, LEED Submittals below.

O. DIVISION 15 – MECHANICAL

1. Low-emission Products:

- a. Field-applied adhesives, sealants, and paints shall meet the requirements of Item 1.11, Products, Sub-Item D., “VOC Limits for Low-Emitting Materials”. Only those products used on the interior of the building (inside of the weatherproofing system) are required to comply with these requirements. VOC content shall be documented in accordance with Item 1.9, LEED Submittals below.

P. DIVISION 16 – ELECTRICAL

1. Low-emission Products:

- a. Field-applied adhesives, sealants, and paints shall meet the requirements of Item 1.11, Products, Sub-Item D., “VOC Limits for Low-Emitting Materials”. Only those products used on the interior of the building (inside of the weatherproofing system) are required to comply with these requirements. VOC content shall be documented in accordance with Item 1.9, LEED Submittals below.

1.9 LEED SUBMITTALS

- A. LEED submittals are required for all installed materials in specification Divisions 2 through 12 and adhesives, sealants, and paints through Divisions 16. The GREEN BUILDING Submittal information shall be assembled into one (1) package per Specification section or sub-contractor. Two (2) copies of the submittals are required. Incomplete or inaccurate LEED Submittals may be used as the basis for rejecting the submitted products or assemblies. Contractor and/or subcontractors shall submit the following LEED BUILDING reporting items:

- 1. A completed GREEN BUILDING MATERIALS REPORTING FORM (GBMRF) for each trade (sample to be provided by architect). Information to be supplied for this form shall include:
 - a. Cost breakdowns for the materials included in the contractor’s or subcontractor’s work. Cost breakdowns shall include total installed cost and itemized material costs.
 - b. The amount of post consumer and/or post industrial recycled content in the supplied products.*

- c. Identification (Y/N) of materials manufactured within 500 miles of the project site.*
- d. Identification (Y/N) of materials harvested or extracted within 500 miles of the project site.*
- e. Identification (Y/N) of “FSC Certified” wood products used.*
- f. VOC content of all field applied adhesives, sealants, and paints used in interior applications.

*If applicable – see Item 1.8 (LEED Performance Criteria for Materials) above to determine the applicable reporting based on the material type.

B. **MATERIALS REPORTING FORM BACK-UP DOCUMENTATION:** These documents are used to validate the information provided on the Green Building Materials Reporting Form (except cost data). For each material listed on the form, provide documentation to certify the material’s LEED BUILDING attributes, as applicable:

- a. Recycled content: Provide published product literature or letter of certification on the manufacturer’s letterhead certifying the amounts of post-consumer and/or post-industrial content.
- b. Regional manufacturing (within 500 miles): Provide published product literature or letter of certification on the manufacturer’s letterhead indicating the city/state where the manufacturing plant is located and the distance in miles from the project site.
- c. Regional raw materials (within 500 miles): Provide published product literature or letter of certification on the manufacturer’s letterhead indicating the city/state from which each of the raw materials in the product were extracted, harvested or recovered, and the distance in miles from the project site.
 - 1) If only some of the raw materials for a particular product or assembly originate within 500 miles of the project site, provide the percentage (by weight) that these materials comprise in the complete product.
- d. FSC Certified Wood:
 - 1) Provide vendor invoices for each wood product that has been harvested in accordance with the “FSC Principles and Criteria” for well-managed forests developed by the Forest Stewardship Council (FSC) of Bonn, Germany. Invoices shall include chain-of-custody certificate numbers and itemized costs for all certified products.
 - 2) For assemblies, provide the percentage (by cost and by weight) of the assembly that is FSC-certified wood.
- e. VOC content: Provide Material Safety Data Sheets (MSDS) certifying the Volatile Organic Compound (VOC) content of the adhesive, sealant, paint, or coating products. VOC content is to be

reported in grams/liter or lbs/gallon. If the MSDS does not show the product's VOC content, this information must be provided through other published product literature from the manufacturer, or stated in a letter of certification from the product manufacturer on the manufacturer's letterhead.

2. **PRODUCT CUT SHEETS:** Provide product cut sheets with the Contractor's or sub-contractor's stamp, confirming that the submitted products are the products installed in the Project.
3. **CRI GREEN LABEL CERTIFICATION:** For carpets and carpet cushions, provide published product literature or letter from the manufacturer (on the manufacturer's letterhead) verifying that the products comply with the "Green Label Plus" IAQ testing program of the Carpet and Rug Institute of Dalton, GA.
4. **CARPET COMPONENT IDENTIFICATION:** For all synthetic carpets, provide documentation from the manufacturer on the manufacturer's letterhead of the specific carpet component identification code that is printed on, or attached to, the carpet supplied for the project. The code must identify the carpet face fiber, and may identify its primary backing, secondary backing, adhesive, adhesive filler, and dyes.
5. **CERTIFICATION OF COMPOSITE WOOD OR AGRIFIBER RESINS:** For all composite wood, engineered wood and agrifiber products, provide published product literature or letter from the manufacturer (on the manufacturer's letterhead) verifying that the products do not contain added urea-formaldehyde resins.
6. **CERTIFICATION OF COMPOSITE WOOD OR AGRIFIBER LAMINATING ADHESIVES:** For all composite wood, engineered wood and agrifiber products, provide published product literature or letter from the manufacturer on the manufacturer's letterhead verifying that the products do not contain added urea-formaldehyde or phenol-formaldehyde resins.
7. **GREEN SEAL COMPLIANCE:** Provide published product literature or letter from the manufacturer (on the manufacturer's letterhead) verifying that the following product types comply with the VOC limits and chemical component restrictions developed by the Green Seal organization of Washington, DC (www.greenseal.org/):
 - a. Topcoat paints: refer to Green Seal standard GS-11 (1st edition, May 1993)
 - b. Anti-corrosive and Anti-rust paints: refer to Green Seal standard GS-03 (2nd Edition, January 1997)
 - c. Aerosol Adhesives: refer to Green Seal standard GS-36 (1st edition, October 2000)

8. ENERGY STAR ROOFING: For exposed roofing materials, including membranes and pavers, provide certification from the manufacturer of ENERGY STAR compliance for the Solar Reflectance Index (SRI). (An SRI of at least 78 when tested in accordance with ASTM E-1980).
9. HIGH ALBEDO ROOFING: For exposed roofing membranes, pavers, and ballast products, provide published product literature or letter from the manufacturer on the manufacturer's letterhead verifying the following minimum Solar Reflectance Index (SRI) values:
 - a. 78 for low-sloped roofing applications (slope \leq 2:12)
 - b. 29 for steep-sloped roofing applications (slope $>$ 2:12)
 - c. SRI values shall be calculated according to ASTM E 1980.
 - d. Reflectance shall be measured according to ASTM E 903, ASTM E 1918, or ASTM C 1549. Emittance shall be measured according to ASTM E 408 or ASTM C 1371.
 - e. Vegetated roof surfaces are exempt from the SRI criteria.
10. HIGH ALBEDO PAVEMENT AND WALKWAYS: For paving and walkway materials made from concrete or brick provide published product literature or letter from the manufacturer on the manufacturer's letterhead verifying a minimum Solar Reflectance Index (SRI) value of 29. SRI values shall be calculated according to ASTM E 1980. Reflectance shall be measured according to ASTM E 903, ASTM E 1918, or ASTM C 1549. Emittance shall be measured according to ASTM E 408 or ASTM C 1371.

C. CONSTRUCTION PROGRESS

1. Concurrent with each Application for Payment, submit reports comparing actual construction and purchasing activities with LEED action plans for the following:
2. Waste Reduction Progress Reports complying with Division 01524 Section "Construction Waste Management".
3. Regional Materials. Provide updated spreadsheet to track Regional Materials.
4. Recycled Content Materials. Provide updated spreadsheet to track Recycled Content.
5. FSC Certified Wood Products. Provide updated spreadsheet to track FSC Certified Wood Materials.
6. Low Emitting VOC Content Materials. Provide updated spreadsheet to track Low Emitting VOC Content Materials.
7. Low Emitting Composite Wood. Provide updated spreadsheet to track low emitting (non-urea-formaldehyde) composite and engineered wood products.

D. LEED ACTION PLANS

- a. The following plans are to be prepared by the Contractor and refer to work reviewed in Items 1.5, LEED Overview and General Requirements of this section.
 - b. Erosion and Sedimentation Control Plan (ESC): Indicate what ESC for site work measures are anticipated and how they will be documented.
- E. Construction Waste Management (CWM):
 - a. General: Develop a plan consisting of waste identification, waste reduction work plan, and progress reporting per the requirements of Section 01524, Construction Waste Management. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.
- 2. Construction Indoor Air Quality Management (IAQ): A copy of the draft and final versions of the Construction IAQ Management Plan, as defined below.
 - a. General: Develop a plan in accordance with Section 01525, Construction IAQ Management where construction activities are planned to meet or exceed standards included in Chapter 3 of the SMACNA "IAQ Guidelines for Occupied Buildings Under Construction", First Edition, 1995.
 - b. Upon the Plan's approval by the Owner and Consultant, the Contractor and subcontractors shall implement the Plan through the duration of the construction process.
 - 1) Develop a construction schedule outlining the start-up date and expected duration of all Construction IAQ Management Plan control measures.

1.10 QUALITY ASSURANCE

- A. Contractor's Quality Control Responsibilities: Contractor is solely responsible for the quality control of the work.
- B. Contractor's LEED Representative: Designate a Representative that is LEED accredited by the USGBC. Contractor's LEED Representative shall oversee the sustainable building for the project, shall instruct workers concerning these goals, and shall be present on site when work is in progress.
- C. LEED Certification Meetings: Schedule and conduct LEED Certification meetings monthly in addition to those outlined in Division 1 "Project Management and Coordination". Meeting attendees shall include at least the following: Owner's Representative, Architect, Contractor's Project Manager, Contractor's LEED Representative, and Sub-Contractor Representatives as appropriate to the stage of work. Discuss LEED Certification at Pre-bid, Pre-construction, and regular job site meetings.

- D. LEED Training: Provide environmental training for workers performing work on the project site. Training shall include the following:
 - 1. Overview of environmental issues related to the building industry
 - 2. LEED Building System – Requirements for this project

1.11 PRODUCTS

- A. Materials with Recycled Content
 - 1. Provide recycled content and/or report recycled content as indicated in Items 1.8, LEED Performance Criteria for Materials and 1.9, LEED Submittals.
- B. Regional Materials
 - 1. Report regional content as indicated in Items 1.8, LEED Performance Criteria for Materials and 1.9, LEED Submittals.
- C. Forest Stewardship Council Certified Materials
 - 1. Track and report (by cost) of permanently all installed wood-based materials that are produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, “FSC Principles and Criteria for Forest Stewardship.”
 - a. Wood-based materials included, but are not limited to, the following materials when made from wood, engineered wood products, or wood based panels products:
 - 1) Rough carpentry
 - 2) Miscellaneous carpentry
 - 3) Heavy timber construction
 - 4) Wood decking
 - 5) Metal-plate-connected wood trusses
 - 6) Structural glued-laminated timber
 - 7) Finish carpentry
 - 8) Architectural woodwork
 - 9) Wood paneling
 - 10) Wood veneer wall covering
 - 11) Wood flooring
 - 12) Wood lockers
 - 13) Wood cabinets
- D. VOC Limits for Low-Emitting Materials
 - 1. Field-Applied Adhesives and Sealants:
 - a. The VOC content of adhesives, adhesive bonding primers, or adhesive primers used in this project shall not exceed the limits defined in Rule 1168 “Adhesives and Sealant Applications” of the South Coast Air Quality Management District (SCAQMD) of the State of California.
 - b. The VOC content of aerosol adhesives shall not exceed the limits defined in the Green Seal Standards for Commercial Adhesives GS-36, requirements in effect October 19, 2000.
 - c. Sealants used as filler must meet or exceed California Bay Area Air Resources Board Reg. 8, Rule 51, Organic Compounds: Adhesive

and Sealant Products (Adopted November 18, 1992, with Amendments through January 7, 1998).

- d. The VOC limits defined by SCAQMD (based on 1/7/05 amendments) are as follows. All VOC limits are defined in grams per liter, less water and less exempt compounds.
 - e. General: Unless otherwise specified below, the VOC content of all adhesives, adhesive bonding primers, or adhesive primers shall not be in excess of 250 grams per liter.
 - f. Non-General: For specified applications, the allowable VOC content is as follows (in grams/liter):
 - 1) Architectural Applications

a)	Indoor carpet adhesive	50
b)	Carpet pad adhesive	50
c)	Outdoor carpet adhesive	150
d)	Wood flooring adhesive	100
e)	Rubber floor adhesive	60
f)	Sub-floor adhesive	50
g)	Ceramic tile adhesive	65
h)	VCT and asphalt tile adhesive	50
i)	Drywall and panel adhesive	50
j)	Cove base adhesive	50
k)	Multipurpose construction adhesive	70
l)	Structural glazing adhesive	100
m)	Single ply roof membrane adhesives	450
 - 2) Specialty Applications

a)	PVC welding	510
b)	CPVC welding	490
c)	ABS welding	325
d)	Plastic cement welding	250
e)	Adhesive primer for plastic	550
f)	Contact adhesive	80
g)	Special purpose contact adhesive	250
h)	Structural wood member adhesive	140
i)	Sheet applied rubber lining operations	850
 - 3) Substrate Specific Applications

a)	Metal to metal	30
b)	Plastic foams	50
c)	Porous material (except wood)	50
d)	Wood	30
e)	Fiberglass	80
2. If an adhesive is used to bond dissimilar substrates together, the adhesive with the highest VOC content shall be allowed.
 3. VOC limits for aerosol adhesives (defined as % of VOC weight in grams per liter less water):
 - a. General purpose mist spray 65% VOC by weight
 - b. General purpose web spray 55% VOC by weight

SUSTAINABLE DESIGN REQUIREMENTS

Bid Package 2A - Issue for Bid

01361 - 25

- c. Special purpose aerosol adhesives 70% VOC by weight
4. The VOC content of sealants or sealant primers used in this project shall not exceed the limits defined in Rule 1168 "Adhesives and Sealant Applications" of the South Coast Air Quality Management District (SCAQMD) of the State of California.
5. The VOC limits defined by SCAQMD Rule 1168 are as follows. All VOC limits are defined in grams per liter, less water and less exempt compounds.
 - a. Sealants

1)	Architectural	250
2)	Marine deck	760
3)	Roadways	250
4)	Single ply roof material installation/repair	450
5)	Non-membrane roof installation/repair	300
6)	Other	420
 - b. Sealant Primer

1)	Architectural - nonporous	250
2)	Architectural – porous	775
3)	Other	750
6. Paints and Coatings:
 - a. Paints and primers (non-specialized applications): Paints and primers used in non-specialized interior and exterior applications (i.e. For wallboard, plaster, wood, metal doors and frames, etc.) shall meet the VOC and chemical component limitations of the Green Seal Paint Standard GS-11, and anti-corrosive paints (IE used in preventing the corrosion of ferrous metal substrates) shall meet the VOC and chemical component limitations of Green Seal Standard GC-03 of Green Seal, Inc., Washington, DC. Product-specific environmental requirements are as follows:
 - 1) VOC concentrations (in grams per liter) of the product shall not exceed those listed below as determined by U.S. Environmental Protection Agency (EPA) Reference Test Method 24. The calculation of VOC shall exclude water and tinting color added at the point of sale.
 - a) Interior coatings
 - i. Non-flat 150
 - ii. Flat 50
 - b) Interior anti-corrosive paints
 - i. Gloss 250
 - ii. Semi-gloss 250
 - iii. Flat 250
 - c) Exterior coatings
 - i. Non-flat 200
 - ii. Flat 100
 - b. Chemical Component Limitations – Aromatic Compounds: The product must contain no more than 1.0% by weight of the sum total

of aromatic compounds. Testing for the concentration of these compounds will be performed if they are determined to be present in the product during a material audit.

- c. Chemical Component Limitations – Other Chemicals: The manufacturer shall demonstrate that the following chemical compounds are not used as ingredients in the manufacture of the product.
- 1) Halomethanes: methylene chloride
 - 2) Chlorinated ethanes: 1,1,1-trichloroethane
 - 3) Aromatic solvents: benzene, toluene (methylbenzene), ethylbenzene
 - 4) Chlorinated ethylenes: vinyl chloride
 - 5) Polynuclear aromatics: naphthalene
 - 6) Chlorobenzenes: 1,2-dichlorobenzene
 - 7) Phthalate esters: di (20ethylhexyl) phthalate, butyl benzyl phthalate, di-n- butyl phthalate, di-n-octyl phthalate, diethyl phthalate, dimethyl phthalate
 - 8) Miscellaneous semi-volatile organics: isophorone
 - 9) Metals and their compounds: antimony, cadmium, hexavalent chromium, lead, mercury
 - 10) Preservatives (antifouling agents): formaldehyde
 - 11) Ketones: methyl ethyl ketone, methyl isobutyl ketone
 - 12) Miscellaneous volatile organics: acrolein, acrylonitrile
- d. Paints and other Architectural Coatings (specializes applications): Paints and other architectural coatings used in specialized interior and exterior applications (as defined below) shall meet the VOC limitations defined in Rule 1113, “Architectural Coatings” of SCAQMD, of the State of California. The VOC limits defined by SCQMD, based on 7/9/04 amendments, are as follows. VOC limits are defined in grams per liter (g/L), less water and less exempt compounds.
- 1) Clear wood finishes:
 - a) Varnish 350
 - b) Lacquer 550
 - 2) Sealers
 - a) Sanding 275
 - b) Waterproofing 250
 - 3) Floor Coatings 100
 - 4) Stains 250
- e. Low-Emitting Carpet Systems
- 1) Document that the installed carpets products and carpet backing are CRI Green Plus Certified.
 - 2) Document that all carpet adhesives contain fewer than 50 grams per liter VOC content.

- f. Non-Urea-Formaldehyde Resins in Engineered Woods
 - 1) Document that the bonding resins in all engineered wood products do not contain added urea-formaldehyde or phenol-formaldehyde resins.
 - 2) Document that the adhesives used for field and shop applied laminations (veneers, plastics, metals) do not contain added urea-formaldehyde resins.

1.12 EXECUTION

- A. EROSION AND SEDIMENTATION CONTROL (ESC)
 - 1. Comply with requirements for Construction Activity Pollution Prevention as outlined in the Sedimentation and Erosion Control Plan.
- B. CONSTRUCTION WASTE MANAGEMENT (CWM)
 - 1. Comply with Section 01524, Construction Waste Management.
 - 2. Maintain spreadsheet tracking waste material description, hauler or recycling location and tabulation of material diverted or recycled based on weight or volume.
- C. RECYCLED CONTENT
 - 1. Maintain a spreadsheet to track Recycled content of materials specified in Divisions 02-10. Include material description, material costs (without labor and equipment), post consumer recycled content, pre consumer recycled content and recycled content information source. Recycled content is based on the cost of qualifying materials as a percent of overall materials costs for Divisions 02 –10.
- D. REGIONAL MATERIALS
 - 1. Maintain a spreadsheet to track Regional Materials specified in Divisions 02-10. Include the product name, manufacturer, material cost (without labor and equipment), direct line distance from project to extraction/harvest location, direct line distance from project to manufacturer's location and source of information regarding harvest/extraction and manufacturing locations.
- E. (FSC) MATERIALS
 - 1. Maintain a spreadsheet listing all new wood on the project. Identify which components are FSC certified, the source of the materials, the value of all FSC certified wood materials (as a % of total product value), and the COC number. Recycled wood fiber that qualifies as contributing to recycled content shall be excluded.
- F. LOW EMITTING VOC CONTENT MATERIALS
 - 1. Maintain a spreadsheet of all adhesives, sealants, and sealant primers, paints and coatings used on the project. Include product manufacturer, product name/model, VOC content, allowable VOC content as per Item 1.11, Products, Sub-Item D., VOC Limits for Low-Emitting Materials, the

source of the VOC data, an estimated quantity of the product used on the project and an estimated cost for each product.

G. LOW EMITTING CARPET

1. Maintain a spreadsheet of all installed carpets and carpet backings. Include manufacturer, recycled content, manufacturing location, and confirmation that the product meets the requirements of the CRI 'Green Label Plus' program. Maintain a listing of all carpet adhesives including the manufacturer, product name and VOC content as reported by the manufacturer.
2. For all synthetic carpets maintain a spreadsheet including the manufacturer, the product name, the specific carpet component identification code that is printed on, or attached to, the carpet supplied for the project.

H. LOW EMITTING COMPOSITE WOOD

1. Maintain a spreadsheet of all install composite wood, engineered wood and agrifiber, including manufacturer, product name and confirmation that the product does not contain any added urea formaldehyde resins. Maintain a listing of the glues used for bonding veneers and laminates to substrates with confirmation that they do not contain any added urea-formaldehyde resins.

I. CONSTRUCTION INDOOR AIR QUALITY MANAGEMENT

1. Comply with the requirements for indoor air quality during construction activity as outlined in the Construction IAQ Management Plan, Section 01525.

END OF SECTION 01361

GREEN BUILDING MATERIALS REPORTING FORM						PROJECT NAME:					
CONTRACTOR:				TEL. NO:		SPEC SECTION:					
CONTACT NAME:				SUBMITTAL NO:							
Product	Vendor or Manufacturer	REQUIRED for ALL products identified in specifications		Is this product post-consumer recycled?	If contains Recycled		Regional Extraction/Manufacture	Partial Extraction/Manufacture	Rapidly Renewable	F&W Product	Other
		Total Installed COST	Material COST (excluding labor & equipment)								
1.											
2.											
3.											
4.											
5.											
6.											
7.											

1. Salvaged: Material or product which has been recovered from existing buildings or construction sites and reused in other buildings (e.g., structural beams, doors, brick).
2. Post-Consumer Recycled Content: Portion of material or product which derives from discarded consumer waste that has been recovered for use as a raw material (e.g., plastic bottles, newspaper)
3. Pre-Consumer Recycled Content: Portion of material or product which derives from recovered industrial and mfg. materials that are diverted from municipal solid waste for use in a different mfg. process, prior to use by a consumer (e.g., fly-ash in concrete or synthetic gypsum board, both of which are by-products of coal-burning power plants). Note that spills and scraps from the original mfg. process that are combined with other constituents after a minimal amount of reprocessing for use in further production of the same product do not qualify.
4. Regional Extraction/Manufacture: Extracted: Extraction, harvesting or recovery of materials that are used for manufacturing of products to be installed in the building. Manufactured: Final assembly of components into a finished product that is furnished and installed by trades (e.g., If the lumber is from Missoula, MT, and the joist (the finished product in this case) is assembled in Kent, WA; then the location of final assembly is Kent, WA). Since Missoula, MT is within a 500 mile radius of Kent, WA the answer for this example would be 'Yes'
5. Partial Extraction/Manufacture: If only a fraction of the material is extracted/harvested/recovered and manufactured within a 500 mile radius then (only) that percentage (by weight) contributes to the regional value.
6. Rapidly Renewable: Materials and products made from raw materials that are harvested within a 10-year cycle (e.g., bamboo, cork, linoleum, fast-growing poplar, wheatboard, wool carpet)

7. FSC Certified: Wood-based products which are certified by the Forest Stewardship Council and carry a Chain-of-Custody certificate number from the vendor or manufacturer.

8. VOC Content: The quantity of volatile organic compounds contained in products such as adhesives, sealants and architectural coatings. VOC content is to be reported in grams/liter or lbs/gallon

Contractor Certification:

I, _____ a duly authorized representative of _____ hereby certify that the material information contained herein is an accurate representation of the material qualifications to be provided by us, as components of the final building construction. Furthermore, I understand that any change in such qualifications during the purchasing period will require prior written approval from the Construction Manager and Owner.

SIGNATURE OF AUTHORIZED REPRESENTATIVE: _____ Date: _____ p. ____ of ____

**NEW PASSENGER TERMINAL
DULUTH INTERNATIONAL AIRPORT
DULUTH, MINNESOTA**

**SECTION 01400 - QUALITY CONTROL -
TESTING SERVICES**

1. GENERAL

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections apply to this Section.
- B. This section specifies the general requirements for testing and inspection services.
- C. Cooperate with Owner's testing laboratory and all others responsible for testing and inspecting the Work.
- D. Provide other testing and inspecting as specified to be furnished by the Contractor in this Section and/or elsewhere in these Specifications.
- E. Provide quality control by the observation and acceptance of work by others being built upon.
- F. Related work described elsewhere:
 - 1. Requirements for testing are described in Divisions 2, 3, 4 and 5 product sections of these Specifications.
 - 2. Where no testing requirements are described, but the Construction Manager decides that testing is required, he may direct that such testing be performed under current standards for testing and Section 7.7 of the General Conditions.
- G. Selection of testing laboratory: The Owner shall hire and pay for an independent testing laboratory.

2. CODES AND STANDARDS

- A. Testing, when required, will be in accordance with pertinent codes and regulations and with selected standards of the American Society for Testing and Materials.

3. REVIEW OF THE CONTRACT DOCUMENTS

- A. On all Project Drawings, figures take precedence over measurement by scale, and any scaling is done at the Contractor's own risk. Before ordering any materials or performing any Work, the Contractor shall verify all measurements at the project site and be responsible for the correctness of same.
- B. Promptly respond to test reports and related instructions to ensure necessary retesting and replacement of materials with the least possible delay in progress of the Work.

4. FIELD CONDITIONS

- A. The Contractor shall take field measurements and verify field conditions and shall carefully compare such field measurements and conditions with the Contract Documents and any shop drawings and product data before commencing any related work. Errors, inconsistencies or omissions shall be reported to the Construction Manager and the Architect at once.

5. PAYMENT FOR TESTING

- A. Initial Services: The Owner's Testing Laboratory shall be responsible for initial testing services as outlined in various sections and Section 7.7 of the General Conditions.
- B. Re-Testing Services: When initial tests indicate non-compliance with the Contract Documents, all subsequent retesting occasioned by the non-compliance shall be performed by the same testing agency and the costs thereof will be borne by the Contractor responsible for the work that is non-compliant.

6. TESTING

- A. Code Compliance Testing: Inspections and tests required by codes or ordinances, or by a plan approval authority, and which are made by a legally constituted authority, shall be the responsibility of and shall be paid for by the Contractor, unless otherwise provided in the Contract Documents.
- B. Contractor's Convenience Testing: Inspecting and testing performed exclusively for the Contractor's convenience shall be the sole responsibility of the Contractor.

7. INSPECTION

- A. Inspection by Owner's Personnel: From time to time, personnel in the employ of the Owner may inspect the Work where the Work is in progress, but shall have no authority to direct the Contractor or request changes in the Work except through the Construction Manager and the Architect.
- B. Inspection of Work by Others: Each Contractor shall inspect Work of others which will receive or is adjacent to his Work before commencing his Work. Do not proceed until conditions which would result in a less than first class installation are satisfactorily corrected. Commencing Work shall be construed as acceptance of the Work of others, by the Contractor, as satisfactory to receive his Work. The Contractor shall bear all costs to correct the unsatisfactory Work.

8. COOPERATION WITH TESTING LABORATORY

- A. Representatives of the testing laboratory shall have access to the Work at all times. Provide facilities for such access in order that the laboratory may properly perform its function.
- B. Specimens and samples for testing, unless otherwise provided in the Contract Documents, will be taken by the testing personnel. Sampling equipment and personnel will be provided by the testing laboratory. Deliveries of specimens and samples to the testing laboratory will be performed by the testing laboratory.

- C. Test results and reports shall be furnished simultaneously to the Engineer (2 copies) and the Construction Manager (1 copy) within one week of testing.

9. TESTING SCHEDULE

- A. The Owner shall pre-qualify and identify qualified independent inspection agencies in a timely manner, allowing Engineer adequate time for review and approval.
- B. Special Structural Testing Schedule to be implemented per specifications.
- C. When changes of construction schedule are necessary during construction, the Construction Manager shall coordinate such changes of schedule with the testing laboratory as required.
- D. When the testing laboratory is ready to test according to the established schedule, but is prevented from testing or taking specimens due to incompleteness of the Work, all extra charges for testing attributable to the delay may be backcharged to the Contractor and shall not be borne by the Owner.

END OF SECTION 01400

**NEW PASSENGER TERMINAL
DULUTH INTERNATIONAL AIRPORT
DULUTH, MINNESOTA**

**SECTION 01421 – STANDARDS
AND DEFINITIONS**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DEFINITIONS

- A. General: Basic contract definitions are included in the Conditions of the Contract.
- B. "Indicated": The term "indicated" refers to graphic representations, notes, or schedules on the Drawings; or to other paragraphs or schedules in the Specifications and similar requirements in the Contract Documents. Terms such as "shown," "noted," "scheduled," and "specified" are used to help the user locate the reference. No limitation on location is intended.
- C. "Directed": Terms such as "directed," "requested," "authorized," "selected," "approved," "required," and "permitted" mean directed by the Architect, requested by the Architect, and similar phrases. However, no such implied meaning will be interpreted to extend the Architect's responsibility into Contractor's area of construction supervision.
- D. "Approved": The term "approved," when used in conjunction with the Architect's action on the Contractor's submittals, applications, and requests, is limited to the Architect's duties and responsibilities as stated in the Conditions of the Contract.
- E. "Regulations": The term "regulations" includes laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, as well as rules, conventions, and agreements within the construction industry that control performance of the Work.
- F. "Furnish": The term "furnish" means to supply and deliver to the Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
- G. "Install": The term "install" describes operations at the Project site including the actual unloading, temporary storage, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.
- H. "Provide": The term "provide" means to furnish and install, complete and ready for the intended use.
- I. "Installer": An installer is the Contractor or another entity engaged by the Contractor, either as an employee, subcontractor, or contractor of lower tier, to perform a particular construction activity, including installation, erection, application, or similar operations. Installers are required to be experienced in the operations they are engaged to perform.

1. Trades: Using a term such as "carpentry" does not imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter." It also does not imply that requirements specified apply exclusively to tradespersons of the corresponding generic name.
- J. "Project Site" is the space available to the Contractor for performing construction activities, either exclusively or in conjunction with others performing other work as part of the Project. The extent of the Project site is shown on the Drawings and may or may not be identical with the description of the land on which the Project is to be built.
- K. "Testing Agencies, Laboratories or Service": All terms interchangeably refer to an independent entity engaged to perform specific inspections or tests, either at the Project site or elsewhere, and to report on and, if required, to interpret results of those inspections or tests.
- L. "Nationally Recognized Testing Laboratories": The term "nationally recognized testing laboratory (NRTL)" shall mean a firm or organization which is recognized by OSHA in accordance with 29 CFR Part 1910.7 to test and approve (i.e., certify, label or list) equipment or materials as being safe for the intended use. Labeling and / or listing of products by NRTL is acceptable wherever a reference to the UL or FMRC label is made in the specifications.
- M. "Label": The label must be provided by a nationally recognized testing laboratory. The Contractor shall provide a statement from the testing laboratory attesting that the laboratory has been approved by OSHA to certify the category of product(s) being submitted for approval.

1.3 SPECIFICATION FORMAT AND CONTENT EXPLANATION

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

1.4 INDUSTRY STANDARDS

- A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.
 - 1. Reference standards (standards referenced directly in the contract documents) take precedence over standards that are not referenced but generally recognized in the industry for applicability to the work.
 - 2. Unreferenced Standards: Except as otherwise limited by the contact documents, standards not referenced but recognized in the construction industry as having direct applicability will be enforced for performance of the work. The decision as to whether an industry code or standard is applicable, or as to which of several standards are applicable, is the sole responsibility of the Architect.

- B. Publication Dates: Comply with the standards in effect as of the date of the Contract Documents.
 - 1. Updated Standards: Submit a change order proposal where an applicable industry code or standard has been revised and reissued after the date of the Contract Documents and before the performance of the work affected. The Architect will decide whether to issue a change order to proceed with the updated standard.

- C. Conflicting Requirements: Where compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer uncertainties and requirements that are different but apparently equal to the Architect for a decision before proceeding.
 - 1. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of the requirements. Refer uncertainties to the Architect for a decision before proceeding.
 - 2. The Architect is the sole interpreter of what constitutes "minimum requirements" in any given situation. Exceeding minimum requirements in one or more aspects of any given specification does not cancel or replace the need to meet minimum requirements of any other aspect of that specification.

- D. Copies of Standards: Each entity engaged in construction on the Project must be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.
 - 1. Where copies of standards are needed to perform a required construction activity, the Contractor shall obtain copies directly from the publication source and make them available on request.

- E. Abbreviations and Names: Trade association names and titles of general standards are frequently abbreviated. Where abbreviations and acronyms are used in the Specifications or other Contract Documents, they mean the recognized name of the trade association, standards-generating organization, authorities having jurisdiction, or other entity applicable to the context of the text provision. Refer to Gale

Research's "Encyclopedia of Associations" or Columbia Books' "National Trade & Professional Associations of the U.S.," which are available in most libraries.

1.5 GOVERNING REGULATIONS AND AUTHORITIES

- A. The Architect has contacted authorities having jurisdiction where necessary to obtain information necessary for preparation of Contract Documents. Contact authorities having jurisdiction directly for information and decision having a bearing on the work.

1.6 SUBMITTALS

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

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 01421

**NEW PASSENGER TERMINAL
DULUTH INTERNATIONAL AIRPORT
DULUTH, MINNESOTA**

**SECTION 01450 – STRUCTURAL TESTS
AND SPECIAL INSPECTIONS**

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 INTENT AND CONDITIONS

- A. Intent:
1. For compliance with the Minnesota State Building Code, the Owner shall employ and pay for a special inspector (or inspectors) as required by Chapter 17 of the International Building Code.
 2. Duties and responsibilities of the special inspector(s) shall be as outlined in Chapter 17 of the International Building Code and as herein specified.
 3. Define and coordinate structural tests and special inspection services.
 4. Define and coordinate conventional testing and inspection services.
 5. Testing and Inspection services are intended to assist in determining probable compliance of the work with requirements specified. These services do not relieve the Contractor of responsibility for compliance with the requirements of the Contract Documents.
- B. Conditions:
1. If inspection of fabricator's work is required, the Owner's representative may require testing and inspection of the work at the plant, before shipment. Owner, Architect and Structural Engineer of Record (SER) reserve the right to reject material not complying with Contract Documents.
 2. Perform testing and inspection in accordance with industry standard used as reference for specific material or procedure unless other criteria are specified. In the absence of a referenced standard, accomplish tests in accordance with generally accepted industry standards.
 3. Failure to detect defective work or materials shall in no way prevent later rejection if defective work or materials are discovered.

1.3 RELATED REQUIREMENTS

- A. Refer to individual technical specification sections for additional qualifications, inspections, tests, frequency and standards required.

1.4 DEFINITIONS

- A. Testing: Evaluation of systems, primarily requiring physical manipulation and analysis of materials, in accordance with approved standards.
- B. Inspection: Evaluation of systems, primarily requiring observation and judgment.

- C. Structural Tests and Special Inspections: Structural Tests and Special Inspection Services herein include items required by Chapter 17 of the International Building Code as adopted by the current Minnesota State Building Code, and other items which in the professional judgment of the Structural Engineer of Record, are critical to the integrity of the building structure.
- D. Conventional Testing and Inspections: Conventional Testing and Inspection Services herein describe those items not specially required by Code but may be considered essential to the proper performance of the building systems.
- E. Architect of Record: The prime consultant in charge of overall design and coordination of the Project.
- F. Structural Engineer of Record (SER): The Licensed Engineer in responsible charge of the structural design for the Project.
- G. Licensed Structural Engineer: A professional engineer with education and experience in the design of structures similar to this Project and licensed in Minnesota.
- H. Testing Agency (TA):
 - a. Testing Agency: Approved independent testing agency acceptable to the Owner, Architect, SER and as noted below:
 - b. Authorized to operate in the State of Minnesota and experienced with the requirements and testing methods specified in the Contract Documents.
 - c. Meeting applicable requirements of references stated in paragraph 1.4.
 - d. Calibrate testing equipment at reasonable intervals by devices of accuracy traceable to either the National Bureau of Standards, or to accepted values of natural physical constants.
- I. Special Inspector (SI): A properly qualified individual or firm performing special inspections.
- J. The categories of special inspector are:
 - 1. Special Inspector - Technical I, II and III: Usually an employee of a testing agency:
 - a. Technical I (Division 02) - Technician shall be under the direct supervision of a licensed civil/geotechnical engineer regularly engaged in this type of work. Work shall be performed in a qualified geotechnical/testing laboratory.
 - b. Technical I (Division 03)
 - 1) ACI Certified Concrete Field Testing Technician – Grade I.
 - 2) ACI Certified Concrete Strength Testing Technician.
 - 3) ACI Certified Concrete Laboratory Testing Technician – Grade 1.
 - 4) ACI Certified Concrete Construction Inspector-In-Training.
 - 5) Inspector shall be employed by a testing laboratory, experienced in the type of work being performed, and under the direct supervision of a licensed civil/structural engineer.
 - c. Technical I (Division 04) - Technician shall be under the direct supervision of a licensed civil/structural engineer regularly engaged in testing and inspection of this type of work. The licensed engineer shall review and approve all inspection reports.

- d. Technical I (Division 05) - Non-destructive Testing Technician SNT-TC-1A Level I, and/or AWS Certified Associate Weld Inspector (CAWI).
- e. Technical I (Division 07) - Shall be familiar with the interpretation and use of ASTM E 605, and have prior field experience in testing and inspection of spray-applied fireproofing. Shall be supervised by an engineer licensed to practice in the state of Minnesota.
- f. Technical II (Division 02) - Technician with a minimum of 2 years' experience, or a graduate engineer, and is an employee of a qualified and approved geotechnical/technical laboratory, under the direct supervision of a licensed civil/geotechnical engineer regularly engaged in this type of work.
- g. Technical II (Division 03)
 - 1) ACI Certified Concrete Laboratory Testing Technician - Grade II.
 - 2) ACI Certified Laboratory Aggregate Testing Technician.
 - 3) ACI Certified Concrete Construction Inspector.
 - 4) Inspector shall be employed by a testing laboratory, experienced in the type of work being performed, and under the direct supervision of a licensed civil/structural engineer.
- h. Technical II (Division 04) - Graduate civil/structural engineer, with experience in this type of work. Supervised by a licensed civil/structural engineer. The licensed engineer shall review and approve all inspection reports.
- i. Technical II (Division 05) - Non-destructive Testing Technician ASNT TC-1A Level II, (NDE Technician II), AWS/CAWI, with minimum 3 years' experience, or an AWS/CWI.
- j. Technical III (Division 02) - A civil/geotechnical engineer regularly engaged in this type of work with a minimum of 4 years' experience, licensed in the state of Minnesota, and is an employee of a qualified and approved geotechnical/testing laboratory. This licensed engineer shall review and approve all final field reports.
- k. Technical III (Division 03) - A civil/structural engineer regularly engaged in this type of work, with a minimum of 4 years' experience and licensed in the state of Minnesota and is an employee of a qualified and approved testing laboratory. The licensed engineer shall review and approve all reports.
- l. Technical III (Division 05) - ASNT Level III with a minimum of 10 years' experience or an AWS/CWI with a minimum of 10 years' experience.
- 2. Special Inspector - Structural I and II: Usually an employee of the Structural Engineer of Record.
 - a. Structural I (Division 03) - Graduate civil/structural engineer, or other personnel acceptable to the SER, with experience in the design of structural systems of this type. Inspections shall be performed under the direct supervision of a licensed civil/structural engineer.
 - b. Structural II (Division 03) - Civil/structural engineer regularly engaged in the design of structural systems of this type, licensed in the state of Minnesota. The licensed engineer shall review and approve all inspection reports.
- K. Building Official: The Officer or duly authorized representative charged with the administration and enforcement of the State Building Code.

1.5 REFERENCES

- A. ANSI/ASTM E329 – Standard Specification for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction.
- B. ASTM E543 – Standard Practice for Agencies Performing Non-destructive Testing.
- C. ASTM C1077 – Standard Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation.
- D. ASTM C1093 – Standard Practice for the Accreditation of Testing Agencies for Unit Masonry.
- E. ANSI/ASTM D3740 - Standard Practice for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.
- F. Minnesota State Building Code.
- G. International Building Code.
- H. See technical specification sections for specific references.

1.6 RESPONSIBILITIES/AUTHORITY

- A. Structural Tests and Special Inspections:
 - 1. Special Inspector:
 - a. Attend all pre-installation meetings to review scope of structural tests and special inspections.
 - b. Test and/or inspect the work assigned for conformance with the building department approved plans, specifications, and applicable material and workmanship provisions of the code. Perform testing and inspection in a timely manner to avoid delay of work.
 - c. Bring nonconforming items to the immediate attention of the Contractor for correction, then, if uncorrected after a reasonable period of time, to the attention of the Structural Engineer of Record, the Building Official, and to the Architect.
 - d. Submit test and/or inspection reports to the Building Official, Contractor, the Structural Engineer of Record, and other designated persons in accordance with the Structural Testing and Special Inspection Schedule.
 - e. Submit a final signed report stating whether the work requiring special inspection was, to the best of the inspector's knowledge, in conformance with the approved plans, specifications and the applicable workmanship provisions of the code.
 - f. Sign the Structural Testing and Special Inspection Schedule in conjunction with other responsible parties prior to commencing construction.
 - 2. Architect:
 - a. Coordinate the flow of reports and related information to expedite resolution of construction issues.
 - b. Attend pertinent pre-installation meetings to review scope of structural testing and special inspection.

- c. Complete and sign the Structural Testing and Special Inspection Schedule in conjunction with other responsible parties prior to commencing construction. Provide a completed copy of the schedule to all signed parties including Building Official.
- 3. Structural Engineer of Record:
 - a. Identify items requiring structural testing and special inspection including special cases.
 - b. Define "type" of special inspector required for "description" of work indicated on the Structural Testing and Special Inspection Schedule.
 - c. Attend pertinent pre-installation meetings to review scope of structural testing and special inspection.
 - d. Complete and sign the Structural Testing and Special Inspection Schedule in conjunction with other responsible parties prior to commencing construction.
 - e. Review reports issued by all special inspectors.
 - f. If engaged as a special inspector, provide structural testing and special inspection services as noted in Article 1.6.A.1.
- 4. Testing Agency:
 - a. When engaged as a special inspector, provide structural testing and special inspection services as noted in Item 1.6.A.1.
 - b. Sign the Structural Testing and Special Inspection Schedule in conjunction with other responsible parties prior to commencing construction.
 - c. Attend pertinent pre-installation meetings to review scope of structural testing and special inspection.
- 5. Contractor:
 - a. Arrange and attend all pre-installation meetings to review scope of structural testing and special inspection. Include the Building Official, Owner, Architect, SER, Testing Agency and other parties concerned.
 - b. Post or make available the Structural Testing and Special Inspection Schedule within project site office. Provide timely notification to those parties designated on the schedule so they may properly prepare for and schedule their work.
 - c. Provide special inspector access to the approved plans and specifications at the project site.
 - d. Review all reports issued by special inspectors.
 - e. Retain at the project site all reports submitted by the special inspectors for review by the building official upon request.
 - f. Correct in a timely manner, deficiencies identified in inspection and/or testing reports.
 - g. Provide safe access to the work requiring inspection and/or testing.
 - h. Provide labor and facilities to provide access to the work and to obtain, handle and deliver samples, to facilitate testing and inspection and for storage and curing of test samples.
 - i. Sign the Structural Testing and Special Inspection Schedule in conjunction with other responsible parties prior to commencing construction.
 - j. Verification of conformance of work within specified tolerances is solely the responsibility of the Contractor.
- 6. Fabricator:
 - a. Submit a Certificate of Compliance to the Building Official, Special Inspector, and Structural Engineer of Record stating the work was performed in accordance with the Contract Documents.

- b. Sign the Structural Testing and Special Inspection Schedule in conjunction with other responsible parties prior to commencing construction.
- 7. Building Official:
 - a. Review all special inspector qualifications.
 - b. Review all fabricators who perform work in their shop, which requires special inspection.
 - c. Accept and sign completed Structural Testing and Special Inspection Schedule.
 - d. Review reports and recommendations submitted by special inspector.
 - e. Review the "final signed reports" submitted by special inspector. These documents must be accepted and approved by the building department prior to issuance of a Certificate of Occupancy.
 - f. Determine work, which, in the Building Officials opinion, involves unusual hazards or conditions.
- 8. Owner:
 - a. Provide and pay cost of structural testing and special inspection services.
 - b. Provide special inspector with Contract Documents and accepted shop drawings.
 - c. Provide special inspectors and testing agencies with full access to the site at all times.
 - d. Sign the Structural Testing and Special Inspection Schedule in conjunction with other responsible parties prior to commencing construction.

- B. Inspections by Building Official: provide timely notice for inspections performed by the building official, as required by IBC Chapter 17, the State Building Code, and local ordinance.

1.7 INSPECTION NOTICES

- A. Contractor: Provide minimum of 24 hours notice for all items requiring testing or inspection. Do not place items requiring testing and inspection services prior to or during placement until testing and inspection services are available. Do not enclose or obscure items requiring testing and inspection services after placement until testing and inspection services are performed.

1.8 REPORTS

- A. Testing agency and/or special inspectors shall submit a report in accordance with the Structural Testing and Special Inspection Schedule and shall conduct and interpret tests and inspections and state in each report whether; (1) test specimens and observations comply with Contract Documents, and specifically state any deviations, (2) record types and locations of defects found in work, (3) record work required and performed, to correct deficiencies.
- B. Submit reports for structural testing and special inspection, in timely manner to the Contractor, Building Official, SER, and Architect.
 - 1. Submit reports for ongoing work, to provide the information noted below:
 - a. Date issued.
 - b. Project title and number.
 - c. Firm name and address.
 - d. Name and signature of tester or inspector.

- e. Date and time of sampling.
 - f. Date of test or inspection.
 - g. Identification of product and specification section.
 - h. Location in project, including elevations, grid location and detail.
 - i. Type of test or inspections.
 - j. Results of tests or inspections and interpretation of same.
 - k. Observations regarding compliance with Contract Documents or deviations there from.
2. Submit final signed report stating that, to the best of the special inspector's knowledge, the work requiring testing and/or inspection conformed to the Contract Documents.

1.9 FREQUENCY OF TESTING AND INSPECTION

- A. For detailed requirements see individual technical specification sections, and Part 3 of this section.

1.10 PROTECTION AND REPAIR

- A. Upon completion of testing, sample-taking, or inspection, repair damaged work and restore substrates and finishes to eliminate deficiencies, including deficiencies in the visual qualities of exposed surfaces, as judged solely by the Architect/Engineer of Record. Protect work exposed by or for testing and/or inspection and protect repaired work. Repair and protection is the Contractor's responsibility, regardless of the assignment of responsibility for testing and/or inspection.

1.11 TESTS TO DEMONSTRATE QUALIFICATION

- A. If the Contractor proposes a product material, method, or other system that has not been pre-qualified, the Architect or SER may require applicable tests, to establish a basis for acceptance or rejection. These tests will be paid for by the Contractor.
- B. The Architect or SER reserves the right to require certification or other proof that the system proposed, is in compliance with any tests, criteria or standards called for. The certificate shall be signed by a representative of an independent testing agency.

PART 2 - PRODUCTS (NOT USED)

2.1

PART 3 - EXECUTION

3.1 SCOPE OF STRUCTURAL TESTS AND SPECIAL INSPECTIONS

- A. Refer to individual specification section articles for Quality Control testing and inspection items.

3.2 STRUCTURAL TESTS AND SPECIAL INSPECTIONS PROGRAM SUMMARY

- A. The parties involved shall complete and sign the Structural Testing and Special Inspection Schedule. The completed schedule is an element of the Contract Documents and after permit issuance, becomes part of the building department approved plans and specifications. The completed schedule shall include the following:
1. Specific listing of items requiring inspection and testing.
 2. Associated specification section which defines applicable standards by which to judge conformance with approved plans and specifications in accordance with IBC Chapter 17 as adopted by the State Building Code. The specification section should also include the degree or basis of inspection and testing; i.e., intermittent/will-call or full-time/continuous.
 3. Frequency of reporting, i.e., intermittent, weekly, monthly, per floor, etc.
 4. Parties responsible for performing inspection and testing work.
 5. Required acknowledgments by each designated party.
- B. See attached "Structural Testing and Special Inspection Schedule".

END OF SECTION 01450

Structural Tests and Special Inspections Schedule

Project Name: _____

Location: _____

Permit No.: _____ (1)

STRUCTURAL TESTS AND SPECIAL INSPECTIONS				
Specification Reference (2)	Description (3)	Type of Inspector (4)	Report Frequency (5)	Assigned Firm (6)
03100	Concrete Formwork	Tech II	Periodic	
03200	Concrete Reinforcement Footings, Foundation Walls, and Columns	Tech II	Periodic	
03300	Cast-In-Place Concrete Material Sampling & Testing	Tech I	Daily	
03300	Cast-In-Place Concrete Concrete Mix Verification	Tech I	Daily	
03300	Cast-In-Place Concrete Concrete Placement	Tech I	Daily	
03300	Cast-In-Place Concrete Protection & Curing	Tech II	Daily	
03300	Cast-In-Place Concrete Embedded Items	Tech II	Periodic	
04200	Unit Masonry Material Testing	Tech II	Periodic	
04200	Unit Masonry Preparation & Placement	Tech II	Periodic	
04200	Unit Masonry Reinforcement	Struc I	Periodic	
04200	Unit Masonry Grouting	Tech II	Daily	
05120	Structural Steel High Strength Bolting	Tech II	Periodic	
05120	Structural Steel Welding	Tech I / Tech II	Periodic	
05120	Structural Steel Headed Shear Studs	Tech I	Periodic	
05120	Structural Steel Mechanical Fasteners	Tech I	Periodic	
05 20	Structural Steel General Configuration	Struc I	Periodic	
05310	Steel Roof Deck Welding	Tech II	Periodic	
02220	Earthwork	Tech II	Daily	

Notes: This schedule to be filled out and included in the project specification. Information unavailable at that time shall be filled out when applying for a building permit.

Permit No. to be provided by the Building Official.

Reference to specific technical scope section in program.

Use descriptions per IBC Chapter 17, as adopted by State Building Code.

Special Inspector – Technical, Special Inspector – Structural.

Weekly, monthly, per test/inspection, per floor, etc.

Firm contracted to perform services.

ACKNOWLEDGEMENTS

Each appropriate representative shall sign below:

Owner:	Firm:	Date:
Contractor:	Firm:	Date:
Architect:	Firm:	Date:
SER:	Firm:	Date:
SI-S:	Firm:	Date:
TA:	Firm:	Date:
SI-T:	Firm:	Date:
TA:	Firm:	Date:
SI-T:	Firm:	Date:
F:	Firm:	Date:
F:	Firm:	Date:

* The individual names of all prospective special inspectors and the work they intend to observe shall be identified. (Use reverse side of form, if more room is needed.).

LEGEND:

SER = Structural Engineer of Record

SI-S = Special Inspector – Structural

TA = Testing Agency

SI-T = Special Inspector – Technical

F = Fabricator.

Accepted for the Building Department By _____

Date. _____

**NEW PASSENGER TERMINAL
DULUTH INTERNATIONAL AIRPORT
DULUTH, MINNESOTA**

**SECTION 01500 - CONSTRUCTION
FACILITIES AND TEMPORARY
CONTROLS**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This section includes requirements for temporary services and facilities, including temporary utilities, support facilities, security and protection.
- B. Temporary utilities include, but are not limited to, the following:
 - 1. Water service and distribution.
 - 2. Temporary electric power and light.
 - 3. Temporary heat.
 - 4. Ventilation.
 - 5. Telephone service.
 - 6. Sanitary facilities, including drinking water.
 - 7. Storm and sanitary sewer.
- C. Temporary construction and support facilities include, but are not limited to, the following:
 - 1. Field offices and storage sheds.
 - 2. Temporary roads and paving.
 - 3. Dewatering facilities and drains.
 - 4. Temporary enclosures.
 - 5. Temporary project identification signs and bulletin boards.
 - 6. Waste disposal services.
 - 7. Rodent and pest control.
 - 8. Construction aids and miscellaneous services and facilities.
- D. Security and protection facilities include, but are not limited to, the following:
 - 1. Temporary fire protection.
 - 2. Barricades, warning signs, and lights.
 - 3. Sidewalk bridge or enclosure fence for the site.
 - 4. Environmental protection.

1.3 QUALITY ASSURANCE

- A. Regulations: Comply with industry standards and applicable laws and regulations of authorities having jurisdiction including, but not limited to, the following:
 - 1. Building Code requirements.
 - 2. Health and safety regulations.
 - 3. Utility company regulations.
 - 4. Police, Fire Department, and Rescue Squad rules.
 - 5. Environmental protection regulations.

- B. Inspections: Arrange for authorities having jurisdiction to inspect and test each temporary utility before use. Obtain required certifications and permits.

1.4 PROJECT CONDITIONS

- A. Conditions of Use: Keep temporary services and facilities clean and neat in appearance. Operate in a safe and efficient manner. Relocate temporary services and facilities as the work progresses. Do not overload facilities or permit them to interfere with progress. Take necessary fire-prevention measures. Do not allow hazardous, dangerous, or unsanitary conditions, or public nuisances to develop or persist on-site.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Use qualified personnel for installation of temporary facilities. Locate facilities where they will serve the Project adequately and result in minimum interference with performance of the work. Relocate and modify facilities as required.
- B. Provide each facility ready for use when needed to avoid delay. Maintain and modify as required. 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: Engage the appropriate local utility company to install temporary service or connect to existing service. Where company provides only part of the service, provide the remainder with matching, compatible materials and equipment. Comply with company recommendations.
 1. Arrange with company and existing users for a time when service can be interrupted, if necessary, to make connections for temporary services.
 2. Provide adequate capacity at each stage of construction. Prior to temporary utility availability, provide trucked-in services.
 3. Obtain easements to bring temporary utilities to the site where the Owner's easements cannot be used for that purpose.
 4. Use Charges: Cost or use charges for temporary facilities are not chargeable to the Owner or Architect. Neither the Owner nor Architect will accept cost or use charges as a basis of claims for Change Orders.
- B. Water Service: Install water service and distribution piping of sizes and pressures adequate for construction until permanent water service is in use.
 1. Sterilization: Sterilize temporary water piping prior to use.
 2. When nonpotable water is used, mark each outlet with hazardous warning signs.
- C. Temporary Electric Power Service: For temporary power alignment and cost, contractor shall contact applicable local electrical utility.
 1. Provide weatherproof, grounded electric power service and distribution system of sufficient size, capacity, and power characteristics during

- construction period. Include meters, transformers, overload-protected disconnects, automatic ground-fault interrupters, and main distribution switch gear.
2. Power Distribution System: Install wiring overhead and rise vertically where least exposed to damage. Where permitted, wiring circuits not exceeding 125 Volts, AC 20 Ampere rating, and lighting circuits may be nonmetallic sheathed cable where overhead and exposed for surveillance.
- D. Temporary Lighting: When overhead floor or roof deck has been installed, provide temporary lighting with local switching.
1. Install and operate temporary lighting that will fulfill security and protection requirements without operating the entire system. Provide temporary lighting that will provide adequate illumination for construction operations and traffic conditions.
- E. Temporary Heat: Provide temporary heat required by construction activities for curing or drying of completed installations or for protection of installed construction from adverse effects of low temperatures or high humidity. Select safe equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce the ambient condition required and minimize consumption of energy.
- F. Heating Facilities: Except where the Owner authorizes use of the permanent system, provide vented, self-contained, LP-gas or fuel-oil heaters with individual space thermostatic control. Use of gasoline-burning space heaters, open flame, or salamander heating units is prohibited.
- G. Temporary Telephones: Provide temporary telephone service throughout the construction period for all personnel engaged in construction activities. Install telephone on a separate line for each temporary office and first-aid station.
1. Separate Telephone Lines: Provide additional telephone lines for the following:
 - a. Where an office has more than 2 occupants, install a telephone for each additional occupant or pair of occupants.
 - b. Provide a dedicated telephone line for a fax machine in the field office.
 - c. Provide a separate line for the Owner's use.
 2. At each telephone, post a list of important telephone numbers.
- H. Sanitary facilities include temporary toilets, wash facilities, and drinking-water fixtures. Comply with regulations and health codes for the type, number, location, operation, and maintenance of fixtures and facilities. Install where facilities will best serve the Project's needs.
1. Provide toilet tissue, paper towels, paper cups, and similar disposable materials for each facility. Provide covered waste containers for used material.
- I. Toilets: Install self-contained toilet units. Shield toilets to ensure privacy. Use of pit-type privies will not be permitted.
1. Provide separate facilities for male and female personnel.
- J. Wash Facilities: Install wash facilities supplied with potable water at convenient locations for personnel involved in handling materials that require wash-up for a

healthy and sanitary condition. Dispose of drainage properly. Supply cleaning compounds appropriate for each condition.

1. Provide safety showers, eyewash fountains, and similar facilities for convenience, safety, and sanitation of personnel.
- K. Drinking-Water Facilities: Provide containerized, tap-dispenser, bottled-water drinking-water units, including paper supply.
1. Where power is accessible, provide electric water coolers to maintain dispensed water temperature at 45 to 55 deg F.
- L. Sewers and Drainage: If sewers are available, provide temporary connections to remove effluent that can be discharged lawfully. If sewers are not available or cannot be used, provide drainage ditches, dry wells, stabilization ponds, and similar facilities. If neither sewers nor drainage facilities can be lawfully used for discharge of effluent, provide containers to remove and dispose of effluent off-site in a lawful manner.
1. Filter out excessive amounts of soil, construction debris, chemicals, oils, and similar contaminants that might clog sewers or pollute waterways before discharge.
 2. Connect temporary sewers to the municipal system, as directed by sewer department officials.
 3. Maintain temporary sewers and drainage facilities in a clean, sanitary condition. Following heavy use, restore normal conditions promptly.
- M. Provide earthen embankments and similar barriers in and around excavations and subgrade construction, sufficient to prevent flooding by runoff of storm water from heavy rains.

3.3 TEMPORARY CONSTRUCTION AND SUPPORT FACILITIES INSTALLATION

- A. Locate field offices, storage sheds, and other temporary construction and support facilities for easy access.
1. Maintain support facilities until near Substantial Completion. Remove prior to Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to the Owner.
- B. Contractor=s Facilities: Provide a field office building and sheds adequate in size and accommodation for all Contractor=s offices, supply and storage.
1. Within the Contractor=s facilities, provide enclosed space adequate for holding project meetings. Furnish with all required tables, chairs and utilities.
 2. The entire facilities, including furniture, will remain the property of the Contractor and shall be removed from the site after completion of the work.
- C. Architect=s Field Office: Per Owner=s directive, Architect shall use third floor of existing terminal building.
- D. Temporary Paving: Construct and maintain temporary roads and paving to adequately support the indicated loading and to withstand exposure to traffic during the construction period. Locate temporary paving for roads, storage areas, and parking where the same permanent facilities will be located. Review proposed modifications to permanent paving with the Architect.
1. Paving: Comply with Division 2 sections for construction and maintenance of temporary paving.

2. Coordinate temporary paving development with subgrade grading, compaction, installation and stabilization of subbase, and installation of base and finish courses of permanent paving.
 3. Install temporary paving to minimize the need to rework the installations and to result in permanent roads and paved areas without damage or deterioration when occupied by the Owner.
 4. Delay installation of the final course of permanent asphalt concrete paving until immediately before Substantial Completion. Coordinate with weather conditions to avoid unsatisfactory results.
 5. Extend temporary paving in and around the construction area as necessary to accommodate delivery and storage of materials, equipment usage, administration, and supervision.
- E. Dewatering Facilities and Drains: Provide drainage and dewatering facilities as required by conditions and applicable requirements. Maintain the site, excavations, and construction free of water.
- F. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities.
1. Where heat is needed and the permanent building enclosure is not complete, provide temporary enclosures where there is no other provision for containment of heat or as required by conditions to allow continuation of scheduled construction activities. Coordinate enclosure with ventilating and material drying or curing requirements to avoid dangerous conditions and effects.
 2. Protection and temporary closures shall be provided at all exterior openings in the building including doors, walls and roof to maintain the building weather and dust tight. All protection shall be substantial so that it will not be disturbed by wind and weather normal to the area and season.
 3. Openings in floors shall be protected and closures provided to prevent floor to floor transfer of dust, debris and conditioned air. Conform to fire and safety regulations of the authorities having jurisdiction.
- G. Project Identification and Temporary Signs: Furnish and install and maintain one project identification sign of the size, graphic design, style of lettering and construction as shown on the drawings or included at the end of this section.
1. Finishes and painting materials shall be adequate to resist weathering and fading for the scheduled construction period.
 2. Location: Unless noted otherwise, erect on the site at a lighted location of high public visibility, adjacent to the main entrance to the site, as approved by the Architect.
 3. Informational Signs: Provide informational signs with painted lettering, or standard products. Size of signs and lettering shall be as required by regulatory agencies, or as appropriate to the usage. Colors as required by regulatory agencies, otherwise of uniform colors throughout the project. Erect at appropriate locations to provide the required information and at a height for optimum visibility.
 4. Materials: Structure and framing may be preservative-treated wood or steel, in sound condition and structurally adequate to the work and suitable specified finish. Paint is specified in Division 9.
 5. Maintenance: Maintain signs and supports in a neat, clean condition, and repair damages to structure, framing or sign as required.
 6. Relocate informational signs as required by progress of the work.

- 7. Remove signs, framing, supports and foundations at project completion.
- H. No other signs or advertising of any kind shall be allowed on the job site, except as specifically approved by the Architect.
- I. Temporary Exterior Lighting: Install exterior yard and sign lights so signs are visible when work is being performed.
- J. Rodent and Pest Control: Before deep foundation work has been completed, retain a local exterminator or pest control company to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests. Employ this service to perform extermination and control procedures at regular intervals so the Project will be free of pests and their residues at Substantial Completion. Perform control operations lawfully, using environmentally safe materials.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Except for use of permanent fire protection as soon as available, do not change over from use of temporary security and protection facilities to permanent facilities until Substantial Completion, or longer, as requested by the Architect.
- B. Temporary Fire Protection: Until fire-protection needs are supplied by permanent facilities, install and maintain temporary fire-protection facilities of the types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 10 "Standard for Portable Fire Extinguishers" and NFPA 241 "Standard for Safeguarding Construction, Alterations, and Demolition Operations."
 - 1. Locate fire extinguishers where convenient and effective for their intended purpose, but not less than one extinguisher on each floor at or near each usable stairwell.
 - 2. Store combustible materials in containers in fire-safe locations.
 - 3. Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire-protection facilities, stairways, and other access routes for fighting fires. Prohibit smoking in hazardous fire-exposure areas.
 - 4. Provide supervision of welding operations, combustion-type temporary heating units, and similar sources of fire ignition.
- C. Permanent Fire Protection: At the earliest feasible date in each area of the Project, complete installation of the permanent fire-protection facility, including connected services, and place into operation and use. Instruct key personnel on use of facilities.
- D. Barricades, Warning Signs, and Lights: Comply with standards and code requirements for erection of structurally adequate barricades. Paint with appropriate colors, graphics, and warning signs to inform personnel and the public of the hazard being protected against. Where appropriate and needed, provide lighting, including flashing red or amber lights.
- E. Enclosure Fence: Before excavation begins, install an enclosure fence with lockable entrance gates. Locate where indicated, or enclose the entire site or the portion determined sufficient to accommodate construction operations. Install in a manner that will prevent people, dogs, and other animals from easily entering the site, except by the entrance gates.

1. Provide open-mesh, chainlink fencing, minimum 6 feet high and complete with all required bracing, with posts set in a compacted mixture of gravel and earth.
 2. Maintain fence and gates throughout the construction period and remove at the end of the project, unless otherwise indicated by Architect.
 3. Repair any damage caused by installation and removal, and restore area to original or specified condition.
- F. Covered Walkway: Comply with regulations of authorities having jurisdiction as necessary if determined required by applicable codes erect a structurally adequate, protective covered walkway for passage of persons along the adjacent public street. Coordinate with entrance gates, other facilities, and obstructions.
1. Construct covered walkways using scaffold or shoring framing. Provide wood plank overhead decking, protective plywood enclosure walls, handrails, barricades, warning signs, lights, safe and well-drained walkways, and similar provisions for protection and safe passage. Extend the back wall beyond the structure to complete the enclosure fence. Paint and maintain in a manner acceptable to the Owner and the Architect.
- G. Security Enclosure and Lockup: Install substantial temporary enclosure of partially completed areas of construction. Provide locking entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security.
- H. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations, and minimize the possibility that air, waterways, and subsoil might be contaminated or polluted or that other undesirable effects might result. Avoid use of tools and equipment that produce harmful noise. Restrict use of noise-making tools and equipment to hours that will minimize complaints from persons or firms near the site.

3.5 OPERATION, TERMINATION, AND REMOVAL

- A. Supervision: Enforce strict discipline in use of temporary facilities. Limit availability of temporary facilities to essential and intended uses to minimize waste and abuse.
- B. Maintenance: Maintain facilities in good operating condition until removal. Protect from damage by freezing temperatures and similar elements.
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.
 2. Protection: Prevent water-filled piping from freezing. Maintain markers for underground lines. Protect from damage during excavation operations.
- C. Termination and Removal: Unless the Architect requests that it be maintained longer, remove each temporary facility when the need has ended, when replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with the 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 the Contractor's property. The Owner reserves the right to take possession of project identification signs.

2. Remove temporary paving not intended for or acceptable for integration into permanent paving. Where the area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil in the area. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at the temporary entrances, as required by the governing authority.
3. At Substantial Completion, clean and renovate permanent facilities used during the construction period including, but not limited to, the following:
 - a. Replace air filters and clean inside of ductwork and housings.
 - b. Replace significantly worn parts and parts subject to unusual operating conditions.
 - c. Replace lamps burned out or noticeably dimmed by hours of use.

END OF SECTION 01500

**NEW PASSENGER TERMINAL
DULUTH INTERNATIONAL TERMINAL
DULUTH, MINNESOTA**

**SECTION 01631 – PRODUCTS
AND SUBSTITUTIONS**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This section includes administrative and procedural requirements for handling requests for substitutions made after award of the Contract.
- B. Related Sections: The following sections contain requirements that relate to this section:
 - 1. Division 1, Section 01421 "Reference Standards and Definitions" specifies the applicability of industry standards to products specified.
 - 2. Division 1, Section 01300 "Submittals" specifies requirements for submitting the Contractor's Construction Schedule and the Submittal Schedule.

1.3 DEFINITIONS

- A. Definitions in this Article do not change or modify the meaning of other terms used in the Contract Documents.
 - 1. "Products" are items purchased for incorporation in the work, whether purchased for the Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
 - a. "Named Products" are items identified by the manufacturer's product name, including make or model number or other designation, shown or listed in the manufacturer's published product literature that is current as of the date of the Contract Documents.
 - 2. "Materials" are products substantially shaped, cut, worked, mixed, finished, refined or otherwise fabricated, processed, or installed to form a part of the work.
 - 3. "Equipment" is a product with operational parts, whether motorized or manually operated, that requires service connections, such as wiring or piping.
- B. Substitutions: Changes in products, materials, equipment, and methods of construction required by the Contract Documents proposed by the Contractor after award of the Contract are considered to be requests for substitutions. The following are not considered to be requests for substitutions:
 - 1. Substitutions requested by bidders during the bidding period, and accepted prior to award of Contract, are considered as included in the Contract Documents and are not subject to requirements specified in this section for substitutions.
 - 2. Revisions to the Contract Documents requested by the Owner or Architect.

3. Specified options of products and construction methods included in the Contract Documents.
4. The Contractor's determination of and compliance with governing regulations and orders issued by governing authorities.

1.4 SUBMITTALS

- A. Materials, products, equipment and systems are specified in the Contract Documents by manufacturer, trade name or distributor to establish a standard of the required criteria, including function, performance, dimension, appearance and quality to be met by any proposed substitution. Unless otherwise specified, application for substitutions will be considered by the Owner and the Architect after execution of the agreement. The burden of proof of merit of proposed substitute is upon the proposer. Substitute items shall not be incorporated in the work without prior written approval of the item by the Architect.
- B. Where an item is specified by one or more manufacturer's model number or specific item identification and "or approved equal" is included, only the item(s) that is specified by manufacturer's model number or specific identification is approved and any other item must be submitted for approval as a substitution.
- C. Where an item is specified by a referenced standard, the item must be submitted for approval same as a substitute.
- D. Submit three (3) copies of each request for substitution for consideration. Submit requests in the form and according to procedures required for change-order proposals.
- E. Identify the product or the fabrication or installation method to be replaced in each request. Include related Specification Section and drawing numbers.
- F. Provide complete documentation showing compliance with the requirements for substitutions, and the following information, as appropriate:
 1. Coordination information, including a list of changes or modifications needed to other parts of the work and to construction performed by the Owner and separate contractors that will be necessary to accommodate the proposed substitution.
 2. A detailed comparison of significant qualities of the proposed substitution with those of the work specified. Significant qualities may include elements such as performance, weight, size, durability, and visual effect.
 3. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
 4. Samples, where applicable or requested.
 5. A statement indicating the substitution's effect on the Contractor's Construction Schedule compared to the schedule without approval of the substitution. Indicate the effect of the proposed substitution on overall Contract Time.
 6. Cost information, including a proposal of the net change, if any in the Contract Sum.
 7. The Contractor's certification that the proposed substitution conforms to or exceeds requirements in the Contract Documents in every respect and is appropriate for the applications indicated. Include the Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of the failure of the substitution to perform adequately.

- G. Architect's Action: If necessary, the Architect will request additional information or documentation for evaluation within one week of receipt of a request for substitution. The Architect will notify the Contractor of acceptance or rejection of the substitution within two (2) weeks of receipt of the request, or one week of receipt of additional information or documentation, whichever is later. Acceptance will be in the form of a change order. If a decision on use of a proposed substitute cannot be made or obtained within the time allocated, use the product specified.

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION

- A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged and, unless otherwise indicated, new at the time of installation.
1. Provide products complete with accessories, trim, finish, safety guards, and other devices and details needed for a complete installation and the intended use and effect.
 2. Standard Products: Where available, provide standard products of types that have been produced and used successfully in similar situations on other projects.
 3. Compliance with Standards, Codes, and Regulations: Where Specifications only require compliance with an imposed code, standard, or regulation, select a product that complies with the standards, codes, or regulations specified.
 4. Visual Matching: Where Specifications require matching an established Sample, the Architect's decision will be final on whether a proposed product matches satisfactorily.
 - a. Where no product available within the specified category matches satisfactorily and complies with other specified requirements, comply with provisions of the Contract Documents concerning "substitutions" for selection of a matching product in another product category.
 5. Visual Selection: Where specified product requirements include the phrase "... as selected from manufacturer's standard colors, patterns, textures ..." or a similar phrase, select a product and manufacturer that complies with other specified requirements. The Architect will select the color, pattern, and texture from the product line selected.
- B. Nameplates: Except for required labels and operating data, do not attach or imprint manufacturers or producer's nameplates or trademarks on exposed surfaces of products that will be exposed to view in occupied spaces or on the exterior.
1. Labels: Locate required product labels and stamps on concealed surfaces or, where required for observation after installation, on accessible surfaces that are not conspicuous.
 2. Equipment Nameplates: Provide a permanent nameplate on each item of service-connected or power-operated equipment. Locate on an easily accessible surface that is inconspicuous in occupied spaces. The nameplate shall contain the following information and other essential operating data:
 - a. Name of product and manufacturer.
 - b. Model and serial number.
 - c. Capacity.

- d. Speed.
- e. Ratings.

2.2 SUBSTITUTIONS

- A. Conditions: The Architect will receive and consider the Contractor's request for substitution when one or more of the following conditions are satisfied, as determined by the Architect. If the following conditions are not satisfied, the Architect will return the requests without action except to record noncompliance with these requirements.
 - 1. The specified product or method of construction cannot be provided within the Contract Time. The Architect will not consider the request if the product or method cannot be provided as a result of failure to pursue the work promptly or coordinate activities properly.
 - 2. The request is directly related to an "or-equal" clause or similar language in the Contract Documents.
 - 3. The requested substitution offers the Owner a substantial advantage, in cost, time, energy conservation, or other considerations, after deducting offsetting responsibilities the Owner may be required to bear. The Owner's additional responsibilities may include additional compensation to the Architect for redesign and evaluation services, increased cost of other construction by the Owner or separate Contractors, and similar considerations.
 - 4. The specified product or method of construction cannot receive necessary approval by a governing authority, and the requested substitution can be approved.
 - 5. The specified product or method of construction cannot be provided in a manner that is compatible with other materials and where the Contractor certifies that the substitution will overcome the incompatibility.
 - 6. The specified product or method of construction cannot be coordinated with other materials and where the Contractor certifies that the proposed substitution can be coordinated.
 - 7. The specified product or method of construction cannot provide a warranty required by the Contract Documents and where the Contractor certifies that the proposed substitution provides the required warranty.
- B. The Contractor's submittal and the Architect's acceptance of shop drawings, product data, or samples for construction activities not complying with the Contract Documents do not constitute an acceptable or valid request for substitution, nor do they constitute approval.
- C. Whether or not the Architect and Owner accept a proposed substitution, the Contractor shall reimburse the Owner for the Architect's cost for the Architect and the Architect's consultants for evaluating any proposed substitute including changes required in the Contract Documents for the substitute.
- D. The Architect's decision of approval or disapproval of a proposed substitution shall be final.
- E. All costs that may be incurred associated with a substitution proposed by the Contractor shall be borne by the Contractor. This shall apply to all interfacing components recognized prior to or after approval of the substitution by the Architect.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 01631

**NEW PASSENGER TERMINAL
DULUTH INTERNATIONAL AIRPORT
DULUTH, MINNESOTA**

**SECTION 01700 - CONTRACT
CLOSEOUT**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.1 SUMMARY

- A. This section includes administrative and procedural requirements for contract closeout including, but not limited to, the following:
 - 1. Inspection procedures.
 - 2. Project record document submittal.
 - 3. Operation and maintenance manual submittal.
 - 4. Submittal of warranties.
 - 5. Final cleaning.
- B. Closeout requirements for specific construction activities are included in the appropriate sections in Divisions 2 through 17.
- C. Definitions: Closeout is hereby defined to include general requirements near the end of Contract time, in preparation for final acceptance, final payment, normal termination of contract, occupancy by Owner and similar actions evidencing completion of the work. Specific requirements for individual units of work are specified in sections of Division 2 through 17. Special requirements for mechanical and electrical work are specified in Divisions 15 and 16 sections, respectively. Time of closeout is directly related to "Substantial Completion" and, therefore, may be either a single time period for entire work or a series of time periods for individual parts of the work which have been certified as substantially complete at different dates. That time variation (if any) shall be applicable to other provisions of this section, regardless of whether resulting from "phased completion" originally specified by the Contract Documents or subsequently agreed upon by Owner and Contractor.

1.2 SUBSTANTIAL COMPLETION

- A. Certificates of Substantial Completion: Certificates of Substantial Completion will be filled out with punch lists attached and shall define the areas of the work which are being accepted. Procedures required to call for inspections and to request certificates shall be as required in this section.
- B. Preliminary Procedures: Before requesting inspection for certification of Substantial Completion, for either the entire work or portions thereof, complete the following. List exceptions in the request.
 - 1. In the Application for Payment that coincides with, or first follows, the date Substantial Completion is claimed, show 100 percent completion for the portion of the work claimed as substantially complete.

- a. Include supporting documentation for completion as indicated in these Contract Documents and a statement showing an accounting of changes to the Contract Sum.
 - b. If 100 percent completion cannot be shown, include a list of incomplete items, the value of incomplete construction, and reasons the work is not complete.
 - 2. Advise the Owner of pending insurance changeover requirements.
 - 3. Submit specific warranties, workmanship bonds, maintenance agreements, final certifications, and similar documents.
 - 4. Obtain and submit releases enabling the Owner unrestricted use of the work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
 - 5. Deliver tools, spare parts, extra stock, and similar items.
 - 6. Make final changeover of permanent locks and transmit keys to the Owner. Advise the Owner's personnel of changeover in security provisions.
 - 7. Complete startup testing of systems and instruction of the Owner's operation and maintenance personnel. Discontinue or change over and remove temporary facilities and services from the site, along with mockups, construction tools, and similar elements.
 - 8. Complete final cleanup requirements, including touchup painting. Touch up and otherwise repair and restore marred, exposed finishes.
- C. Inspection Procedures: On receipt of a request for inspection, the Architect will either proceed with inspection or advise the Contractor of unfilled requirements. The Architect will prepare the Certificate of Substantial Completion following inspection or advise the Contractor of construction that must be completed or corrected before the certificate will be issued.
- 1. The Architect will repeat inspection when requested and assured that the work is substantially complete.
 - 2. Results of the completed inspection will form the basis of requirements for final acceptance.

1.3 FINAL ACCEPTANCE

- A. Preliminary Procedures: Before requesting final inspection for certification of final acceptance and final payment, complete the following. List exceptions in the request.
- 1. Submit the final payment request with releases and supporting documentation not previously submitted and accepted. Include certificates of insurance for products and completed operations where required.
 - 2. Submit an updated final statement, accounting for final additional changes to the Contract Sum.
 - 3. Submit a certified copy of the Architect's final inspection list of items to be completed or corrected, stating that each item has been completed or otherwise resolved for acceptance, endorsed and dated by the Architect.
 - 4. Submit final meter readings for utilities, a measured record of stored fuel, and similar data as of the date of Substantial Completion or when the Owner took possession of and assumed responsibility for corresponding elements of the work.
 - 5. Submit consent of surety to final payment.
 - 6. Submit a final liquidated damages settlement statement.
 - 7. Submit evidence of final, continuing insurance coverage complying with insurance requirements.

8. Submit record documents, final project photographs, property survey and similar final record information.
- B. Reinspection Procedure: The Architect will reinspect the work upon receipt of notice that the work, including inspection list items from earlier inspections, has been completed, except for items whose completion is delayed under circumstances acceptable to the Architect.
1. Upon completion of reinspection, the Architect will prepare a certificate of final acceptance. If the work is incomplete, the Architect will advise the Contractor of work that is incomplete or of obligations that have not been fulfilled but are required for final acceptance.
 2. If necessary, reinspection will be repeated. Contractor will promptly reimburse the Architect for all incurred costs.

1.4 RECORD DOCUMENT SUBMITTALS

- A. General: Do not use record documents for construction purposes. Protect record documents from deterioration and loss in a secure, fire-resistant location. Provide access to record documents for the Architect's reference during normal working hours.
- B. Record Drawings: Maintain a clean, undamaged set of blue or black line white-prints of Contract Drawings and Shop Drawings. Mark the set to show the actual installation where the installation varies substantially from the work as originally shown. Mark which drawing is most capable of showing conditions fully and accurately. Where Shop Drawings are used, record a cross-reference at the corresponding location on the Contract Drawings. Give particular attention to concealed elements that would be difficult to measure and record at a later date.
1. Mark record sets with red erasable pencil. Use other colors to distinguish between variations in separate categories of the work.
 2. Mark new information that is important to the Owner but was not shown on Contract Drawings or Shop Drawings.
 3. Note related change-order numbers where applicable.
 4. Organize record drawing sheets into manageable sets. Bind sets with durable-paper cover sheets; print suitable titles, dates, and other identification on the cover of each set.
 5. Preparation of Transparencies: In preparation for certification of Substantial Completion on the last major portion of the work, review completed markup of record drawings with Architect. When authorized, proceed with preparation of a full set of corrected transparencies for Contract Drawings and shop drawings. Incorporate changes and additional information previously marked-up on print sets, by erasing and redrawing where applicable, and by adding details and notations where applicable; refer instances of uncertainty to Architect for determination. Identify and date each updated drawing.
 6. One set of transparencies of original Contract Drawings will be furnished by Architect to Contractor for use in recording changes and additional information. Other printing as required herein is Contractor's responsibility.
 7. Review of Transparencies: Prior to forwarding to Architect, submit corrected transparencies to Architect for review and acceptance. Architect will review each transparency for general scope of changes and information recorded thereon, and of the general quality of draftsmanship thereon (erasures and drafting). Transparencies will be returned to Contractor for organizing into a set and for final submittal.

8. Copies, Distribution: At the completion of the Work the Contractor shall forward one set of original marked-up transparencies to Architect for distribution to Owner. Organize transparencies into a set matching print sets, place set in a durable tube-type drawing container (with end caps), and mark end cap with suitable identification.
- C. Record Specifications: Maintain one complete copy of the Project Manual, including addenda. Include with the Project Manual one copy of other written construction documents, such as Change Orders and modifications issued in printed form during construction.
1. Mark these documents to show substantial variations in actual work performed in comparison with the text of the Specifications and modifications.
 2. Give particular attention to substitutions and selection of options and information on concealed construction that cannot otherwise be readily discerned later by direct observation.
 3. Note related record drawing information and Product Data.
 4. Upon completion of the work, submit record Specifications to the Architect for the Owner's records.
- D. Record Sample Submitted: Immediately prior to the date or dates of Substantial Completion, the Contractor shall meet with the Architect and the Owner's personnel at the site to determine which of the submitted samples that have been maintained during progress of the work are to be transmitted to the Owner for record purposes. Comply with the Owner's instructions regarding packaging, identification marking and delivery to the Owner's designated storage area. Dispose of other samples in a manner specified for disposal of surplus and waste materials, unless otherwise indicated by the Architect.
- E. Miscellaneous Record Submittals: Refer to other Specification Sections for requirements of miscellaneous record keeping and submittals in connection with actual performance of the work. Immediately prior to the date or dates of Substantial Completion, complete miscellaneous records and place in good order. Identify miscellaneous records properly and bind or file, ready for continued use and reference. Submit to the Architect for the Owner's records.
- F. Maintenance Manuals: Organize operation and maintenance data into suitable sets of manageable size. Bind properly indexed data in individual, heavy-duty, 2-inch, 3-ring, vinyl-covered binders, with pocket folders for folded sheet information. Mark appropriate identification on front and spine of each binder. Provide the Architect with two (2) copies of each manual. Include the following types of information:
1. Emergency instructions.
 2. Spare parts list.
 3. Copies of warranties.
 4. Wiring diagrams.
 5. Recommended "turn-around" cycles.
 6. Inspection procedures.
 7. Shop Drawings and Product Data.
 8. Fixture lamping schedule.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 CLOSEOUT PROCEDURES

- A. Operation and Maintenance Instructions: Arrange for each Installer of equipment that requires regular maintenance to meet with the Owner's personnel to provide instruction in proper operation and maintenance. Provide instruction by manufacturer's representatives if installers are not experienced in operation and maintenance procedures. Include a detailed review of the following items:
 - 1. Maintenance manuals.
 - 2. Record documents.
 - 3. Spare parts and materials.
 - 4. Tools.
 - 5. Lubricants.
 - 6. Fuels.
 - 7. Identification systems.
 - 8. Control sequences.
 - 9. Hazards.
 - 10. Cleaning.
 - 11. Warranties and bonds.
 - 12. Maintenance agreements and similar continuing commitments.
- B. As part of instruction for operating equipment, demonstrate the following procedures:
 - 1. Startup.
 - 2. Shutdown.
 - 3. Emergency operations.
 - 4. Noise and vibration adjustments.
 - 5. Safety procedures.
 - 6. Economy and efficiency adjustments.
 - 7. Effective energy utilization.

3.2 FINAL CLEANING

- A. General: The General Conditions require general cleaning during construction. Regular site cleaning is included in Division 1, Section 01500 - CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS.
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to the condition expected in a normal, commercial building cleaning and maintenance program. Comply with manufacturers' instructions.
 - 1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion.
 - a. Remove labels that are not permanent labels.
 - b. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other substances that are noticeable vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials.
 - c. Clean exposed exterior and interior hard-surfaced finishes to a dust-free condition, free of stains, films, and similar foreign substances. Restore reflective surfaces to their original condition. Except as otherwise indicated, avoid disturbance of natural wea-

- thering of exterior surfaces. Leave concrete floors broom clean. Vacuum carpeted surfaces.
 - d. Wipe surfaces of mechanical and electrical equipment. Remove excess lubrication and other substances. Clean plumbing fixtures to a sanitary condition. Clean light fixtures and lamps.
 - e. Clean the site, including landscape development areas, of rubbish, litter, and other foreign substances. Sweep paved areas broom clean; remove stains, spills, and other foreign deposits. Rake grounds that are neither paved nor planted to a smooth, even-textured surface.
 - f. Remove debris and surface dust from limited access spaces including roofs, plenums, shafts, trenches, equipment vaults, man-holes, attics and similar spaces.
- C. Pest Control: Engage an experienced, licensed exterminator to make a final inspection and rid the Project of rodents, insects, and other pests. Submit report (letter) of compliance from exterminator.
- D. Removal of Protection: Remove temporary protection and facilities installed for protection of the work during construction, where applicable.
- E. Compliance: Comply with regulations of authorities having jurisdiction and safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on the Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from the site and dispose of in a lawful manner.
- 1. Where extra materials of value remain after completion of associated work, they become the Owner's property. Dispose of these materials as directed by the Owner.

END OF SECTION 01700

**NEW PASSENGER TERMINAL
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SECTION 01710 - CLEANING UP

1. GENERAL

- A. The Contractors shall furnish all labor, materials, tools, equipment, and perform all work and services necessary for cleaning up required in conjunction with work performed, as shown on drawings and as specified, in accordance with provisions of the Contract Documents and completely coordinated with work of all other trades.
- B. Although such work is not specifically indicated, furnish and install all supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a sound, secure and complete installation.
- C. This Section specifies administrative and procedural requirements for final cleaning at Substantial Completion.
 - 1) Special cleaning requirements for specific elements of the Work are included in appropriate Sections of Divisions 2 through 16.
 - 2) Multiple Prime Contracts: Except as otherwise indicated, each Prime Contractor is responsible for coordination of final cleaning where more than one Prime Contractor is involved in final cleaning a single area or piece of equipment.
 - 3) Environmental Requirements: Conduct cleaning and waste disposal operations in compliance with local laws and ordinances. Comply fully with federal and local environmental and anti-pollution regulations.
 - a. Do not dispose of volatile wastes such as mineral spirits, oil or paint thinner in storm or sanitary drains.
 - b. Burning or burying of debris, rubbish or other waste material on the premises will not be permitted.
 - 4) Related work specified elsewhere:
 - a. Section 01700 - Contract Closeout, include general project closeout requirements.
 - b. Section 01500 - Temporary Facilities, include general cleanup and waste removal requirements.

2. MATERIALS

- A. Cleaning Agents: Use cleaning materials and agents recommended by the 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.

3. DURING CONSTRUCTION

- A. Oversee cleaning and ensure that building and grounds are maintained free from accumulation of waste and rubbish.
 - 1) Special attention shall be given to cleaning up the site of debris, waste and rubbish. The Owner is extremely concerned over items left in the open that can be thrown through windows.
- B. Sprinkle dusty debris with water.
- C. At reasonable intervals, minimum once a week, clean up site and access and dispose of debris.
- D. Provide metal containers for collection of debris.
- E. Remove debris from site. Legally dispose of off Owner's site.
- F. Vacuum interior areas when ready for painting.
- G. Handle waste materials in a controlled manner. Do not drop or throw materials from heights.
- H. Schedule cleaning operations so that contaminants resulting from cleaning do not fall on wet painted surfaces.

END OF SECTION 01710

**NEW PASSENGER TERMINAL
DULUTH INTERNATIONAL AIRPORT
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**SECTION 01720 - PROJECT RECORD
DOCUMENTS**

1. GENERAL

- A. This section covers the furnishing of all labor, materials, tools, equipment, and performing all work and services to provide record documents as specified, in accordance with the provisions of the Contract Documents, and completely coordinated with work of all other trades.
- B. This Section specifies administrative and procedural requirements for Project Record Documents.
 - 1) Project Record Documents required include:
 - a. Marked-up copies of Contract Drawings.
 - b. Marked-up copies of Shop Drawings.
 - c. Newly prepared Drawings.
 - d. Marked-up copies of Specifications, addenda and Change Orders.
 - e. Marked-up Product Data submittals.
 - f. Record Samples.
 - g. Field records for variable and concealed conditions.
 - h. Record information on Work that is recorded only schematically.
 - 2) Maintenance of Documents and Samples: Store record documents and Samples in the field office apart from Contract Documents used for construction. Do not permit Project Record Documents to be used for construction purposes. Maintain record documents in good order, and in a clean, dry, legible condition. Make documents and Samples available at all times for inspection by the Architect.
- C. Related work specified elsewhere:
 - 1) Section 01700 - Contract Closeout, includes general project closeout requirements.
 - 2) Section 01300 - Submittals, includes general requirements for submittal of Project Record Documents.

2. RECORD DRAWINGS

- A. Mark-up Procedure: During the construction period, maintain a set of blue- or black-line white-prints of Contract Drawings and Shop Drawings for Project Record Document purposes. Include the printed designation "PROJECT RECORD DRAWINGS" in a prominent location on each Drawing.
 - 1) Mark these Drawings to indicate the actual installation where the installation varies appreciably from the installation shown originally. Give particular attention to information on concealed elements which would be difficult to identify or measure and record later. Items required to be marked include but are not limited to:

- a. Dimensional changes to the Drawings.
 - b. Revisions to details shown on the Drawings.
 - c. Changes made by Change Order.
 - d. Details not on original Contract Drawings.
 - e. RFPs, SIs, PCOs.
- 2) Mark completely and accurately record prints of Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions. Where Shop Drawings are marked, show cross-reference on Contract Drawings location.
 - 3) Mark record sets with red erasable colored pencil; use other colors to distinguish between changes for different categories of the Work at the same location.
 - 4) Mark important additional information which was either shown schematically or omitted from original Drawings.
 - 5) Note construction change directive numbers, alternate numbers, Change Order numbers and similar identification.
 - 6) Responsibility for Markup: Where feasible, the individual or entity who obtained record data, whether the individual or entity is the installer, subcontractor, or similar entity, is required to prepare the mark-up on record Drawings.
 - a. Accurately record information in an understandable Drawing technique.
 - b. Record data as soon as possible after it has been obtained. In the case of concealed installations, record and check the mark-up prior to concealment.
 - c. At time of Substantial Completion, submit three (3) copies of the record Drawings to Construction Manager for the Architect's approval. Upon Architect's approval, the Drawings will then become the Owner's records. Organize into sets, bind and label sets for Owner's continued use.

3. RECORD SPECIFICATIONS

- A. During the construction period, maintain one copy of the Project Specifications, including addenda and modifications issued, for Project Record Document purposes.
 - 1) Mark the Specifications to indicate the actual installation where the installation varies substantially from that indicated in Specifications and modifications issued. Note related Project Record Drawing information, where applicable. Give particular attention to substitutions, selection of product options, and information on concealed installations that would be difficult to identify or measure and record later.
 - a. In each Specification Section where products, materials or units of equipment are specified or scheduled, mark the copy with the proprietary name and model number of the product furnished.
 - 2) Upon completion of mark-up, submit record Specifications to the Construction Manager for Owner's records.

4. RECORD PRODUCT DATA

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

5. MISCELLANEOUS RECORD SUBMITTALS

- A. Refer to other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Immediately prior to Substantial Completion, complete miscellaneous records and place in good order, properly identified and bound or filed, ready for use and reference. Submit to the Construction Manager for the Owner's records.
- 1) Categories of requirements resulting in miscellaneous records include, but are not limited to the following:
 - a. Field records on excavations and foundations.
 - b. Field records on underground construction and similar Work.
 - c. Survey showing locations and elevations of underground lines.
 - d. Invert elevations of drainage piping.
 - e. Surveys establishing building lines and levels.
 - f. Authorized measurements utilizing unit prices or allowances.
 - g. Records of plant treatment.
 - h. Ambient and substrate condition tests.
 - i. Certifications received in lieu of labels on bulk products.
 - j. Batch mixing and bulk delivery records.
 - k. Testing and qualification of tradesmen.
 - l. Documented qualification of installation firms.
 - m. Load and performance testing.
 - n. Inspections and certifications by governing authorities.
 - o. Leakage and water-penetration tests.

- p. Fire resistance and flame spread test results.
- q. Final inspection and correction procedures.

6. RECORDING

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

END OF SECTION 01720

**NEW PASSENGER TERMINAL
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**SECTION 01732 – SELECTIVE
DEMOLITION**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1) Demolition and removal of selected portions of building or structure.
 - 2) Demolition and removal of selected site elements.
 - 3) Salvage of existing items to be reused or recycled.
- B. Related Requirements:
 - 1) Division 1 Section "Summary" for restrictions on the use of the premises, Owner-occupancy requirements, and phasing requirements.
 - 2) Division 2 Section "Site Clearing" for site clearing and removal of above- and below-grade improvements.

1.3 DEFINITIONS

- A. Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged or removed and reinstalled.
- B. Remove and Salvage: Carefully detach from existing construction, in a manner to prevent damage, and deliver to Owner.
- C. Remove and Reinstall: Detach items from existing construction, prepare for reuse, and reinstall where indicated.
- D. Existing to Remain: Existing items of construction that are not to be permanently removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.4 MATERIALS OWNERSHIP

- A. Unless otherwise indicated, demolition waste becomes property of Contractor.
- B. Historic items and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.
 - 1) Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.5 PREINSTALLATION MEETINGS

- A. Pre-demolition Conference: Conduct conference at Project site.
 - 1) Inspect and discuss condition of construction to be selectively demolished.
 - 2) Review structural load limitations of existing structure.
 - 3) Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
 - 4) Review requirements of work performed by other trades that may rely on substrates exposed by selective demolition operations.
 - 5) Review areas where existing construction is to remain and requires protection.
 - 6) Review and finalize protection requirements.
 - 7) Review procedures for noise control and dust control.
 - 8) Review procedures for protection of adjacent buildings.
 - 9) Review items to be salvaged and returned to Owner.

1.6 INFORMATIONAL SUBMITTALS

- A. Proposed Protection Measures: Submit report, including drawings, that indicates the measures proposed for protecting individuals and property for environmental protection, dust control and for noise control. Indicate proposed locations and construction of barriers.
- B. Schedule of Selective Demolition Activities: Indicate the following:
 - 1) Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's and other tenants' on-site operations are uninterrupted.
 - 2) Interruption of utility services. Indicate how long utility services will be interrupted.
 - 3) Coordination for shutoff, capping, and continuation of utility services.
 - 4) Use of elevator and stairs.
 - 5) Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.
- C. Inventory: Submit a list of items to be removed and salvaged and deliver to Owner prior to start of demolition.
- D. Pre-demolition Photographs or Video: Submit before Work begins.
- E. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

1.7 CLOSEOUT SUBMITTALS

- A. Inventory: Submit a list of items that have been removed and salvaged.
- B. Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

1.8 QUALITY ASSURANCE

- A. Refrigerant Recovery Technician Qualifications: Certified by an EPA-approved certification program.
- B. Regulatory Requirements: Comply with governing EPA notification regulations before beginning demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- C. Standards: Comply with ANSI/ASSE A10.6 and NFPA 241.

1.9 FIELD CONDITIONS

- A. Owner will occupy portions of building adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.
 - 1) Provide not less than seventy-two (72) hours notice of activities that will affect operations of adjacent occupied buildings.
 - 2) Maintain access to existing walkways, exits, and other facilities used by occupants of adjacent buildings.
 - a) Do not close or obstruct walkways, exits, or other facilities used by occupants of adjacent buildings without written permission from authorities having jurisdiction.
- B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
- C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
 - 1) Hazardous materials will be removed by Owner before start of the Work.
 - a) If suspected hazardous materials are encountered, do not disturb; immediately notify Owner. Hazardous materials will be removed by Owner under a separate contract.
- E. Storage or sale of removed items or materials on-site is not permitted.
- F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
 - 1) Maintain fire-protection facilities in service during selective demolition operations.

1.2 COORDINATION

- A. Arrange demolition schedule so as not to interfere with Owner's on-site operations.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- B. Standards: Comply with ANSI/ASSE A10.6 and NFPA 241.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that utilities have been disconnected and capped before starting selective demolition operations.
- B. Review record documents of existing construction provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in record documents.
- C. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.
- D. Inventory and record the condition of items to be removed and salvaged. Provide photographs or video of conditions that might be misconstrued as damage caused by salvage operations.
- E. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.
- F. Engage a professional engineer licensed in the State of Minnesota to perform an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective building demolition operations.
 - 1. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.
 - 1) Survey of Existing Conditions: Record existing conditions by use of preconstruction photographs and / or preconstruction video.
- G. Inventory and record the condition of items to be removed and salvaged. Provide photographs or video of conditions that might be misconstrued as damage caused by salvage operations.

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Existing Services / Systems to Remain: Maintain Services / Systems indicated to remain and protect them against damage.
 - 1. Comply with requirements for existing Services / Systems interruptions specified in Division 1 Section "Summary".

- B. Existing Services / Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.
 - 1. Owner will arrange to shut off indicated Services / Systems when requested by Contractor.
 - 2. If Services / Systems are required to be removed, relocated, or abandoned, provide temporary Services / Systems that bypass area of selective demolition and that maintain continuity of Services / Systems to other parts of building.
 - 3. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated to be removed.
 - 1) Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
 - 2) Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
 - 3) Equipment to Be Removed: Disconnect and cap services and remove equipment.
 - 4) Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
 - 5) Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
 - 6) Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
 - 7) Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material.
- C. Refrigerant: Remove refrigerant from mechanical equipment to be selectively demolished according to 40 CFR 82 and regulations of authorities having jurisdiction.

3.3 PREPARATION

- 1. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
- B. Comply with requirements for access and protection specified in Division 1 Section "Temporary Facilities and Controls."
- C. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
- D. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
- E. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
- F. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.

- G. Cover and protect furniture, furnishings, and equipment that have not been removed.
- H. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Division 1 Section "Temporary Facilities and Controls."
- I. Temporary Shoring: Provide and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.
 - 1. Strengthen or add new supports when required during progress of selective demolition.

3.4 SELECTIVE DEMOLITION, GENERAL

- A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
- B. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
- C. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
- D. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
- E. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain fire watch and portable fire-suppression devices during flame-cutting operations.
- F. Maintain adequate ventilation when using cutting torches.
- G. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
- H. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
- I. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
- J. Dispose of demolished items and materials promptly. Comply with requirements in Division 1 Section "Construction Waste Management."
- K. Removed and Salvaged Items:
 - 1. Clean salvaged items.
 - 2. Pack or crate items after cleaning. Identify contents of containers.
 - 3. Store items in a secure area until delivery to Owner.

4. Transport items to Owner's storage area designated by Owner.
 5. Protect items from damage during transport and storage.
- L. Removed and Reinstalled Items:
1. Clean and repair items to functional condition adequate for intended reuse.
 2. Pack or crate items after cleaning and repairing. Identify contents of containers.
 3. Protect items from damage during transport and storage.
 4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.
- M. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and reinstalled in their original locations after selective demolition operations are complete.

3.5 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

- A. Concrete: Demolish in small sections. Using power-driven saw, cut concrete to a depth of at least 3/4 inch (19 mm) at junctures with construction to remain. Dislodge concrete from reinforcement at perimeter of areas being demolished, cut reinforcement, and then remove remainder of concrete. Neatly trim openings to dimensions indicated.
- B. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, then remove masonry between saw cuts.
- C. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, then break up and remove.
- D. Resilient Floor Coverings: Remove floor coverings and adhesive according to recommendations in RFCI's "Recommended Work Practices for the Removal of Resilient Floor Coverings." Do not use methods requiring solvent-based adhesive strippers.
- E. Roofing: Remove existing roofing so that interior of building to remain remains weathertight.

3.6 DISPOSAL OF DEMOLISHED MATERIALS

- A. General: Except for items or materials indicated to be recycled, reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill.
 1. Do not allow demolished materials to accumulate on-site.
 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
 3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
 4. Comply with requirements specified in Division 1 Section "Construction Waste Management."
- B. Burning: Do not burn demolished materials.

- C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

3.7 CLEANING

- A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION 01732

**NEW PASSENGER TERMINAL
DULUTH INTERNATIONAL AIRPORT
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SECTION 01740 – WARRANTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This section specifies general administrative and procedural requirements for warranties required by the Contract Documents, including manufacturer's standard warranties on products and special warranties.
 - 1. Refer to the General Conditions for terms of the Contractor's period for correction of the work and special warranty of workmanship and materials.
- B. The Contractor will provide a warranty on all project work (including that added by subsequent change order after execution of the construction contract) for a period of one (1) year following the formal declaration of Substantial Completion. This one (1) year warranty will be separate from and in no way affect other standard product / manufacturer or workmanship warranties that extend beyond this one (1) year period for goods and services provided to this project.
- C. Related Sections: The following sections contain requirements that relate to this section:
 - 1. Division 1, Section 01300 - SUBMITTALS specifies procedures for submitting warranties.
 - 2. Division 1, Section 01700 - CONTRACT CLOSEOUT specifies contract closeout procedures.
 - 3. Divisions 2 through 16 sections for specific requirements for warranties on products and installations specified to be warranted.
 - 4. Certifications and other commitments and agreements for continuing services to Owner are specified elsewhere in the Contract Documents.
- D. Disclaimers and Limitations: Manufacturer's disclaimers and limitations on product warranties do not relieve the Contractor of the warranty on the work that incorporates the products. Manufacturer's disclaimers and limitations on product warranties do not relieve suppliers, manufacturers, and subcontractors required to countersign special warranties with the Contractor.

1.3 WARRANTY REQUIREMENTS

- A. Related Damages and Losses: When correcting failed or damaged warranted construction, remove and replace other work that has been damaged as a result of such failure or must be removed and replaced to provide access for correction of warranted construction.
- B. Reinstatement of Warranty: When work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written

endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.

- C. Replacement Cost: Upon determination that work covered by a warranty has failed, replace or rebuild the work to an acceptable condition complying with requirements of the Contract Documents. The Contractor is responsible for the cost of replacing or rebuilding defective work regardless of whether the Owner has benefited from use of the work through a portion of its anticipated useful service life.
- D. Owner's Recourse: Expressed warranties made to the Owner are in addition to implied warranties and shall not limit the duties, obligations, rights, and remedies otherwise available under the law. Expressed warranty periods shall not be interpreted as limitations on the time in which the Owner can enforce such other duties, obligations, rights, or remedies.
 - 1. Rejection of Warranties: The Owner reserves the right to reject warranties and to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
- E. Where the Contract Documents require a special warranty, or similar commitment on the work or part of the work, the Owner reserves the right to refuse to accept the work, until the Contractor presents evidence that entities required to countersign such commitments are willing to do so.

1.4 SUBMITTALS

- A. Submit written warranties to the Architect prior to the date certified for Substantial Completion. If the Architect's Certificate of Substantial Completion designates a commencement date for warranties other than the date of Substantial Completion for the work, or a designated portion of the work, submit written warranties upon request of the Architect.
 - 1. When a designated portion of the work is completed and occupied or used by the Owner, by separate agreement with the Contractor during the construction period, submit properly executed warranties to the Architect within fifteen (15) days of completion of that designated portion of the work.
- B. When the Contract Documents require the Contractor, or the Contractor and a subcontractor, supplier or manufacturer to execute a special warranty, prepare a written document that contains appropriate terms and identification, ready for execution by the required parties. Submit a draft to the Owner, through the Architect, for approval prior to final execution.
 - 1. Refer to Divisions 2 through 16 sections for specific content requirements and particular requirements for submitting special warranties.
- C. Form of Submittal: At Final Completion compile two (2) copies of each required warranty properly executed by the Contractor, or by the Contractor, subcontractor, supplier, or manufacturer. Organize the warranty documents into an orderly sequence based on the table of contents of the Project Manual.
- D. Bind warranties and bonds in heavy-duty, commercial-quality, durable 3-ring, vinyl-covered loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
 - 1. Provide heavy paper dividers with celluloid covered tabs for each separate warranty. Mark the tab to identify the product or installation. Provide a typed

- description of the product or installation, including the name of the product, and the name, address, and telephone number of the Installer.
2. Identify each binder on the front and spine with the typed or printed title "WARRANTIES AND BONDS," Project title or name, and name of the Contractor.
 3. When warranted construction requires operation and maintenance manuals, provide additional copies of each required warranty, as necessary, for inclusion in each required manual.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 01740

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**SECTION 01742 - CONSTRUCTION
WASTE MANAGEMENT**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for the following:
 - 1. Salvaging non-hazardous demolition and construction waste
 - 2. Recycling non-hazardous demolition and construction waste
 - 3. Disposing of non-hazardous demolition and construction waste
- B. Related Sections include the following:
 - 1. Division 1 Section 01040 "Coordination" for coordination of responsibilities for waste management
 - 2. Division 1 Section 01361 "Sustainable Design Requirements"
 - 3. Division 1 Section 01500 "Temporary Facilities and Controls" for environmental-protection measures during construction
 - 4. Division 1 Section 01732 "Selective Demolition" for disposition of waste resulting from demolition of buildings, structures, and site improvements.

1.3 DEFINITIONS

- A. Clean: Untreated and unpainted; not contaminated with oils, solvents, caulk, paint, or the like
- B. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.
- C. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations
- D. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction
- E. Diversion: Avoidance of demolition and construction waste sent to landfill or incineration. Diversion does not include using materials for landfill, alternate daily cover on landfills, or materials used as fuel in waste-to-energy processes
- F. Hazardous: Exhibiting the characteristics of hazardous substances, i.e., ignitability, corrosiveness, toxicity or reactivity

- G. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse
- H. Recycling: The process of sorting, cleansing, treating, and reconstituting solid waste and other discarded materials for the purpose of using the altered form. Recycling does not include burning, incinerating, or thermally destroying waste.
- I. Salvage: Recovery of demolition or construction waste and subsequent reuse or sale in another facility
- J. Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work
- K. Source Separation: The act of keeping different types of waste materials separate beginning from the first time they become waste
- L. Toxic: Poisonous to humans either immediately or after a long period of exposure
- M. Trash: Any product or material unable to be reused, returned, recycled, or salvaged
- N. Waste: Extra material or material that has reached the end of its useful life in its intended use. Waste includes salvageable, returnable, recyclable, and reusable material.

1.4 PERFORMANCE REQUIREMENTS

- A. The Owner has established that this Project shall generate the least amount of waste possible and that processes that ensure the generation of as little waste as possible due to error, poor planning, breakage, mishandling, contamination, or other factors shall be employed.
- B. Of the waste that is generated, as many of the waste materials as economically feasible shall be reused, salvaged, or recycled. Waste disposal in landfills or incinerators shall be minimized, thereby reducing disposal costs.
- C. Develop a construction waste management plan that results in end-of-Project rates for salvage / recycling of 95% (by weight) of construction and demolition waste.
- D. Salvage / Recycle Requirements: Salvage and recycle as much non-hazardous demolition and construction waste as possible, including the following materials:
 - 1. Demolition Waste:
 - a. Asphaltic concrete paving
 - b. Concrete
 - c. Concrete reinforcing steel
 - d. Brick
 - e. Concrete masonry units
 - f. Wood studs
 - g. Wood joists
 - h. Plywood and oriented strand board
 - i. Wood paneling
 - j. Wood trim
 - k. Structural and miscellaneous steel

CONSTRUCTION WASTE MANAGEMENT

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- l. Rough hardware
- m. Roofing
- n. Insulation
- o. Doors and frames
- p. Door hardware
- q. Windows
- r. Glazing
- s. Metal studs
- t. Gypsum board
- u. Acoustical tile and panels
- v. Carpet
- w. Carpet pad
- x. Demountable partitions
- y. Equipment
- z. Cabinets
- aa. Plumbing fixtures
- bb. Piping
- cc. Supports and hangers
- dd. Valves
- ee. Sprinklers
- ff. Mechanical equipment
- gg. Refrigerants
- hh. Electrical conduit
- ii. Copper wiring
- jj. Lighting fixtures
- kk. Lamps
- ll. Ballasts
- mm. Electrical devices
- nn. Switchgear and panelboards
- oo. Transformers
- 2. Construction Waste:
 - a. Masonry and CMU
 - b. All untreated wood, including lumber and finish materials
 - c. Wood sheet materials
 - d. Wood trim
 - e. Metals
 - f. Roofing
 - g. Insulation
 - h. Carpet and pad
 - i. Gypsum board
 - j. Unused (leftover) paint
 - k. Piping
 - l. Electrical conduit
 - m. Packaging: Regardless of salvage / recycle goal indicated above, salvage or recycle 100 percent of the following uncontaminated packaging materials:
 - 1) Paper
 - 2) Cardboard
 - 3) Boxes
 - 4) Plastic sheet and film
 - 5) Polystyrene packaging
 - 6) Wood crates
 - 7) Plastic pails

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n. Beverage and packaged food containers

1.5 SUBMITTALS

- A. Construction Waste Management Plan (CWMP): It is the intent of this specification to maximize the diversion of demolition and construction waste from landfill disposal. Accordingly, not more than 30 days after receipt of Notice to Proceed and prior to the generation of any waste, prepare and submit a draft Construction Waste Management Plan in accordance with Section 01742 including, but not limited to, the following:
1. Procedures for Recycling / Reuse Program to divert a minimum of 95% (by weight) of construction and demolition waste from landfill disposal, including waste resulting from demolition of any existing building and site paving scheduled for demolition; any site paving is required to be ground on site and reused as granulated fill on site.
 2. Approval of the Contractor's CWMP shall not relieve the Contractor of responsibility for adequate and continuing control of pollutants and other environmental protection measures.
- B. Submit a 3-ring binder with calculations on end-of-project recycling rates, salvage rates, and landfill rates itemized by waste material, demonstrating that a minimum of 75% of construction wastes were recycled or salvaged and diverted from landfill. Include documentation of recovery rate (if commingled); waste hauling certificates or receipts, and a brief narrative explaining how and to where each waste type has been diverted.
- C. Construction Waste Management Plan: Submit four copies of plan within forty-five (45) days of date established for the Notice to Proceed.
- D. Waste Reduction Progress Reports: Concurrent with each Application for Payment, submit four (4) copies of report. Include separate reports for demolition and construction waste. Include the following information:
1. Material category
 2. Generation point of waste
 3. Total quantity of waste in tons
 4. Quantity of waste salvaged, both estimated and actual in tons
 5. Quantity of waste recycled, both estimated and actual in tons
 6. Total quantity of waste recovered (salvaged plus recycled) in tons
 7. Total quantity of waste recovered (salvaged plus recycled) as a percentage of total waste
 8. Include up-to-date records of donations, sales, recycling and landfill / incinerator manifests, weight tickets, hauling receipts, and invoices.
- E. Waste Reduction Calculations: Before request for Substantial Completion, submit four copies of calculated end-of-project rates for salvage, recycling, and disposal as a percentage of total waste generated by the Work. Complete a table similar to the example below.

Recycled / Salvaged / Diverted Materials	Hauler or Location	Quantity of Material (tons)

Total Construction Waste Diverted		
Landfilled Materials		
Total Construction Waste Landfilled		

Total Construction Waste		Total Construction Waste Diverted + Total Construction Waste Landfilled
Percentage of Construction Waste Diverted from Landfill		(Total Construction Waste Diverted / Total Construction Waste)*100

- F. Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether organization is tax-exempt.
- G. Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax-exempt.
- H. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
- I. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills (or transfer stations) and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

1.6 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with all applicable local ordinances and regulations.
- B. Waste Management Meetings: Conduct an initial conference at Project Site to comply with requirements in Division 1 Section "Project Management and Coordination." Contractor shall include discussions on construction waste management requirements in the preconstruction meeting. Contractor shall include discussions on construction waste management requirements in the regular job meetings conducted during the course of the Project; at these meetings, review methods and procedures related to waste management including, but not limited to, the following:
 - 1. Review and discuss waste management plan including responsibilities of the Waste Management Coordinator.

2. Review requirements for documenting quantities of each type of waste and its disposition.
3. Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays.
4. Review procedures for periodic waste collection and transportation to recycling and disposal facilities.
5. Review waste management requirements for each trade.

1.7 CONSTRUCTION WASTE MANAGEMENT PLAN

- A. General: Develop and implement a CWMP consisting of waste identification, waste reduction work plan, and cost/revenue analysis. Include separate sections in plan for demolition and construction waste. Indicate quantities by weight or volume, but use the same units of measure throughout the CWMP.
- B. Draft Construction Waste Management Plan: Within 30 days after receipt of Notice to Proceed, or prior to any waste removal, whichever occurs sooner, the Contractor shall submit to the Owner and Architect a Draft Waste Management Plan.
- C. Final Construction Waste Management Plan: Once the Owner has determined which of the recycling options addressed in the draft Waste Management Plan are acceptable, the Contractor shall submit, within 10 calendar days, a Final Waste Management Plan.
- D. Waste Identification: Indicate anticipated types and quantities of demolition, site-clearing, and construction waste generated by the Work. Include estimated quantities and assumptions for estimates.
- E. Landfill Options: Indicate the name of the landfill(s) and / or transfer station(s) and / or incinerator(s) where trash will be disposed of, the applicable landfill tipping fee(s), and the projected cost of disposing of all Project waste in the landfill(s).
- F. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, reused, recycled, or disposed of in landfill or incinerator. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.
 1. Salvaged Materials for Reuse: For materials that will be salvaged and reused in this Project, describe methods for preparing salvaged materials before incorporation into the Work.
 2. Salvaged Materials for Sale: For materials that will be sold to individuals and organizations, include list of their names, addresses, and telephone numbers.
 3. Salvaged Materials for Donation: For materials that will be donated to individuals and organizations, include list of their names, addresses, and telephone numbers.
 4. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
 5. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.
 6. Handling and Transportation Procedures: Describe method that will be used for separating recyclable waste, including sizes of containers, container labeling, and designated location on Project Site where materials separation will be located.

- G. Materials: The following list of required materials, at a minimum, must be included for salvaging / recycling:
1. Cardboard
 2. Clean dimensional wood
 3. Beverage and food containers
 4. Paper
 5. Concrete
 6. Concrete Masonry Units (CMUs)
 7. Asphalt: Include the approximate weight of the asphalt paving to be crushed and utilized as granulated fill from the existing paving as a component of waste material diverted from the landfill.
 8. Ferrous and non-ferrous metals (banding, stud trim, ductwork, piping, rebar, roofing, other trim, steel, iron, galvanized sheet steel, stainless steel, aluminum, copper, zinc, lead, brass, and bronze)
 9. Stretch and shrink wrap
 10. Gypsum wallboard
 11. Paint containers and other clean, empty plastic containers
- H. Meetings: Provide a description of the regular meetings to be held to address waste management.
- I. Materials Handling Procedures: Provide a description of the means by which any waste materials identified will be protected from contamination, and a description of the means to be employed in recycling the above materials consistent with requirements for acceptance by designated facilities.
- J. Transportation: Provide a description of the means of transportation of the recyclable materials (whether materials will be site-separated and self-hauled to designated centers, or whether mixed materials will be collected by a waste hauler and removed from the site) and destination of materials.

1.8 CONSTRUCTION WASTE MANAGEMENT RESOURCES

- A. General information contacts regarding construction and demolition waste:
1. EPA Construction and demolition (C&D) debris website:
<http://www.epa.gov/epaoswer/non-hw/debris-new/bytype.htm>
 2. Directory of Wood-Framed Building Deconstruction and Reused Building Materials Companies:
http://www.fpl.fs.fed.us/documnts/fplgtr/fpl_gtr150.pdf
 3. Additional resources to be developed by Contractor with assistance from Owner and Architect, as requested.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PLAN IMPLEMENTATION

- A. General: Implement waste management plan as approved by Architect and Owner. Provide handling, containers, storage, signage, transportation, and other

items as required to implement waste management plan during the entire duration of the Contract.

1. Comply with Division 1 Section "Temporary Facilities and Controls" for operation, termination, and removal requirements.
- B. Waste Management Coordinator: Engage a waste management coordinator to be responsible for implementing, monitoring, and reporting status of waste management work plan. Coordinator shall be present at the Project Site full-time for duration of Project.
- C. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work occurring at Project Site.
1. Distribute waste management plan to everyone concerned within three days of submittal return.
 2. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.
- D. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
1. Designate and label specific areas on Project Site necessary for separating materials that are to be salvaged, recycled, reused, donated, and sold.
 2. Recycling and waste bin areas are to be kept neat, and clean, and clearly marked in order to avoid contamination of materials.
 3. Comply with Division 1 Section "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.
- E. Hazardous Wastes: Hazardous wastes shall be separated, stored, and disposed of according to local regulations and should not be included in Construction Waste Management Plan's calculations of waste.

3.2 SALVAGING DEMOLITION WASTE

- A. Salvaged Items for Reuse in the Work:
1. Clean salvaged items.
 2. Pack or crate items after cleaning. Identify contents of containers.
 3. Store items in a secure area until installation.
 4. Protect items from damage during transport and storage.
 5. Install salvaged items to comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make items functional for use indicated.
- B. Salvaged Items for Owner's Use:
1. Clean salvaged items.
 2. Pack or crate items after cleaning. Identify contents of containers.
 3. Store items in a secure area until delivery to Owner.
 4. Transport items to Owner's storage area designated by Owner.
 5. Protect items from damage during transport and storage.
 6. Doors and Hardware: Brace open end of door frames. Except for removing door closers, leave door hardware attached to doors.

CONSTRUCTION WASTE MANAGEMENT

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3.3 RECYCLING DEMOLITION AND CONSTRUCTION WASTE, GENERAL

- A. General: Recycle paper and beverage containers used by on-site workers.
- B. Recycling Receivers and Processors: List below is provided for information only; available recycling receivers and processors include, but are not limited to, the following:
 - 1. List to be developed by Contractor.
- C. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall accrue to Contractor.
- D. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project Site to the maximum extent practical.
 - 1. Provide appropriately marked containers or bins for controlling recyclable waste until they are removed from Project Site. Include list of acceptable and unacceptable materials at each container and bin.
 - a. Inspect containers and bins for contamination and remove contaminated materials if found.
 - 2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
 - 3. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
 - 4. Store components off the ground and protect from the weather.
 - 5. Remove recyclable waste off Owner's property and transport to recycling receiver or processor.

3.4 RECYCLING DEMOLITION WASTE

- A. Asphaltic Concrete Paving: Break up and transport paving to asphalt-recycling facility or recycle on-site into new paving.
- B. Concrete: Remove reinforcement and other metals from concrete and sort with other metals.
 - 1. Pulverize concrete to maximum 4-inch (100-mm) size.
 - 2. Crush concrete and screen to comply with requirements in Division 2 Section "Earthwork" for use as satisfactory soil for fill or subbase.
- C. Masonry: Remove metal reinforcement, anchors, and ties from masonry and sort with other metals.
 - 1. Pulverize masonry to maximum 1-1/2-inch (38-mm) size.
 - a. Crush masonry and screen to comply with requirements in Division 2 Section "Earthwork" for use as general fill or subbase.
 - b. Crush masonry and screen to comply with requirements in Division 2 Section "Exterior Plants" for use as mineral mulch.
 - 2. Clean and stack undamaged, whole masonry units on wood pallets.
- D. Wood Materials: Sort and stack members according to size, type, and length. Separate lumber, engineered wood products, and panel products for reuse and /

or recycling. Separate wood material treated with heavy metal preservatives for reuse or landfill disposal.

- E. Metals: Separate metals by type.
 - 1. Structural Steel: Stack members according to size, type of member, and length.
 - 2. Remove and dispose of bolts, nuts, washers, and other rough hardware.
- F. Asphalt Shingle Roofing: Separate organic and glass-fiber asphalt shingles and felts for recycling into asphalt paving or by other recycling entities.
- G. Gypsum Board: Stack large, clean pieces on wood pallets and store in a dry location for recycling off-site. Remove edge trim and sort with other metals. Remove and dispose of fasteners.
 - 1. Moisture-damaged gypsum board with evidence of significant mold growth shall be disposed of in accordance with New York City's "Guidelines on Assessment and Remediation of Fungi in Indoor Environments": <http://www.nyc.gov/html/doh/html/epi/moldrpt1.shtml>
- H. Acoustical Ceiling Panels and Tile: Stack large, clean pieces on wood pallets and store in a dry location.
 - 1. Separate suspension system, trim, and other metals from panels and tile and sort with other metals.
- I. Carpet and Pad: Roll large pieces tightly after removing debris, trash, adhesive, and tack strips.
 - 1. Store clean, dry carpet and pad in a closed container or trailer provided by a carpet recycler or manufacturer-related carpet reclamation agency.
- J. Equipment: Drain tanks, piping, and fixtures. Seal openings with caps or plugs. Protect equipment from exposure to weather.
- K. Plumbing Fixtures: Separate by type and size.
- L. Piping: Reduce piping to straight lengths and store by type and size. Separate supports, hangers, valves, sprinklers, and other components by type and size.
- M. Lighting Fixtures: Separate lamps by type and protect from breakage.
- N. Electrical Devices: Separate switches, receptacles, switchgear, transformers, meters, panelboards, circuit breakers, and other devices by type.
- O. Conduit: Reduce conduit to straight lengths and store by type and size.

3.5 RECYCLING CONSTRUCTION WASTE

- A. Packaging:
 - 1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
 - 2. Polystyrene Packaging: Separate and bag materials.
 - 3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project Site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.

4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.
- B. Site-Clearing Wastes: Chip brush, branches, and trees on-site.
 1. Comply with requirements in Division 2 Section "Exterior Plants" for use of chipped organic waste as organic mulch.
- C. Wood Materials:
 1. Clean Cut-Offs of Lumber: Grind or chip into material appropriate for mulch or erosion control.
 2. Lumber Treated with Heavy-Metal Preservatives: Do not grind, chip, or incinerate; must be reused or landfilled.
- D. Gypsum Board: Stack large, clean pieces on wood pallets and store in a dry location for recycling and / or reuse on-site or off-site.
 1. Moisture-damaged gypsum board with evidence of significant mold growth shall be disposed of in accordance with New York City's "Guidelines on Assessment and Remediation of Fungi in Indoor Environments": <http://www.nyc.gov/html/doh/html/epi/moldrpt1.shtml>
 2. Clean Gypsum Board: Grind scraps of clean gypsum board using small mobile chipper or hammer mill. Screen out paper after grinding.
 - a. Comply with requirements in Division 2 Section "Exterior Plants" for use of clean ground gypsum board as inorganic soil amendment.
- E. Miscellaneous: Anything called out to be ground and used on site should utilize an on-site grinder.
 1. Grinder should be able to accommodate a variety of materials including masonry, asphalt shingles, wood, and drywall.

3.6 DISPOSAL OF WASTE

- A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project Site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.
 1. Except as otherwise specified, do not allow waste materials that are to be disposed of to accumulate on site.
 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
 3. Do not burn or bury waste materials on or off site. Appropriate on-site topical application of ground gypsum or wood, or use of site paving as granulated fill is considered reuse, not waste.

END OF SECTION 01742

**NEW PASSENGER TERMINAL
DULUTH INTERNATIONAL AIRPORT
DULUTH, MINNESOTA**

**SECTION 02220 - BUILDING
EARTHWORK**

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. Provide building excavation, dewatering, fill, backfill and compaction specified and shown on the drawings. Included is preparation of subgrade for footings, slabs and pavement within the general building area.

1.3 SUBMITTALS

- A. Test Reports: The independent testing lab shall submit copies of the following reports to the Architect-Engineer and Owner:
 1. Report and certification of backfill and fill materials.
 2. Test reports on borrow material.
 3. Verification of each footing subgrade.
 4. Field density test reports.
 5. One optimum moisture-maximum density curve for each type of soil encountered.
 6. Other tests and material certificates, as required.

1.4 QUALITY ASSURANCE

- A. Codes and Standards: Comply with the provisions of the following codes, specifications and standards except as otherwise shown or specified:
 1. Governing Local Building Code.
 2. American Society for Testing and Materials (ASTM) C136 -- Standard Test for Sieve Analysis of Fine and Coarse Aggregates
 3. ASTM D 698 – Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³)
 4. ASTM D1556 Standard Test method for Density and Unit Weight of Soil in Place by the Sand-Cone Method
 5. ASTM D 1557 – Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³)
 6. ASTM D 2487 – Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)
 7. ASTM D 2922 – Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
- B. Regulations: Perform excavation work in compliance with applicable requirements of governing authorities having jurisdiction.
- C. Inspection Testing Laboratory: The Owner shall employ and pay an independent geotechnical testing laboratory, acceptable to the Architect-Engineer, to perform sampling and testing of soil materials proposed for use in the work, field observation

and testing for quality control during earthwork operations. All testing and inspection shall be performed by an Inspector Type Technical II as indicated in Division 01 Structural Tests and Special Inspections.

1.5 PROJECT / SITE CONDITIONS

- A. Site Information: The data on subsurface conditions shall be as interpreted in the Project Geotechnical Report and the General Conditions. Additional test borings and other exploratory operations may be made at no cost to the Owner.
- B. Verify that survey bench marks and intended elevations for the Work are as indicated in the Contract Documents.
- C. Existing Utilities: Locate existing underground utilities in the areas of work. If utilities are to remain in place, provide adequate means of protecting during excavation operations.
 - 1. Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavation, consult the utility owner immediately for directions. Cooperate with the Owner, the public and private utility companies in keeping their respective services and facilities in operation. Repair damaged utilities to the satisfaction of the utility Owner.
 - 2. Do not interrupt existing utilities serving facilities occupied and used by the Owner or others, except when permitted in writing by the Architect-Engineer and then only after acceptable temporary utility services have been provided.
 - 3. Demolish and completely remove from the site existing underground utilities indicated to be removed. Coordinate with local utility companies for shut-off of services if lines are active.
- D. Use of explosives is not permitted.
- E. Protection: Protect structures, utilities, sidewalks, pavements and other facilities from damages caused by settlement, lateral movement, undermining, washout and other hazards created by excavation operations.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

- A. Non-Frost Susceptible (NFS) Engineered Fill: Gradation as defined in the Project Geotechnical Report.
- B. General Engineered Fill: Non-organic granular material as defined in the Project Geotechnical Report. Excavated on-site soils can also be used as engineered fill under conditions noted in the Project Geotechnical Report.
- C. Future Aircraft Pavement Backfill: As defined in the Contract Documents.

2.2 COMPACTION EQUIPMENT

- A. Vibratory Rollers: The vibratory drum roller shall have the following minimum requirements:
 - 1. Drum Roller: 36 to 48 inches in diameter.
 - 2. Static at Drum Weight: 6,000 to 10,000 pounds.
 - 3. Approved compactors include Galion, Dynapac and Bros.
 - 4. Vibratory compaction shall be performed so as not to damage existing structures. Rollers shall not be used adjacent to the existing structures or

within a distance which will have an adverse effect. When compacting within 15 feet of the existing structure, a lightweight walk-behind sled or roller compactor should be used. Use mechanical hand equipment or alternate compaction equipment as needed.

- B. Alternate Compaction Equipment: Steel wheeled or pneumatic-tired nonvibratory rollers capable of meeting the compaction requirements specified herein. Use for clayey fine sands and adjacent to existing structures.
- C. Mechanical Hand Equipment: Hand vibratory sleds, rollers and tampers shall be capable of meeting the compaction requirements specified herein. Total weight shall be on the order of 100 to 500 pounds.

2.3 SOURCE QUALITY CONTROL

- A. Testing: The independent testing laboratory shall perform the following:
 1. Test soil materials proposed for use in the work and promptly submit test result reports.
 2. Provide one optimum moisture-maximum density curve for each type of soil encountered in subgrade and fills under building slabs and foundations and paved areas. Determine maximum densities in accordance with ASTM D1557.
 3. For backfill and fill materials, perform a mechanical analysis, AASHTO T88; plasticity index, AASHTO T90; and moisture-density curve, AASHTO T180 or ASTM D1557.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine the areas and conditions under which building excavation and fill is to be performed and do not proceed with the work prior to correcting unsatisfactory conditions.

3.2 CLEARING AND STRIPPING BUILDING AREAS

- A. Clear and strip the entire building area to at least 10 feet beyond perimeter to building footings and foundation, walks and slabs to remove existing vegetation, concrete and asphalt pavement layers and other obstructions to the work.
- B. Strip topsoil from areas within the building and slab areas and stockpile on the site for future use in site grading.

3.3 COMPACTION OF EXPOSED SOILS

- A. No compactive effort should be used on exposed soils.

3.4 EXCAVATION

- A. Excavation consists of the removal and disposal of materials encountered when establishing the required grade elevations for the site including footings, utilities and all other items indicated in the drawings and specifications.

- B. If any existing or former building foundations or any other unexpected subsurface conditions are encountered in the required excavation, notify the Architect-Engineer immediately.
- C. Earth excavation includes the removal and disposal of pavement and other obstructions visible on the ground surface, under-ground structures and utilities to be demolished and removed, material of any classification indicated in data on subsurface conditions, and other materials encountered that are not classified as unauthorized excavation.
- D. Unauthorized excavation consists of removal of materials beyond indicated subgrade elevations or side dimensions –indicated in the Project Geotechnical Report. Unauthorized excavation, as well as remedial work shall be at the Contractor's expense. Backfill and compact unauthorized excavations as specified for authorized excavations of the same classification, unless otherwise directed by the Architect - Engineer.
- E. Additional Excavation:
 - 1. When excavation has reached required subgrade elevations, notify the independent testing laboratory which shall make an inspection of conditions.
 - 2. If unsuitable bearing materials are encountered at the required subgrade elevations, carry excavations deeper and replace the excavated material as directed by the Geotechnical Engineer.
 - 3. If an excavation extends below the bottom of footing elevation in suitable bearing material, a 1H:1V excavation oversize shall be required for every foot of new fill placed below the base of the footing. The contractor shall not receive additional compensation.
 - 4. Removal of unsuitable material in excess of one foot in depth and its replacement as directed will be paid on the basis of contract conditions relative to changes in the work.
- F. Stability of Excavations:
 - 1. Comply with local codes and ordinances and requirements of agencies having jurisdiction. Slope sides of excavations as necessary for stability and compliance. Shore and brace where sloping is not possible either because of space restrictions or stability of material excavated. Maintain sides and slopes of excavations in a safe condition until completion of backfilling. Refer to the Geotechnical Report for further excavation stability requirements.
 - 2. Shoring and Bracing: Provide shoring and bracing designed for and adequate to resist all imposed loads.
- G. Dewatering:
 - 1. Prevent surface water and subsurface or ground water from flowing into the excavations and flooding the project site and surrounding area.
 - 2. Do not allow water to accumulate in excavations. Remove water from excavations to prevent softening of foundation bottoms, undercutting footings and soil changes detrimental to the stability of subgrades and foundations. Provide and maintain pumps, well points, sumps, suction and discharge lines and other dewatering system components necessary to convey the water away from excavations.
 - 3. Convey water removed from excavations and rainwater to collecting or run-off area. Establish and maintain temporary drainage ditches and other diversions outside the excavation limits for each structure. Do not use trench excavations for site utilities as temporary drainage ditches.

4. Provide groundwater control as required to maintain groundwater levels at least 12 inches below the bottom of any excavation made during construction and at least 24 inches below the surface of any vibratory compaction operations.
- H. Material Storage:
1. Stockpile excavated materials classified as satisfactory soil material where directed, until required for backfill or fill. Place, grade and shape stockpiles for proper drainage.
 2. Locate and retail fill materials away from edges of excavations.
 3. Dispose of excess soil material and waste materials as herein specified.
- I. Excavation for Structures:
1. Conform to the elevations and dimensions shown on the drawings, within a tolerance of plus or minus 0.10 foot, and extending a sufficient distance from footings and foundations to permit placing and removal of concrete formwork, installation of services, other construction and for inspection.
 2. After excavating footings and foundations to approximate bearing elevations, perform final excavation in the presence of the Inspection and Testing Service Representative.
 - a. In excavating for final grading of footings and foundations, take care not to disturb the bottom of the excavation. Excavate by hand to final grade just before concrete reinforcement is placed. Trim bottoms to the required lines and grades to leave a solid base to receive concrete.
- J. Excavation for Trenches: Dig trenches to the uniform width required for the particular item to be installed, sufficiently wide to provide ample working room.
1. Excavate trenches to the depth indicated or required. Carry the depth of trenches for piping to establish the indicated flow lines and invert elevations. Beyond the building perimeter, keep bottoms of trenches sufficiently below finish grade to avoid freeze-ups.
 2. Grade bottom of trenches as indicated, notching under pipe bells to provide solid bearing for the entire body of the pipe.
 3. Backfill trenches with concrete where trench excavations pass within 18 inches of column or wall footings and which are carried below the bottom of such footings, or which pass under wall footings. Place concrete to the level of the bottom of adjacent footing. Concrete is specified in Division 3.
 4. Do not backfill trenches until tests and inspections have been made and backfilling authorized by the Architect-Engineer. Use care in backfilling to avoid damage or displacement of pipe systems.
- K. Closing Abandoned Underground Utilities: Fully grout any abandoned underground utilities not indicated to be removed.
- L. Cold Weather Protection: Protect excavation bottoms against freezing when the atmospheric temperature is less than 35 degrees F.

3.5 BACKFILL AND FILL

- A. General:
1. In all excavations, use satisfactory excavated or borrow material that has been sampled, tested and approved by the soil testing agency.
 2. Backfill excavations as promptly as the work permits, but not until completion of the following:

- a. Completion of construction below finish grade including, where applicable, damproofing, waterproofing and perimeter insulation.
 - b. Inspection, testing, approval and recording locations of underground utilities.
 - c. Removal of concrete framework.
 - d. Removal of shoring and bracing, and backfilling of voids with satisfactory materials. Cut off temporary sheet piling driven below bottom of structures and remove in manner to prevent settlement of the structure or utilities, or leave in place if required.
 - e. Removal of trash and debris.
 - f. Permanent or temporary horizontal bracing is in place on horizontally supported walls.
- B. Placement and Competition:
- 1. Place backfill and fill materials in layers not more than 8 to 10 inches in loose depth for material compacted by vibratory compaction equipment and not more than 4 inches in loose depth for material compacted by hand-operated tampers.
 - 2. Before compaction, moisten or aerate each layer as necessary to provide the optimum moisture content of the soil material. Compact each layer to the required percentage of maximum dry density or relative dry for each area classification. Do not place backfill or fill material on surfaces that are muddy, frozen or contain frost or ice.
 - 3. Place backfill and fill materials evenly adjacent to structures, to the required elevations. Take care to prevent wedging action of the backfill against structures by carrying the material uniformly around the structure to approximately the same elevation in each lift. Do not overcompact against retaining walls and structures. Provide temporary bracing for retaining walls which are backfilled prior to construction of any restraining slab or other element.
- C. Backfill at Specific Locations:
- 1. Building footings shall bear directly on undisturbed native soils or lean-mix concrete over undisturbed native soil as defined by the Addendum to the Project Geotechnical Report dated January 29, 2010, and the Contract Documents. Determination of all footing bearing elevations shall be made in the field by a qualified geotechnical engineer.
 - 2. Floor slabs shall bear on a 6 inch thick clean sand layer over engineered fill as defined in the Project Geotechnical Report.
 - 3. Retaining Wall Backfill: Backfill within 6 horizontal feet of retaining walls shall consist of NFS sand fill with gradation as defined in the Project Geotechnical Report.

3.6 COMPACTION

- A. General: Control soil compaction during construction for compliance with the percentage of density specified.
- B. Percentage of Maximum Density Requirements: Compact soil to the following percentages of maximum dry density determined in accordance with ASTM D1557:
Typical Floor Slab Supporting Areas: Prepare slab subgrade areas as defined in the Project Geotechnical Report. Compact each layer of engineered fill material

to not less than 95 percent maximum dry density determined in accordance with ASTM D1557.2. Against Retaining Structures: Compact to not less than 95 percent maximum dry density determined in accordance with ASTM D1557.

3. Lawn and Planting Areas: Compact top 6 inches of subgrade and each layer of backfill or fill material to 90 percent maximum dry density.

C. Moisture Control:

1. Where the subgrade or layer or soil material must be moisture conditioned before compaction uniformly apply water to the surface of subgrade, or layer of soil material, to prevent free water appearing on the surface during or subsequent to compaction operations.
2. Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to specified density.
3. Soil material that has been removed because it is too wet to permit compaction may be stockpiled or spread and allowed to dry. Assist drying by discing, harrowing or pulverizing, until the moisture content is reduced to a satisfactory value.

3.7 FIELD QUALITY CONTROL

- A. Allow independent testing laboratory to inspect and approve subgrades and fill layers before further construction work is performed.
- B. The independent testing laboratory shall perform the following:
 1. Field density tests in accordance with ASTM D1556 (sand cone method) or ASTM D2922 (nuclear method).
 2. Footing Subgrade: For each strata of soil on which footings will be placed, conduct, at least one density test to verify the required design bearing capacities. Subsequent verification and approval of each footing subgrade may be based on a visual comparison of each subgrade with the related tested strata, when acceptable to the Architect-Engineer.
 3. Paved Areas and Building Slab Subgrade: Make at least one field density test of the subgrade and each lift of compacted fill for every 5,000 square feet of paved area or building slab, but in no case less than three tests at each level.
- C. If, in the opinion of the Architect-Engineer, based on testing service reports and inspection, the subgrade or fills which have been placed are below the specified density, provide additional compaction and testing at no additional expense.
 1. The results of density tests will be considered satisfactory when the average of any four consecutive test are each instance equal to or greater than the specified density, and if not more than one density test out of five has a value greater than two percent below the required density.

3.8 PROTECTION

- A. Protection of Graded Areas:
 1. Protect newly graded areas from traffic and erosion. Keep free of trash and debris.
 2. Repair and re-establish grades in settled, eroded and rutted areas to the specified tolerances.
- B. Reconditioning Compacted Areas: Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify the surface, re-

shape and compact to the required density prior to further construction. Use hand tamping for re-compaction over underground utilities and underfloor subdrains, if any.

3.9 DISPOSAL OF EXCESS AND WASTE MATERIAL

- A. Removal from Owner's Property: Remove all waste materials, including excavated material classified as unsatisfactory soil material, trash and debris, and legally dispose of it off the Owner's property.

3.10 TESTING AND INSPECTION

- A. General: Inspection and testing of soils shall conform to the requirements of Section 1704.7 of the International Building Code, 2006 Edition in addition to other requirements as stated herein.

END OF SECTION 02220

**NEW PASSENGER TERMINAL
DULUTH INTERNATIONAL AIRPORT
DULUTH, MINNESOTA**

**SECTION 02466 - DRILLED
CONCRETE PIERS**

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. Dry-installed drilled piers.
- B. Related Sections:
 - 1. Division 01 Section "Project Record Documents."
 - 2. Division 01 Section "Construction Facilities and Temporary Controls."
 - 3. Division 03 Section "Cast-In-Place Concrete".
 - 4. Division 31 Section "Site Clearing" for preparation of subgrade for drilled-pier operations including removal of vegetation, topsoil, debris, obstructions, and deleterious materials from ground surface.

1.3 REFERENCES

- A. American Concrete Institute (ACI):
 - 1. ACI 301 – Specification for Structural Concrete.
 - 2. ACI 336.1 – Reference Specification for the Construction of Drilled Piers.
- B. American Society for Testing and Materials (ASTM).
- C. American Welding Society (AWS):
 - 1. AWS D1.4 - Structural Welding Code - Reinforcing Steel.
- D. Concrete Reinforcing Steel Institute (CRSI): Manual of Standard Practice.

1.4 UNIT PRICES

- A. Unit prices are included in Division 01 Section "Unit Prices."
- B. Drilled Piers: Actual net volume of drilled piers in place and approved. Actual length, shaft diameter, and bell diameter if applicable, may vary, to coincide with elevations where satisfactory bearing strata are encountered. These dimensions may also vary with actual bearing value of bearing strata determined by an independent testing and inspecting agency. Adjustments will be made on net variation of total quantities, based on design dimensions for shafts.
 - 1. Base bids on indicated number of drilled piers and, for each pier, the design length from top elevation to bottom of shaft, and the diameter of shaft.
 - 2. Unit prices include labor, materials, tools, equipment, and incidentals required for excavation, trimming, shoring, casings, dewatering, reinforcement, concrete fill, testing and inspecting, removal of boulders (rocks with a diameter greater than 12 inches), and all other items for complete drilled-pier installation.

1.5 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
 - 1. Indicate amounts of mixing water to be withheld for later addition at Project site.
- C. Shop Drawings: For concrete reinforcement detailing fabricating, bending, supporting, and placing.
- D. Welding certificates, if applicable.
- E. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:
 - 1. Aggregates.
- F. Field quality-control reports.
- G. Sustainable Design Submittals:
 - 1. LEED Credit: Product Data for Credit MR 4.1: For products having recycled content, documentation indicating weights, costs, and percentages by weight of postconsumer and preconsumer recycled content.
 - a. Include statement indicating material weights and costs for each product having recycled content.
 - 2. LEED Credit: Product Data for Credit MR 5.1: For products having Regional content (Extracted, and processed or manufactured within 500 miles of site), documentation indicating total weights, costs and percentages by weight of regional content.
 - a. Include statement indicating material weights, and costs for each product having regional content.
- H. Other Informational Submittals:
 - 1. Record drawings.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer that has specialized in drilled-pier work.
- B. Testing Agency Qualifications: Qualified according to ASTM C 1077, ASTM D 3740, and ASTM E 329 for testing indicated.
- C. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1, "Structural Welding Code - Steel."
 - 2. AWS D1.4, "Structural Welding Code - Reinforcing Steel."
- D. Drilled-Pier Standard: Comply with ACI 336.1 unless modified in this Section.
- E. Preinstallation Conference: Conduct conference at project site.
 - 1. Review methods and procedures related to drilled piers including, but not limited to, the following:
 - a. Review geotechnical report.
 - b. Discuss existing utilities and subsurface conditions.
 - c. Review coordination with temporary controls and protections.

1.7 PROJECT CONDITIONS

- A. Existing Utilities: Locate existing underground utilities before excavating drilled piers. If utilities are to remain in place, provide protection from damage during drilled-pier operations.
 - 1. Should uncharted or incorrectly charted piping or other utilities be encountered during excavation, adapt drilling procedure if necessary to prevent damage to utilities. Cooperate with Owner and utility companies in keeping services and facilities in operation without interruption. Repair damaged utilities to satisfaction of utility owner.
- B. Interruption of Existing Utilities: Do not interrupt any utility to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility according to requirements indicated:
 - 1. Notify Construction Manager and Owner no fewer than three days in advance of proposed interruption of utility.
 - 2. Do not proceed with interruption of utility without Construction Manager's and Owner's written permission.
- C. Project-Site Information: A geotechnical report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by geotechnical engineer. Owner will not be responsible for interpretations or conclusions drawn from this data.
 - 1. Make additional test borings and conduct other exploratory operations necessary for drilled piers.
 - 2. The geotechnical report is included elsewhere in the Project Manual.
- D. Survey Work: Engage a qualified land surveyor or professional engineer to perform surveys, layouts, and measurements for drilled piers. Before excavating, lay out each drilled pier to lines and levels required. Record actual measurements of each drilled pier's location, shaft diameter, bottom and top elevations, deviations from specified tolerances, and other specified data.
 - 1. Record and maintain information pertinent to each drilled pier and cooperate with Owner's testing and inspecting agency to provide data for required reports.

PART 2 - PRODUCTS

2.1 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615, Grade 60, deformed.

2.2 CONCRETE MATERIALS

- A. Cementitious Material: Use the following cementitious materials, of same type, brand, and source, throughout Project:
 - 1. Portland Cement: ASTM C 150, Type I. Supplement with the following:
 - a. Fly Ash: ASTM C 618.
- B. Normal-Weight Aggregate: ASTM C 33, graded, 1-1/2 inch nominal maximum coarse-aggregate size. Provide aggregate from a single source
 - 1. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- C. Water: ASTM C 94 and potable.

- D. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
 - 1. Water-Reducing Admixture: ASTM C 494, Type A.
 - 2. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.
 - 3. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494, Type G.
 - 4. Plasticizing and Retarding Admixture: ASTM C 1017, Type II.

2.3 STEEL CASINGS

- A. Steel Pipe Casings: ASTM A 283, Grade C, or ASTM A 36, carbon-steel plate, with joints full-penetration welded according to AWS D1.1.
- B. Liners: Comply with ACI 336.1.

2.4 CONCRETE MIXTURES

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
- B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement to 15%.
- C. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.
- D. Proportion normal-weight concrete mixture as follows:
 - 1. Compressive Strength (28 Days): 4000 psi.
 - 2. Maximum Water-Cementitious Materials Ratio: 0.50.
 - 3. Minimum Slump: Capable of maintaining the following slump until completion of placement:
 - a. 4 inches for dry, uncased, or permanent-cased drilling method.
 - b. 6 inches for temporary-casing drilling method.
 - c. 7 inches for slurry displacement method.
 - 4. Air Content: Do not air entrain concrete.

2.5 FABRICATING REINFORCEMENT

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.6 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94, and furnish batch ticket information.
 - 1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, vibration, and other hazards created by drilled-pier operations.

3.2 EXCAVATION

- A. Unclassified Excavation: Excavate to bearing elevations regardless of character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions.
 - 1. Obstructions: Unclassified excavated materials may include removal of unanticipated boulders, concrete, masonry, or other subsurface obstructions. Payment for removing obstructions that cannot be removed by conventional augers fitted with soil or rock teeth, drilling buckets, or underreaming tools attached to drilling equipment of size, power, torque, and downthrust necessary for the Work will be according to Contract provisions for changes in the Work.
- B. Prevent surface water from entering excavated shafts. Conduct water to site drainage facilities.
- C. Excavate shafts for drilled piers to indicated elevations. Remove loose or disturbed material from bottom of excavation exposing undisturbed native soils or bedrock.
 - 1. Excavate bottom of drilled piers to level plane within 1:12 tolerance.
 - 2. Remove water from excavated shafts before concreting.
 - 3. Excavate rock sockets of dimensions indicated.
 - 4. Cut series of grooves about perimeter of shaft to height from bottom of shaft, vertical spacing, and dimensions indicated.
- D. Notify and allow testing and inspecting agency to test and inspect bottom of excavation. If unsuitable bearing stratum is encountered, make adjustments to drilled piers as determined by Architect.
 - 1. Do not excavate shafts deeper than elevations indicated unless approved by Architect.
 - 2. Payment for additional authorized excavation will be according to Contract provisions for changes in the Work.
- E. Excavate shafts for closely spaced drilled piers and for drilled piers occurring in fragile or sand strata only after adjacent drilled piers are filled with concrete and allowed to set.
- F. Temporary Casings: Install watertight steel casings of sufficient length and thickness to prevent water seepage into shaft; to withstand compressive, displacement, and withdrawal stresses; and to maintain stability of shaft walls.
 - 1. Remove temporary casings, maintained in plumb position, during concrete placement and before initial set of concrete.
- G. Tolerances: Construct drilled piers to remain within ACI 336.1 tolerances.
 - 1. If location or out-of-plumb tolerances are exceeded, provide corrective construction. Submit design and construction proposals to Architect for review before proceeding.

3.3 STEEL REINFORCEMENT

- A. Comply with recommendations in CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
- B. Clean reinforcement of loose rust and mill scale, earth, and other materials that reduce or destroy bond with concrete.
- C. Fabricate and install reinforcing cages symmetrically about axis of shafts in a single unit.
- D. Accurately position, support, and secure reinforcement against displacement during concreting. Maintain minimum cover over reinforcement.

- E. Use templates to set anchor bolts, leveling plates, and other accessories furnished in work of other Sections. Provide blocking and holding devices to maintain required position during final concrete placement.
- F. Protect exposed ends of extended reinforcement, dowels, or anchor bolts from mechanical damage and exposure to weather.

3.4 CONCRETE PLACEMENT

- A. Place concrete in continuous operation and without segregation immediately after inspection and approval of shaft by Owner's independent testing and inspecting agency.
 - 1. Construction joints are not allowed without written permission from the Architect.
- B. Dry Method: Place concrete to fall vertically down the center of drilled pier without striking sides of shaft or steel reinforcement.
 - 1. Where concrete cannot be directed down shaft without striking reinforcement, place concrete with chutes, tremies, or pumps.
 - 2. Vibrate top 60 inches of concrete.
- C. Coordinate withdrawal of temporary casings with concrete placement to maintain at least a 60-inch head of concrete above bottom of casing.
 - 1. Vibrate top 60 inches of concrete after withdrawal of temporary casing.
- D. Screed concrete at cutoff elevation level and apply scoured, rough finish. Where cutoff elevation is above the ground elevation, form top section above grade and extend shaft to required elevation.
- E. Protect concrete work, according to ACI 301, from frost, freezing, or low temperatures that could cause physical damage or reduced strength.
 - 1. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
 - 2. Do not use calcium chloride, salt, or other mineral-containing antifreeze agents or chemical accelerators.
- F. If hot-weather conditions exist that would seriously impair quality and strength of concrete, place concrete according to ACI 301 to maintain delivered temperature of concrete at no more than 90 deg F.
 - 1. Place concrete immediately on delivery. Keep exposed concrete surfaces and formed shaft extensions moist by fog sprays, wet burlap, or other effective means for a minimum of seven days.

3.5 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:
 - 1. Drilled piers.
 - 2. Excavation.
 - 3. Concrete.
 - 4. Steel reinforcement welding.
- B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- C. Drilled-Pier Tests and Inspections: For each drilled pier, before concrete placement.

1. Soil Testing: Bottom elevations, bearing capacities, and lengths of drilled piers indicated have been estimated from available soil data. Actual drilled-pier lengths below existing adjacent ground surface and bearing capacities will be determined by testing and inspecting agency. Final evaluations and approval of data will be determined by Architect.
- D. Concrete Tests and Inspections: ASTM C 172 except modified for slump to comply with ASTM C 94.
1. Slump: ASTM C 143; one test at point of placement for each compressive-strength test but no fewer than one test for each concrete load.
 2. Concrete Temperature: ASTM C 1064; 1 test hourly when air temperature is 40 deg F and below and 80 deg F and above, and 1 test for each set of compressive-strength specimens.
 3. Compression Test Specimens: ASTM C 31; one set of four standard cylinders for each compressive-strength test unless otherwise indicated. Mold and store cylinders for laboratory-cured test specimens unless field-cured test specimens are required.
 4. Compressive-Strength Tests: ASTM C 39; one set for each drilled pier but not more than one set for each truck load. One specimen will be tested at 7 days, 2 specimens will be tested at 28 days, and 1 specimen will be retained in reserve for later testing if required.
 5. If strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
 6. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
 7. Report test results in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. List Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests in reports of compressive-strength tests.
 8. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
 9. Additional Tests: Testing and inspecting agency will make additional tests of concrete if test results indicate that slump, compressive strengths, or other requirements have not been met, as directed by Architect.
 - a. Continuous coring of drilled piers may be required, at Contractor's expense, if temporary casings have not been withdrawn within specified time limits or if observations of placement operations indicate deficient concrete quality, presence of voids, segregation, or other possible defects.
 10. Perform additional testing and inspecting, at Contractor's expense, to determine compliance of replaced or additional work with specified requirements.
 11. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.
- E. An excavation, concrete, or a drilled pier will be considered defective if it does not pass tests and inspections.
- F. Prepare test and inspection reports for each drilled pier as follows:
1. Actual top and bottom elevations.
 2. Actual drilled-pier diameter at top and bottom.
 3. Description of soil materials.

4. Description, location, and dimensions of obstructions.
5. Final top centerline location and deviations from requirements.
6. Variation of shaft from plumb.
7. Shaft excavating method.
8. Design and tested bearing capacity of bottom.
9. Levelness of bottom and adequacy of cleanout.
10. Ground-water conditions and water-infiltration rate, depth, and pumping.
11. Description, purpose, length, wall thickness, diameter, tip, and top and bottom elevations of temporary casings. Include anchorage and sealing methods used and condition and weather tightness of splices if any.
12. Description of soil or water movement, sidewall stability, loss of ground, and means of control.
13. Date and time of starting and completing excavation.
14. Inspection report.
15. Condition of reinforcing steel and splices.
16. Position of reinforcing steel.
17. Concrete placing method, including elevation of consolidation and delays.
18. Elevation of concrete during removal of casings.
19. Locations of construction joints.
20. Concrete volume.
21. Concrete testing results.
22. Remarks, unusual conditions encountered, and deviations from requirements.

3.6 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it as directed by the Owner and/or Construction Manager.

END OF SECTION 02466

**NEW PASSENGER TERMINAL
DULUTH INTERNATIONAL AIRPORT
DULUTH, MINNESOTA**

**SECTION 03100 - CONCRETE
FORMWORK**

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. This Section specifies formwork for cast-in-place concrete for the following:
 - 1. Footings.
 - 2. Foundation walls.
 - 3. Slabs-on-grade.
 - 4. Concrete toppings.
 - 5. Building walls.
- B. Related Sections include the following:
 - 1. Division 01 Section "Structural Testing and Special Inspections".
 - 2. Division 03 Section "Concrete Reinforcement".
 - 3. Division 03 Section "Cast-In-Place Concrete".
 - 4. Division 05 Section "Structural Steel" for embedded items.

1.3 REFERENCES

- A. ACI 117 – Specifications for Tolerance for Concrete Construction and Materials
- B. ACI 301 – Specification for Structural Concrete for Buildings.
- C. ACI 318 – Building Code Requirements for Structural Concrete.
- D. ACI 347 – Guide to Formwork for Concrete.
- E. PS1 – Construction and Industrial Plywood.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Formwork Shop Drawings: Prepared by or under the supervision of a Specialty Structural Engineer detailing fabrication, assembly, and support of formwork.
 - 1. Engineering Responsibility: Formwork, bracing, shoring, and reshoring design for construction loads are sole responsibility of Installer's Specialty Structural Engineer.
- C. Material Certificates: For each of the following, signed by manufacturers:

1. Form materials and form-release agents.

1.5 INFORMATIONAL SUBMITTALS

- A. Submittal Schedule for all action submittal items.
- B. Minutes of Pre-Installation conference.
- C. Sustainable Design Submittals:
 1. LEED Credit: Product Data for Credit EQ 4.1: For adhesives, including printed statement of VOC content.
 2. Product Data for Credit EQ 4.4: For composite-wood products, documentation indicating that product contains no urea formaldehyde.
 3. Certificates for Credit MR 7: Chain-of-custody certificates certifying that products specified to be made from certified wood comply with forest certification requirements. Include evidence that mill is certified for chain of custody by an FSC-accredited certification body.
 - a. Include statement indicating costs for each certified wood product.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has completed concrete work similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- B. Specialty Structural Engineer Qualifications: Employ professional Engineer, registered in the State of Minnesota, to perform design of formwork and shoring for construction loads. Sign and seal design Shop Drawings submitted to Owner for review.
- C. Mockups: See Specification Section 03300 "Cast in Place Concrete."
- D. Pre-Installation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."
 1. Review special inspection and testing and inspecting agency procedures for field quality control, concrete finishes and finishing, forms and form removal limitations.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
 2. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.2 FORM-FACING MATERIALS

- A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
 - 1. Plywood, metal, or other approved panel materials.
 - 2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
 - a. High-density overlay, Class 1 or better.
 - b. Medium-density overlay, Class 1 or better; mill-release agent treated and edge sealed.
 - c. Structural 1, B-B or better; mill oiled and edge sealed.
 - d. B-B (Concrete Form), Class 1 or better; mill oiled and edge sealed.
- B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.
- C. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that will produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.
- D. Void Forms: Biodegradable paper surface, treated for moisture resistance, structurally sufficient to support weight of plastic concrete and other superimposed loads.
- E. Soil Retainers: Material to be rigid and non-degradable.
- F. Chamfer Strips: Wood, metal, PVC, or rubber strips.
- G. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.
- H. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
 - 1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
- I. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
 - 1. Furnish units that will leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
 - 2. Furnish ties that, when removed, will leave holes no larger than 1 inch in diameter in concrete surface.
 - 3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

PART 3 - EXECUTION

3.1 FORMWORK

- A. Work shall conform to ACI 117 and ACI 301, except as modified by requirements of these Contract Documents.
- B. Design, erect, shore, brace, and maintain formwork, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.
- C. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated.
- D. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:
 - 1. Class B, 1/4 inch for smooth-formed finished surfaces exposed to view and as indicated by the Architect.
 - 2. Class C, 1/2 inch, for rough-formed finished surfaces unless noted otherwise.
- E. Construct forms tight enough to prevent loss of concrete mortar.
- F. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
 - 1. Install keyways, reglets, recesses, and the like, for easy removal.
 - 2. Do not use rust-stained steel form-facing material.
- G. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.
- H. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.
- I. Chamfer exterior corners and edges of permanently exposed concrete. Size chamfer as indicated on drawings.
- J. Form openings, chases, offsets, sinkages, keyways, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.
- K. Fastening Devices for Other Work:
 - 1. Provide for installation of inserts, reglets, hangers, metal ties, anchor bolts and other fastening devices required for attachment of other work.
 - 2. Properly locate fastening devices in cooperation with other trades and secure position before concrete is placed.
 - 3. Where concrete surfaces are veneered with masonry, install masonry anchor slots.

- a. In concrete forms set vertically 2'-0" on center.
 - b. Install two continuous slots per face at each column face wider than 1'-4".
- 4. Where masonry abuts concrete surface, install one continuous masonry anchor slot in concrete forms set vertically for each eight inches width of masonry, centered in masonry width.
- L. Install sleeves in concrete piers, columns, beams or joists only upon approval of the Architect.
- M. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- N. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- O. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 INSTALLATION OF VOID FORMS AND SOIL RETAINERS

- A. Placement:
 - 1. Place forms on smooth, level, firm, dry surface.
 - 2. Butt carton forms tightly end to end and side to side, seam side down.
 - 3. Place cover sheets on carton forms and staple.
- B. Moisture Protection:
 - 1. Do not let carton forms become wet.
 - 2. Remove and replace wet cartons.
- C. Place soil retainers at edge of grade beams.

3.3 REMOVING AND REUSING FORMS

- A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete, if concrete is hard enough to not be damaged by form-removal operations and curing and protection operations are maintained.
 - 1. Leave formwork for beam soffits, joists, slabs, and other structural elements that supports weight of concrete in place until concrete has achieved at least 75 percent of its 28-day design compressive strength.
 - 2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.
- B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.
- C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.4 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage a qualified special inspector and independent testing agency to perform field tests and inspections and prepare test reports. Cooperate with testing agency to facilitate the execution of its duties.
- B. Inspect formwork prior to concrete placement to verify resulting element width, depth and length correspond to those indicated on formwork installation drawings and Contract Documents.
- C. Where special formed surface finish requirements are required, verify forming materials comply with requirements.
- D. Adequacy of formwork, shoring, and reshoring to support vertical and lateral loads during construction is sole responsibility of Contractor.

END OF SECTION 03100

**NEW PASSENGER TERMINAL
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**SECTION 03200 - CONCRETE
REINFORCEMENT**

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. Reinforcing bars for cast-in-place concrete.
 - 2. Smooth bar dowels and diamond dowels and dowel baskets for concrete slab joints.
 - 3. Deformed bar anchors and headed shear connectors.
 - 4. Stud rails.
 - 5. Couplers for reinforcing bars.
 - 6. Welded wire fabric.
 - 7. Ties and supports for reinforcement.
- B. Related Sections:
 - 1. Division 01 Section "Structural Testing and Special Inspections".
 - 2. Division 03 Section "Concrete Formwork".
 - 3. Division 03 Section "Cast-In-Place Concrete".
 - 4. Division 03 Section "Unbonded Post-Tensioned Concrete".

1.3 REFERENCES

- A. ACI 117 - Specification for Tolerances for Concrete Construction and Materials.
- B. ACI 301 – Specification for Structural Concrete.
- C. ACI 315 - Standards on Details and Detailing of Concrete Reinforcement.
- D. ACI 318 - Building Code Requirements for Structural Concrete.
- E. AWS D1.4 - Structural Welding Code Reinforcing Steel.
- F. CRSI - Manual of Standard Practice.
- G. CRSI - Placing Reinforcing Bars.

1.4 ACTION SUBMITTALS

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

- B. Shop Drawings: Submit in accordance with ACI 315, "Standards on Details and Detailing of Concrete Reinforcement"
 - 1. Provide necessary plan, elevation and section detail placing drawings that illustrate fabrication, bending, and placement of reinforcement.
 - 2. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.
- C. Welding certificates – signed by contractor certifying that welders comply with requirements of Article 1.5 – "Quality Assurance."

1.5 INFORMATIONAL SUBMITTALS

- A. Minutes of Pre-Installation conference.
- B. Sustainable Design Submittal:
 - 1. LEED Credit: Product Data for Credit MR 4.1 and Credit MR4.2 (if required): For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.
 - a. Include statement indicating costs for each product having recycled content.

1.6 QUALITY ASSURANCE

- A. Fabricator Qualifications: A qualified fabricator utilizing experienced detailers who have successfully completed CRSI's Reinforcing Bar Detailer Program.
- B. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548.
- C. Welding: Qualify procedures and personnel according to AWS D1.4, "Structural Welding Code--Reinforcing Steel."
- D. Pre-Installation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."
 - 1. Review special inspection and testing and inspecting agency procedures for field quality control, steel reinforcement installation, and protection during concrete placement.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage. Avoid damaging coatings on steel reinforcement.

1.8 EXTRA MATERIALS

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
 - 2. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.2 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615, Grade 60, deformed.
- B. Low-Alloy-Steel Reinforcing Bars: ASTM A 706, deformed.
- C. Deformed Bar Anchors (DBA): Standard fluxed ASTM A496 deformed bars prepared for stud welding.
 - 1. Available Manufacturers:
 - a. Erico Fastening.
 - b. Nelson Stud Welding.
- D. Headed Shear Connectors: ASTM A 108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1, Type B.
 - 1. Available Manufacturers:
 - a. Erico Fastening.
 - b. Nelson Stud Welding.
- E. Epoxy-Coated Reinforcing Bars: ASTM A 615, Grade 60, deformed bars, ASTM A 775, epoxy coated.
- F. Plain-Steel Wire: ASTM A 82, galvanized.
- G. Deformed-Steel Wire: ASTM A 496.
- H. Plain-Steel Welded Wire Reinforcement: ASTM A 185, plain, fabricated from as-drawn steel wire into flat sheets.

2.3 JOINT DOWELS

- A. Dowel Caps: Plastic material of size recommended for rod diameter.
- B. Smooth Dowel Bars: ASTM A 615, Grade 60, plain-steel bars, cut bars true to length with ends square and free of burr. Provide dowel ends that are sawn with round ends, not sheared with crimped ends.

- C. Smooth Dowel Support Baskets:
 - 1. Available Manufactures:
 - a. American Highway Technology.
- D. Smooth Dowel Coating: Grease or bituminous coating.
- E. Diamond Plate Dowels: Saw cut from ASTM A 36 hot rolled plate.
 - 1. Available Products:
 - a. Diamond Dowel™ by PNA, Inc.
- F. Smooth Plate Dowels and Baskets:
 - 1. Approved Manufacturers:
 - a. PNA, Inc.
- G. Epoxy-Coated Joint Dowel Bars: ASTM A 615, Grade 60, plain-steel bars, ASTM A 775 epoxy coated.

2.4 REINFORCEMENT ACCESSORIES

- A. Epoxy Repair Coating: Liquid, two-part, epoxy repair coating; compatible with epoxy coating on reinforcement and complying with ASTM A 775.
 - 1. Available Products:
 - a. 3M Scotchkote 213PC or liquid, two-part, epoxy repair coating or approved equal.
- B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, or plastic according to CRSI's "Manual of Standard Practice," and as follows:
 - 1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.
 - 2. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.
- C. Rebar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place. Chairs are to be stable and resist tipping.
 - 1. Dayton Richmond: Aztec E-Z Chair – PEZ and Tower Chair PTC.
 - 2. General Technologies, Inc.: Composite Chairs and Composite Slab-Beam Bolsters.
- D. Supports for slabs-on-grade with steel reinforcement: Use supports with sand plates or horizontal runners.
 - 1. Dayton Richmond: Aztec E-Z Chair – PEZ with E-Z Chair Sand Plate PSP.
 - 2. General Technologies, Inc.: Composite Chairs on Sand Plates.
- E. Compression Couplers: Use only where explicitly referenced on Drawings.
 - 1. Speed sleeve by Erico.
 - 2. G-Loc by Gateway Erectors.

- F. Tension Couplers: Use only where explicitly referenced on Drawings.
 - 1. Lenton Couplers by Erico.
 - 2. MRC 150 by Dayton Superior.
 - 3. No-Slip Coupler by Fox-Howlet.

2.5 FABRICATING REINFORCEMENT

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice" and accepted shop drawings.
- B. Do not re-bend or straighten steel reinforcement except where specifically accepted.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Comply with CRSI's "Manual of Standard Practice" and accepted shop drawings for placing reinforcement. Adjust reinforcing to avoid sleeves, blockouts and other voids in concrete.
- B. Underfloor Vapor Retarders: When chairing reinforcement on top of underfloor vapor retarders, use only supports with integral sand plates.
 - 1. Do not cut or puncture vapor retarder.
 - 2. Repair damage and reseal cuts or punctures in vapor retarder before placing concrete.
- C. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.
- D. Accurately position, support, and secure reinforcement against displacement by formwork, construction, or concrete placement operations. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
 - 1. Weld reinforcing bars according to AWS D1.4, where indicated.
- E. Provide bar supports in sufficient number and heavy enough to carry steel they support. Place no bar more than 2 inches beyond last leg of continuous bar support. Do not use bar supports to support runways for concrete buggies, or similar loads.
 - 1. Maximum support bar spacing shall not exceed 48 inches.
 - 2. Maximum bolster spacing shall not exceed 36 inches for #4 support bar or 48 inches for #5 support bar.
- F. Bar supports on ground may be concrete block for slab depth of 7 inches or less and if positioned in staggered pattern. Provide bar chairs with sand feet where slab thickness exceeds 7 inches.
- G. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- H. Steel reinforcement partially embedded in concrete shall not be field bent, except as indicated or permitted by Structural Engineer.

- I. For walls reinforced on both faces, provide spreader bars and chairs to surfaces of forms on each side at spacings not to exceed 8 feet in either direction. For walls with single layer of reinforcing, provide chairs each side at spacings not to exceed 8 feet in either direction.
- J. Install epoxy coated reinforcing bars using either epoxy or plastic coated tie wires. Place epoxy coated steel on epoxy coated bar supports. Patch cut ends and areas of damage.
- K. Install welded wire reinforcement in longest practicable lengths. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.
- L. Center smooth dowel bars on joints, position dowels at center of slab depth and align perpendicular to face of joints both vertically and horizontally. Within 30 minutes before placement of adjacent concrete along doweled joints, apply dowel coating on free ends of dowels.
- M. Install diamond plate dowels in concrete slab-on-grade joints where shown. Install diamond plate dowels per manufacturer's written instructions.

3.2 PROTECTION AND REPAIR

- A. Install additional bar supports at locations where reinforcement position is not maintained due to collapsed chairs or construction activity from time of original placement.
- B. Epoxy-Coated Reinforcement: Repair cut and damaged epoxy coatings with epoxy repair coating according to ASTM D 3963. Use epoxy-coated steel wire ties to fasten epoxy-coated steel reinforcement.

3.3 FIELD QUALITY CONTROL

- A. Assign individual to monitor reinforcement position during concrete placement and reposition bars that are displaced due to construction activity.
- B. Testing and Inspecting: Owner will engage a qualified special inspector and material testing agency to perform field quality control inspections and testing in accordance with Division 01 Section "Structural Tests and Inspections" and as specified herein.
- C. Submit reports of inspections and material testing as soon as practical after they are made.
- D. Inspect reinforcement in all cast-in-place concrete footings, foundation frost walls, basement walls, retaining walls, and columns, slabs on grade, and topping slabs.
- E. Verify reinforcing bar grade.
- F. Verify reinforcing bars are free of dirt, excessive rust and damage.

- G. Verify reinforcing bars are adequately tied, chaired and supported to prevent displacement during concrete placement.
- H. Verify proper clear distances between bars and to surfaces of concrete.
- I. Verify reinforcing bar size and placement.
- J. Verify bar laps for proper length and stagger and bar bends for minimum diameter, slope and length.
- K. Verify mechanical splices are placed in accordance with Contract Documents and reviewed shop drawings.
- L. Verify epoxy coating is present at locations noted on the Contract Documents; include tie wires, chairs, bolsters, etc. Verify coating damage is repaired in accordance with the Contract Documents.
- M. Verify installation of anchor rods, embedded plates and angles are placed in accordance with the Contract Documents.
- N. Correct work that does not comply with specified requirements prior to scheduling concrete placement.
- O. Additional inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

END OF SECTION 03200

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**SECTION 03300 – CAST-IN-PLACE
CONCRETE**

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. This Section specifies cast-in place concrete, vapor retarder, concrete materials, mixture design, placement procedures, finishes and all related accessories, for the following:
 - 1. Footings.
 - 2. Foundation walls and piers.
 - 3. Slabs-on-grade.
 - 4. Columns.
 - 5. Concrete toppings.
 - 6. Base slabs.
 - 7. Miscellaneous concrete items.
 - 8. Placement of embedded items provided by other trades
- B. Related Requirements:
 - 1. Division 01 Section "Structural Tests and Special Inspections".
 - 2. Division 03 Section "Concrete Formwork".
 - 3. Division 03 Section "Concrete Reinforcement".
 - 4. Division 03 Section "Concrete Topping".
 - 5. Division 04 Section "Unit Masonry" for wedge type inserts and dovetail slots.
 - 6. Division 05 Sections for items cast into concrete.
 - 7. Division 31 Section "Earth Moving".

1.3 REFERENCES

- A. ACI 117 – Specifications for Tolerances for Concrete Construction and Materials.
- B. ACI 214 - Recommended Practice for Evaluation of Strength Test Results of Concrete.
- C. ACI 223 – Standard Practice for the Use of Shrinkage Compensation Concrete.
- D. ACI 301 - Specifications for Structural Concrete for Buildings.
- E. ACI 302 – Guide for Concrete Floor and Slab Construction.
- F. ACI 304 - Guide for Measuring, Mixing, Transporting and Placing Concrete.
- G. ACI 305 - Hot Weather Concreting.

- H. ACI 306 - Cold Weather Concreting.
- I. ACI 308 – Standard Practice for Curing Concrete.
- J. ACI 309 - Guide for Consolidation of Concrete.
- K. ACI 318 - Building Code Requirements for Structural Concrete.
- L. ASTM E 1155 – Standard Test Method for Determining F_F Floor Flatness and F_L Floor Levelness Numbers.

1.4 DEFINITIONS

- A. Floor Flatness Number, F_F , measures floor curvature or flatness per ASTM E 1155.
- B. Floor Levelness Number, F_L , measures floor inclination from a horizontal plane per ASTM E 1155.
 - 1. Floor Levelness, (F_L), tolerances only apply to nonsloping slabs-on-grade and suspended slabs shored at time of testing. Floor Levelness tolerances shall not apply to slabs placed on unshored form surfaces, shored surfaces after removal of shores, or pitched slab surfaces per ACI 302.
- C. Overall F_F/F_L numbers represent minimum values acceptable for all combined local floor test sections representing the specified floor finish area per ACI 302.
- D. Local F_F/F_L test areas shall be defined as follows per ACI 302.
 - 1. Areas bounded by construction or control joints for slabs-on-grade.
 - 2. Areas bounded by columns and/or wall lines for elevated structural slabs. No less than one-half bay size.
- E. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume; subject to compliance with requirements.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
 - 1. Form-release agents
 - 2. Concrete Admixtures.
 - 3. Curing Materials.
 - 4. Joint Fillers.
 - 5. Waterstops.
 - 6. Floor and Slab Treatments.
 - 7. Bonding Agents.
 - 8. Adhesives.
 - 9. Repair Materials
- B. Concrete Mix Designs: Each concrete mix design submittal shall contain the following information:
 - 1. Mix Number (which will correspond to mix ticket on trucks delivered to site).

2. Application for which concrete is designed (i.e. – footings, slabs, etc...)
3. Applicable mix performance criteria including:
 - a. Final Design strength at 28 days.
 - b. Unit Weight.
 - c. Air Content.
 - d. Slump (with water only and after addition of WRA and/or HRWRA).
 - e. For shrinkage compensating concrete, provide results of restrained prism expansion tests, ASTM C878, with mix design.
4. Applicable mix ingredients including quantities, ASTM designations, and sources for:
 - a. Cementitious materials.
 - b. Aggregate source, geological type, size, and shape.
 - 1) Include total gradation for combined coarse and fine aggregates for mixes specified to contain Well Graded Aggregate.
 - 2) Included calculated Coarseness Factor and Workability Factor for mixes specifying limits on these values.
 - c. Water.
 - 1) Indicate amount of mixing water to be withheld for later addition at Project site.
 - d. Water cementitious materials ratio, w/cm.
 - e. Admixtures.
 - f. Fibers, color pigments, and other additions.
5. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

C. Proposed construction joint and saw-cut contraction joint locations for slabs-on-grade.

1.6 INFORMATIONAL SUBMITTALS

- A. Submittal Schedule for all action submittal items.
- B. Manufacturer's Instructions for each type of product indicated:
 1. Curing and Sealing Compounds.
 2. Joint Fillers.
 3. Waterstops.
 4. Floor and Slab Treatments.
 5. Bonding Agents.
 6. Adhesives.
 7. Repair Materials.
- C. Preconstruction Material Test Reports:
 1. Cementitious Materials.
 2. Compressive strength results of trial batches or historical test data, in accordance with ACI 318 Chapter 5, indicating following:
 - a. Specified compressive strength, f'_c .
 - b. Average compressive strength, f'_{cr} .
 - c. Number of consecutive tests.
 - d. Overall standard deviation.
 - e. Overall coefficient of variation.
 - f. Minimum moving average of three consecutive strength tests.
 3. Aggregate gradation, specific gravity, and absorption.

4. Aggregate potential alkali-silica reactivity (ASR) for concrete in exterior, corrosive, or wet environments in accordance with ASTM C 289.

D. Minutes of Pre-Installation conference.

E. Sustainable Design Submittals:

1. LEED Credit: Product Data for Credit MR 4.1 and Credit MR 4.2 if required: For products having recycled content, documentation indicating weights, costs, and percentages by weight of postconsumer and preconsumer recycled content.
 - a. Include statement indicating material weights and costs for each product having recycled content.
 - b. Design Mixtures for Credit ID 1.1: For each concrete mixture containing recycled pozzolanic or cementitious materials as a replacement for portland cement and for equivalent concrete mixtures that do not contain portland cement replacements.
2. LEED Credit: Product Data for Credit MR 5.1 and Credit MR 5.2 if required: For products having Regional content (Extracted, and processed or manufactured within 500 miles of site), documentation indicating total weights, costs and percentages by weight of regional content.
 - a. Include statement indicating material weights, and costs for each product having regional content.

F. Construction Test Reports:

1. Concrete tests.
2. Floor tolerance measurement.
3. Industrial floor joint filler inspection.

1.7 CLOSEOUT SUBMITTALS

A. Floor Correction Agreement: Submit written floor slab extended correction period agreement in duplicate within ten days after date of Substantial Completion.

B. Maintenance Contracts:

1. Curing and Sealing Compounds.
2. Floor and Slab Treatments.

C. Operation and Maintenance Data:

1. Curing and Sealing Compounds.
2. Floor and Slab Treatments.

D. Bonds.

E. Warranty Documentation.

F. Record Documentation.

G. Sustainable Design Closeout Documentation.

1.8 QUALITY ASSURANCE

- A. **Installer Qualifications:** An experienced installer who has completed concrete work similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- B. **Manufacturer Qualifications:** A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94 requirements for production facilities and equipment.
 - 1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."
- C. **Testing Agency Qualifications:** An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548.
- D. **Source Limitations:** Obtain materials from same source throughout Work.
- E. **Mockups:** Construct mockups as directed by the Architect to demonstrate aesthetic effects and qualities of materials and execution. Build mockups to comply with the following requirements, using materials indicated for the completed Work:
 - 1. **Exposed Concrete Panel Samples:** Cast concrete formed-surface panels to demonstrate typical joints, surface finish, texture, tolerances, and standard of workmanship for review and acceptance by Architect and Owner.
 - a. Build panel to size and in the location as directed by the Architect.
 - b. Approved mockups may become part of the completed Work and shall remain exposed to view for duration of work as basis for quality of final construction.
 - c. Sample mockups not selected for incorporation shall be demolished and removed from site.
- F. Contractor shall assign a qualified staff member to perform quality control on their own work in the field on a daily basis, for each day work is performed. The Contractor's quality control staff shall review their own work for compliance with contract documents before the Contractor notifies the design team of readiness for required inspections, tests and observations to be provided by the Owner's Representatives.
- G. **Pre-Installation Conference:** Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination" and Division 01 Section "Structural Tests and Special Inspections".
 - 1. Review installer qualifications, methods, scheduling and testing procedures before work is started.
 - 2. Review special inspection and testing and inspecting agency procedures for field quality control, steel reinforcement installation, concrete finishes and finishing, cold- and hot-weather concreting procedures, curing procedures, construction contraction and isolation joints, and joint-filler strips, semirigid joint fillers, vapor-retarder installation, anchor rod and anchorage device installation tolerances, floor and slab flatness and levelness measurement, concrete repair procedures, and concrete protection.

3. Authorized representatives of concrete supplier, industrial floor supplier and installer, floor finisher, testing and inspection agency, admixture supplier, steel fiber reinforcement supplier, Engineer, Owner and Construction Manager.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.
- B. Joint Filler, Joint Sealers and Curing Materials: Deliver in original factory packaging and unopened containers and protect from damage and contamination.

1.10 SITE CONDITIONS

- A. Provide total building enclosure including weather tight roof and walls before placing interior concrete slabs.
- B. During installation of interior slabs on grade, close openings in exterior walls and roofs enclosing areas.
- C. Provide minimum interior temperature 50 degrees F during installation and curing.
- D. Vent heaters or combustion equipment to outside.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
 2. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.2 CONCRETE MATERIALS

- A. Cementitious and Pozzolanic Materials: Use the following materials, of the same type, brand, and source for each required type of concrete and on which selection of concrete proportions was based:
 1. Portland Cement: ASTM C 150, Type 1 or Type I/II.
 2. Fly Ash: ASTM C 618, Class C or F, and as specified herein.
 - a. Available Alkalis, as Na₂O equivalent: 1.5% maximum
 - b. Loss On Ignition (LOI): 1% maximum
 - c. Calcium Oxide Limit (CaO): 20% maximum
 3. Microsilica: ASTM C 1240, amorphous silica.
 4. Replacement Ratio: Portland cement shall be replaced on an equal mass (not weight) basis. Material replacements shall be expressed as a percent, by mass, of the total cementitious materials content, with proportions selected for 28 day compressive strengths equal to those specified. The change in volume resulting

from the substitutions shall be determined and an adjustment in both coarse and fine aggregate proportions shall be determined in order to ensure a unit volume.

- a. Fly Ash replacement shall not exceed 30% for Class C, 20% for Class F, or as specified for a particular mix design.
- b. Microsilica replacement shall not exceed 10%.
- c. Maximum cement replacement of concrete mixes containing pozzolan shall not exceed 40% unless specified otherwise.

B. Normal-Weight Aggregates: ASTM C 33. Do not use aggregates containing soluble salts or other substances which can cause stains on exposed surfaces. Use aggregates from one source of supply corresponding to that on which selection of concrete proportions was based.

1. Coarse Aggregate: Minimum Class Designation:
 - a. Class 3S Typical
 - b. Class 4S Exterior horizontal concrete
 - 1) Maximum absorption 1.7%
 - c. Class 5S Exterior exposed architectural concrete
 - 1) Maximum absorption 1.7%
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
3. Aggregate Gradation: Conform to ASTM C 33 and as specified herein.
 - a. Well Graded Aggregate: Provide in concrete mixes indicated with the combined coarse and fine aggregates meeting the following criteria:

Sieve Size	Top Size Aggregate		
	1 1/2"	1"	3/4"
% Retained on Sieve			
1 1/2"	0% - 8%		
1"	8% - 18%	0% - 8%	
3/4"	8% - 18%	8% - 22%	0% - 6%
1/2"	8% - 18%	8% - 22%	6% - 22%
3/8"	8% - 18%	8% - 22%	6% - 22%
No. 4	8% - 18%	8% - 22%	6% - 22%
No. 8	8% - 18%	8% - 22%	6% - 22%
No. 16	8% - 18%	8% - 22%	6% - 22%
No. 30	8% - 18%	8% - 22%	6% - 22%
No. 50	3% - 12%	3% - 12%	3% - 12%
No. 100	0% - 8%	0% - 8%	0% - 8%
No. 200	0% - 5%	0% - 5%	0% - 5%

- 1) At least 55% by weight shall be retained on or above the #4 sieve.
 - 2) A maximum of two non-adjacent sieves between 1 inch and No. 50 may fall outside the prescribed limits above with a minimum of 5% retained and a maximum of 22% retained on these nonconforming sieves.
4. Aggregates for Exposed Architectural Finish Concrete: Aggregates shall be specially selected for color and size as selected by Architect.

C. Water: ASTM C 94 and potable.

2.3 ADMIXTURES

- A. General: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use admixtures containing calcium chloride or thiocyanates.
- B. Air-Entraining Admixture (AEA): ASTM C 260.
 - 1. Available Products:
 - a. BASF: MB AE 90 or Micro Air.
 - b. Euclid Chemical Company: Air-Mix.
 - c. General Resource Technology: Polychem AE.
 - d. Grace Construction Products: Daravair series or Darex series.
 - e. Protex Industries: Protex AES.
- C. Water-Reducing Admixture (WRA): ASTM C 494, Type A.
 - 1. Available Products:
 - a. BASF: Pozzolith 210 or Pozzolith 322 N
 - b. Euclid Chemical Company: Eucon WR-75.
 - c. General Resource Technology: Polychem 1000.
 - d. Grace Construction Products: WRDA.
- D. Mid-Range Water-Reducing Admixture (MRWRA): ASTM C 494, Type A.
 - 1. Available Products:
 - a. BASF: Polyheed 997 or Polyheed FC100.
 - b. Euclid Chemical Company: Eucon A+.
 - c. General Resource Technology: KB-1000.
 - d. Grace Construction Products: Daracem-65.
- E. Polycarboxylate High-Range Water-Reducing Admixture (HRWRA): ASTM C 494, Type F.
 - 1. Available Products:
 - a. BASF: Glenium 3000 NS, 3030 NS, or 3200 HES.
 - b. Euclid Chemical Company: Plastol 5000.
 - c. Grace Construction Products: ADVA.
- F. Whelan Gum or Methylcellulose Viscosity Modifying Admixture (VMA):
 - 1. Available Products:
 - a. BASF: Rheomac VMA 358, 362, or 450.
 - b. Euclid Chemical Company: Viscrol.
- G. Water-Reducing and Retarding Admixture: ASTM C 494, Type B and D.
 - 1. Available Products:
 - a. BASF: Pozzolith 80 or Pozzolith 200 N.
 - b. Euclid Chemical Company: Eucon Retarder-75.
 - c. General Resource Technology: Polychem R.
 - d. Grace Construction Products: Daratard 17.
- H. Non-Corrosive, Non-Chloride Accelerator: ASTM C494, Type C or E.
 - 1. Available Products:
 - a. BASF: Pozzolith NC 534.

- b. Euclid Chemical Company: Accelguard 80.
- c. General Resource Technology: Polychem Super Set.
- d. Grace Construction Products: Polarset.

I. Integral Water Repellant Admixtures:

- 1. Available Products:
 - a. Grace Construction Products: Darapel
 - b. Xypex Chemical Corporation: Admix C-1000 or C-2000.

J. Prohibited Admixtures: Calcium chloride, thiocyanates or admixtures effectively containing chloride ions (more than 0.05 percent) are not permitted.

2.4 WATERSTOPS

A. Self-Expanding Butyl Strip Waterstops: Manufactured rectangular or trapezoidal strip, butyl rubber with sodium bentonite or other hydrophilic polymers, for adhesive bonding to concrete, 3/4 by 1 inch.

- 1. Available Products:
 - a. Colloid Environmental Technologies Company; Volclay Waterstop-RX.
 - b. Concrete Sealants Inc.; Conseal CS-231.
 - c. Greenstreak; Swellstop.
 - d. Henry Company, Sealants Division; Hydro-Flex.
 - e. JP Specialties, Inc.; Earthshield Type 20.
 - f. Progress Unlimited, Inc.; Superstop.
 - g. TCMiraDRI; Mirastop.

2.5 MISCELLANEOUS EMBEDDED ITEMS

A. Headed Anchor Rods: ASTM F 1554, Grade 36, straight.

- 1. Nuts: ASTM A 563 heavy hex carbon steel.
- 2. Plate Washers: ASTM A 36 carbon steel.
- 3. Washers: ASTM F 436 hardened carbon steel.

B. Miscellaneous angles, channels, and plates: ASTM A 36.

C. Reglets: Fabricate reglets of not less than 0.0217-inch- thick (26-ga.), galvanized steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.

- 1. Available Manufacturers:
 - a. Gateway Building Products.
 - b. Heckman Building Products.
 - c. Hohmann-Bernard.

D. Stair Nosings:

- 1. Available Products:
 - a. Wooster Products: Spectra Type WP4C.

2.6 CURING, CLEANING, AND SEALING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
 - 1. Available Products:
 - a. BASF: Confilm
 - b. Burke by Edoco; BurkeFilm.
 - c. ChemMasters; Spray-Film.
 - d. Conspec; Aquafilm.
 - e. Dayton Superior Corporation; Sure Film.
 - f. Euclid Chemical Company; Eucobar.
 - g. Kaufman Products, Inc.; Vapor Aid.
- B. Water Cure:
 - 1. Waterproof paper.
 - 2. Reef Industries: Transguard Economy Grade. (ASTM C 171, 20-mils thick, polypropylene sheet with nonperforated white coating.)
 - 3. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.
 - 4. Dayton Bag and Burlap: Burlene.
 - 5. Reef Industries: Transguard 4000; 42-mil thick, fiber mat with polyethylene sheet backing.
- C. Water: ASTM C 94 and potable.
- D. Clear, Solvent-Borne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A, minimum 25 percent total solids.
 - 1. Available Products:
 - a. Burke by Edoco; Cureseal 1315.
 - b. ChemMasters; Spray-Cure & Seal Plus.
 - c. Dayton Superior Corporation; Day-Chem Cure and Seal (J-22UV).
 - d. Euclid Chemical Company; Super Diamond Clear.
 - e. L&M Construction Chemicals, Inc.; Lumiseal Plus.
 - f. Meadows, W. R., Inc.; CS-309/30.
- E. Concrete Floor Cleaner and Stripper:
 - 1. Available Products:
 - a. Burke by Edoco; Burke Klean.
 - b. Dayton Superior Corporation; Citrus Peel (J-48).
 - c. Euclid Chemical Company; Euco Clean & Strip.
 - d. Kaufman Products, Inc.; K Pro CD.
 - e. L&M Construction Chemicals, Inc.; Citrex.
- F. Penetrating Liquid Densifier and Sealer: Clear, chemically reactive, waterborne solution of inorganic silicate or silicate materials and proprietary components; odorless; colorless; that penetrates, hardens, and densifies concrete surfaces.
 - 1. Available Products:
 - a. Burke by Edoco; Titan Hard.
 - b. ChemMasters; Chemisil Plus.
 - c. Curecrete Distribution Inc.; Ashford Formula.
 - d. Dayton Superior Corporation; Day-Chem Sure Hard.

- e. Euclid Chemical Company; Euco Diamond Hard.
- f. Kaufman Products, Inc.; SureHard.
- g. L&M Construction Chemicals, Inc.; Seal Hard.

2.7 JOINT MATERIALS

- A. Equipment Control joint saw:
 - 1. Available Products:
 - a. Soff-Cut International; "Soff-Cut System," early-entry dry-cut saw with Skid Plate.
- B. Expansion Joint Material: ASTM D 1751, asphalt-saturated cellulosic fiber.
 - 1. Available Manufacturers:
 - a. W.R. Meadows.
 - b. BASF.
- C. Joint Backer Rod: Flexible, compressible, closed-cell polyethylene foam, not less than 10 psi compression deflection.
- D. Joint Filler-Industrial Slabs: Two-component, semirigid, 100 percent solids, per ASTM D 2240.
 - 1. Metzger/McGuire, MM80.
 - 2. Metzger/McGuire, SPAL-PRO RSF at freezers.
- E. Interior Joint Sealer: Mameco, Vulkem 45.
- F. Interior Bond Breaker Joint: 30 pound asphalt felt, unperforated.

2.8 RELATED MATERIALS

- A. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
- B. Under Slab Vapor Retarder: ASTM E1745, Class A. Permeance of less than 0.01 perms after mandatory conditioning tests per ASTM E 1745 (7.1.1 – 7.1.5). Not less than 15 mils thick.
 - 1. Manufacturers and Products:
 - a. Barrier Bac, Inc..
 - b. Raven Industries.
 - c. Reef Industries, Inc..
 - d. Stego Industries.
 - e. Monaflex
 - f. Flatiron Films
 - 2. Accessories:
 - a. Seam tape: High density polyethylene tape with pressure sensitive adhesive, minimum 4 inches wide.
 - b. Pipe boots: Constructed from vapor barrier membrane and seam tape.

2.9 REPAIR MATERIALS

- A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.
 - 1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
 - 2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
 - 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by underlayment manufacturer.
 - 4. Compressive Strength: Not less than 4000 psi at 28 days when tested according to ASTM C 109.
- B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.
 - 1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
 - 2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
 - 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.
 - 4. Compressive Strength: Not less than 5000 psi at 28 days when tested according to ASTM C 109/C 109M.

2.10 CONCRETE MIXING

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
- B. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94, with exceptions specified herein, and ASTM C 1116 where fibers are used, and furnish batch ticket information.
 - 1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.
- C. Admixtures: Use approved admixtures according to manufacturer's written instructions.
 - 1. Use chemical admixtures in concrete, as required, for placement, workability, durability, and controlled set time.
- D. Air Content: Do not allow air content of hard-troweled finished floors to exceed 3 percent.
- E. Concrete Slump Limits: Measured according to ASTM C 143 at point of placement.
 - 1. 4 inches without water reducing admixtures
 - 2. 5 inches after addition of WRA or MWRA.
 - 3. 7 inches after addition of HRWRA.

4. A tolerance of up to one inch above indicated maximum will be allowed for one batch in any five consecutive batches tested.
5. If the maximum water-cement ratio is not exceeded, concrete arriving at the jobsite within 60 minutes of the initial batching that has a slump less than the maximum allowed may have water added when accepted by the project inspector.
6. Water reducing admixtures will not be incorporated in combination with shrinkage compensating concrete unless approved by the Engineer.
7. Water reducing admixtures may be added to increase the slump when water can not be added and additional slump is necessary for workability when accepted by the project inspector.
8. Water shall not be added to the mix after any supplemental water reducing admixtures have been dosed into the mixer.

2.11 CONCRETE MIXTURES FOR BUILDING ELEMENTS

- A. Footings: Proportion normal-weight concrete mixture as follows:

Item	Requirements
Compressive Strength at 56 days (min), f'_c	4000 psi
Maximum Cementitious Content	520 lb/cy
Maximum water/cementitious materials ratio, w/cm	0.50
Cementitious Materials Portland Cement, Type I or Type I/II Supplementary Cementitious Materials	50%-100% 0%-50%
Top Size Aggregate	1-1/2 inch

- B. Foundation Walls and Piers: Proportion normal-weight concrete mixture as follows:

Item	Requirements
Compressive Strength at 28 days (min), f'_c	4000 psi
Maximum Cementitious Content	520 lb/cy
Maximum water/cementitious materials ratio, w/cm	0.45
Cementitious Materials Portland Cement, Type I or Type I/II Supplementary Cementitious Materials	60%-100% 0%-40%
Top Size Aggregate	1-1/2 inch
Air Content (at point of placement) at un-insulated exterior foundation walls	5.5% (\pm 1.5%)

- C. Slabs-on-Grade: Proportion normal-weight concrete mixture as follows:

Item	Requirements
Compressive Strength at 28 days (min), f'_c	4000 psi
Maximum Cementitious Content	520 lbs/yd ³
Maximum water/cementitious materials ratio, w/cm	0.44

Cementitious Materials Portland Cement, Type I or Type I/II Fly Ash, Class C or F	70%-100% 0% - 30%
Maximum Top Size Aggregate	1-1/2 inch
Aggregate Gradation	Well Graded
Coarseness Factor	52 - 70
Workability Factor	32 - 40
Air Content (at point of placement) for slabs exposed to freezing and thawing	5.5% (\pm 1.5%)

- D. Suspended Slabs-On-Metal Deck: Proportion normal-weight concrete mixture as follows:

Item	Requirements
Compressive Strength at 28 days (min), f'_c	4000 psi
Equilibrium Unit Weight	150 lbs/ft ³ (\pm 3 lbs/ft ³)
Cementitious Materials Content	520 lbs/yd ³
Maximum water/cementitious materials ratio, w/cm	0.44
Cementitious Materials Portland Cement, Type I or Type I/II Fly Ash, Class C or F	70%-80% 20% - 30%
Top Size Aggregate	1.5 inch
Coarseness Factor	52-70
Workability Factor	32-40
Aggregate Gradation	Well Graded
Air Content (at point of placement)	3% maximum
Strux 90/40 Synthetic Fiber Reinforcement	As indicated on drawings

- E. Concrete Topping Slabs: Proportion normal-weight concrete mixture as follows:

Item	Requirements
Compressive Strength at 28 days (min), f'_c	3000 psi
Maximum Cementitious Content	564 lbs/yd ³
Maximum water/cementitious materials ratio, w/cm	0.42
Cementitious Materials Portland Cement, Type I or Type I/II Fly Ash, Class C or F	70%-100% 0% - 30%
Minimum Top Size Aggregate	1/2 inch
Aggregate Gradation	Well Graded

- F. Miscellaneous Concrete Items: Concrete stair pan fill, curbs, housekeeping pads, etc. Proportion normal-weight concrete mixture as follows:

Item	Requirements
Compressive Strength at 28 days (min), f'_c	3000 psi

Maximum water/cementitious materials ratio, w/cm	0.45
Cementitious Materials Portland Cement, Type I or Type I/II	60%-100%
Supplementary Cementitious Materials	0%-40%
Minimum Top Size Aggregate	1/2 inch

- G. Drilled Piers—See specification section 31 63 29.

PART 3 - EXECUTION

3.1 GENERAL

- A. Work shall conform to ACI 117 and ACI 301, except as modified by requirements of these Contract Documents.

3.2 EMBEDDED ITEMS

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."
 2. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
 3. Install wedge inserts for masonry shelf angle supports and sleeves for pipe and conduit.

3.3 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect and Engineer.
1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless otherwise indicated.
 2. Form joints with keyways and/or dowels as detailed. Embed keys at least 1-1/2 inches into concrete.
 3. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
 4. Space vertical joints in walls as indicated. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
 5. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth

equal to at least one-fourth of concrete thickness as follows where not specifically shown on Drawings:

1. Exterior Slabs:
 - a. Spacing shall not exceed 24 times slab thickness; 10 feet on center, maximum.
 - b. Short: long side ratio shall not be less than 3:4.
2. Interior Slabs:
 - a. As indicated on drawings.
3. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
4. Sawed Joints: Form contraction joints with early-entry dry-cut power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch-wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.
 - a. Install cuts 0 to 2 hours after final finishing and prior to final set.
 - b. Install joint protector at saw-cut intersections prior to cross cut.
5. Provide cleanly cut, straight joints in toppings over joints in base slab.
6. Do not saw cut slabs on metal deck.

D. Isolation Joints in Slabs-on-Grade: After removing formwork, install expansion joint material at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

1. Extend expansion joint material full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated.
2. Terminate full-width expansion joint material not less than 1/2 inch or more than 1 inch below finished concrete surface where joint sealants, specified in Division 07 Section "Joint Sealants," are indicated.
3. Install expansion joint material in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

3.4 WATERSTOPS

A. Self-Expanding Strip Waterstops: Install in construction joints and at other locations indicated, according to manufacturer's written instructions, adhesive bonding, mechanically fastening, and firmly pressing into place. Install in longest lengths practicable.

3.5 INSTALLING UNDER SLAB VAPOR RETARDER

- A. Install according to membrane manufacturer's current published instructions and ASTM E1643.
- B. Install over level granular base and under reinforcing and slabs on grade.
- C. Lap over footings and seal to foundation walls.
- D. Overlap membrane joints minimum 6 inches and seal continuously with seam tape.

- E. Seal penetrations and pipes with pipe boot fashioned from membrane and sealed with seam tape.
- F. Repair damaged membrane with patches of membrane overlapping damage minimum 6 inches and sealing completely with seam tape.

3.6 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.
- B. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.
 - 1. Do not add water to concrete after adding water-reducing admixtures to mixture.
- C. Clean forms, reinforcing and accessories and lubricate forms prior to placing concrete.
- D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
 - 1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
 - 2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
 - 3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.
 - 4. Do not insert vibrators to bottom of slabs-on-grade with underfloor vapor retarders to avoid damaging this membrane.
 - 5. Do not allow concrete to drop freely more than 4 feet.
 - 6. Use approved chutes equipped with suitable hoppers for placing where required.
 - 7. Place at rate that concrete is always plastic and flows readily into every space.
 - 8. Place beams, girders and haunches monolithically with floor system.
 - 9. Wait until concrete in columns and walls is no longer plastic before casting beams, girders or slabs supported by them.
- E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
 - 1. Before concrete slabs on grade are placed, verify that granular base is level and compacted.
 - 2. Sprinkle base to eliminate suction of water from concrete.
 - 3. Allow no freestanding water.
 - 4. Place interior slabs only after permanent walls and roof enclose slab area.
 - 5. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
 - 6. Maintain reinforcement in position on chairs during concrete placement.

7. Do not insert vibrators to bottom of slabs-on-grade with underfloor vapor retarders to avoid damaging this membrane.
8. Screed slab surfaces with a straightedge and strike off to correct elevations.
9. Slope surfaces uniformly to drains where required.
10. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

F. Concrete Finish Topping:

1. Prior to placing topping, remove laitance and loose particles of sand and dirt.
2. Remove oil and grease spots by washing with 10 percent solution of muriatic acid or strong washing soda.
3. After cleaning, hose down with pressure hose and keep base slab wet for at least 12 hours.

G. Do not use concrete that has partially hardened or been contaminated by foreign materials, nor concrete that has been retempered or remixed after initial set.

H. Before depositing new concrete on or against concrete that has set at construction joints, clean, wet and apply bonding agent to existing surfaces. Tighten forms prior to resuming pouring.

I. Exercise care to prevent splashing of forms or reinforcing with concrete above level of concrete being placed.

J. Clean reinforcement projecting above or out of concrete immediately after completion of particular unit of pour.

K. Do not place concrete under adverse weather conditions unless adequate protection is provided. Refer to ACI 301, for weather restrictions and placing temperatures.

3.7 COLD WEATHER CONCRETING

A. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. When average high and low temperature is expected to fall below 40 deg F, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.
4. Ensure minimum temperatures are maintained for the duration of the curing period in accordance with ACI 306.1.
5. Concrete shall be allowed to dry for at least 12 hours before removing temperature protection for water cured or moisture retention cured concrete.

3.8 HOT WEATHER CONCRETING

- A. Hot-Weather Placement: Comply with ACI 301 and as follows:
 - 1. When high temperature, measured on jobsite at concrete placement area, is expected to rise above 90 deg F, maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
 - 2. When temperature of steel reinforcement, embeds, subgrade, or forms, is greater than 120 degrees F, fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.
 - 3. Protect concrete from wind and direct sunlight to avoid rapid drying.
 - 4. Apply evaporation retarder to unformed concrete surfaces if the air temperature exceeds 80 degrees F, the wind speed exceeds 10 mph, or the relative humidity is less than 40%. Apply according to manufacturer's written instructions immediately after placing and screeding.
 - 5. Apply moisture retaining covers or wet cure in accordance with concrete curing and protection methods as specified.

3.9 FINISHING FLOORS AND SLABS

- A. Finish bare concrete floors (adjacent to floors with other surfacing) so concrete surface is level with other finishes, unless otherwise noted.
- B. At areas to receive floor covering, grind smooth joints between slabs on grade and structural slabs and between existing and new surfaces to eliminate unevenness and to provide smooth, level surface across joints.
- C. Wetting the concrete surface during finishing operations is prohibited.
- D. Power floating with troweling machines equipped with normal trowel blades is prohibited.
- E. Use caution when finishing lightweight concrete slabs to maintain trowel blades at shallow angle as possible during final finishing operations.
 - 1. Do not provide a tight steel trowel finish to lightweight concrete slabs.
- F. Protect finished surfaces from damage. Keep free of abrasive materials.
- G. In areas where water will be present (interior and exterior) place and finish slabs so areas will drain and water will not stand in puddles. Conform to slopes shown. At structural slabs, verify elevations of drains to insure drains will be at low points. Where elevations and slopes are not indicated, generally slope floors 1/8 inch per foot uniformly to drains, unless otherwise directed by Architect.
- H. Finish and measure surface so gap at any point between concrete surface and an unlevelled, freestanding, 10-foot-long straightedge resting on 2 high spots and placed anywhere on the surface does not exceed 1/4-inch.

- I. Apply slab finish to Floor Profile Number tolerances listed unless specifically noted otherwise on Drawings, according to ASTM E 1155 "Standard Test Method for Determining F_F Floor Flatness and F_L Floor Levelness Numbers" for randomly trafficked floor surfaces.
 - 1. Refer to ACI 302, Chapter 8 and Table 8.15.3, for recommended typical procedures to attain specified Floor Profile Numbers.
- J. General Finishing Requirements: Comply with ACI 302.1R recommendations for screeding, restraighening, and finishing operations for concrete surfaces as appropriate to attain slab finish specified.
 - 1. Utilize wet-screed guides, dry-screed guides, and/or edge forms for initial strikeoff set with optical or laser instruments as appropriate to attain specified Floor Profile Number. Check elevation after initial strikeoff and repeat as necessary.
 - 2. Smooth and restraighen surface using 8 to 10 foot wide bull float, darby, or modified highway straightedge.
 - a. Apply in two directions at 45 degree angle to strip for Overall Floor Flatness, F_F 30 or greater.
 - 3. Wait until bleed water sheen has disappeared and concrete can sustain finishing operations employed without digging in or disrupting the levelness of the surface.
 - 4. Float surface with one or more passes using a power float (float shoe blades or pans) or by hand floating if area is small or inaccessible to power driven floats. Restraighen, cut down high spots, and fill low spots. Repeat float passes and restraighening until surface is left with a uniform, smooth, granular texture.
- K. CONC FIN-1: Light Trowel Finish.
 - 1. Follow General Finishing Requirements for initial procedures.
 - 2. Restraighen surface if required following paste-generating float passes using 10-foot wide highway straightedge.
 - 3. Consolidate concrete surface, uniform in texture and appearance, with one to two passes using power trowel. Hand trowel areas inaccessible by power trowel.
- L. CONC FIN-2: Medium Trowel Finish.
 - 1. Follow General Finishing Requirements for initial procedures.
 - 2. Restraighen surface if required following paste-generating float passes using 10-foot wide highway straightedge. Apply in two directions at 45 degree angle to strip. Use supplementary material to fill low spots.
 - 3. Consolidate concrete surface, uniform in texture and appearance, with two to three passes using power trowel. Hand trowel areas inaccessible by power trowel.
- M. CONC FIN-3: Trowel and Fine Broom Finish.
 - 1. Follow General Finishing Requirements for initial procedures.
 - 2. Consolidate concrete surface, with one pass using a power trowel.
 - 3. Slightly scarify surface with soft bristled broom while concrete is still plastic.
- N. CONC FIN-4: Broom Finish.
 - 1. Surfaces of concrete mixes with silica fume and/or calcium nitrite must be kept moist (not wet) during finishing operations to promote proper texturing. Pressure foggers with a reach capable of covering the entire surface can aid finishing operations.

2. Follow General Finishing Requirements, steps 1 through 3, for initial procedures.
 3. Scarify surface with a transverse scored texture using a medium bristled broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.
 4. Finish Tolerance: Surface shall not vary by more than $\pm 1/2$ inch anywhere from elevation noted on Drawings.
 5. Finish all concrete slabs to proper elevations to insure that all surface moisture will drain freely, and that no puddles exist. Contractor must bear cost of any corrections to provide positive drainage and repairing poorly finished surface areas.
- O. CONC FIN-5: Slip-Resistive Aggregate Finish.
1. Apply at rates recommended by the manufacturer, but not less than 25 pounds per 100 square feet.
 2. Verify all procedures noted below are in compliance with manufacturer's written instructions. Notify Architect of any discrepancies requiring resolution.
 3. Follow General Finishing Requirements, steps 1 through 3, for initial procedures.
 4. Break the surface using a power trowel with float shoes or attached pan.
 5. Evenly distribute approximately two-thirds of the specified amount of non-slip aggregate with mechanical spreader.
 6. After applied material has absorbed moisture, float surface using hand wooden floats. Take care not to tear through into the underlying concrete.
 7. Apply remaining one-third of dry-shake hardener. Tamp aggregate flush with surface, but do not force below surface. Float surface in a like manner.
 8. If needed, trowel until the desired surface finish is achieved.
 9. After curing, lightly work surface with a steel wire brush or an abrasive stone and water to expose slip-resistive aggregate.
- P. Coordinate final slab texture requirements with Division 9 flooring installer for proper adhesion of final flooring materials.
- Q. Summary Slab Finish Schedule:

SLAB USE	SLAB FINISH	OVERALL F _F /F _L	LOCAL F _F /F _L
Carpet; raised access floor; or base slabs below acoustic concrete topping slabs	CONC FIN-1 Light Trowel Finish	F _F 25/F _L 20	F _F 17/F _L 15
Thin set resilient flooring; paint; or other thin film-finish coating system	CONC FIN-2 Medium Trowel Finish	F _F 30/F _L 25	F _F 24/F _L 15
Thin set ceramic or quarry tile; stone flooring; epoxy terrazzo	CONC FIN-3 Trowel and Fine Broom Finish	F _F 18/F _L 15	F _F 15/F _L 10
Parking ramps; exterior concrete pavement (Ramp > 7%)	CONC FIN-4 Broom Finish (Rake Finish)	F _F 18/F _L 15	F _F 15/F _L 10
Egress stair exposed concrete treads and landings; where shown on	CONC FIN-5 Slip-Resistive Aggregate	F _F 25/F _L 20	F _F 17/F _L 15

SLAB USE	SLAB FINISH	OVERALL F _F /F _L	LOCAL F _F /F _L
Drawings	Finish		

R. Measurement of Floor Tolerance:

1. Frequency: For industrial slabs, conduct floor tolerance measurements for each day's slab placement.
 - a. Report deficient areas to Architect to determine repair procedures appropriate for final required finish.
 - b. Make appropriate adjustments to construction procedures prior to next slab placement when previous slab placement is deficient.
2. Frequency: Conduct floor tolerance or measurements within 72 hours of final finishing operations and prior to removal of forms on elevated slabs for each slab placement.
3. Frequency: Conduct floor tolerance or measurements only if slab appears to be out of tolerance.
4. Floor slab tolerances provided for localized areas shall apply to sections maximum one bay in length and minimum one-half bay.
5. Conduct measurement of floor tolerance for F_F100/F_L75 areas by floor consultant utilizing Face Floor Profileograph, or other system approved by Architect.
6. Conduct measurement of floor tolerance for other slab areas utilizing Dip Stick Floor Profiler.

3.10 FINISHING FORMED SURFACES

- A. CONC FIN-20: Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
 1. Apply to concrete surfaces exposed to public view, to receive a rubbed finish, or to be covered with a coating or covering material applied directly to concrete.
- B. CONC FIN-21: Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.
 1. Apply to Smooth-Formed Finish as-cast concrete where indicated.
- C. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

3.11 MISCELLANEOUS CONCRETE ITEMS

- A. Filling In: Fill in holes and openings left in concrete structures, unless otherwise indicated, after work of other trades is in place. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.

- B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.
- C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates from manufacturer furnishing machines and equipment.
- D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Drawings. Screed, tamp, and trowel-finish concrete surfaces. Before final troweling of exposed treads and landings, apply dampened non-slip shake at a minimum rate of ¼ pound over square foot of surface.

3.12 CONCRETE PROTECTING AND CURING

- A. General: Concrete shall be maintained above 50-degrees F and in a moist condition for at least the first seven days after placement. Provide curing and protection immediately after placement in accordance with ACI 301 using materials as specified herein.
- B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if the air temperature exceeds 80 degrees F, the wind speed exceeds 10 mph, or the relative humidity is less than 40% before and during finishing operations as measured at the Project site. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.
- D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.
- E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
 - 1. Wet Curing: Keep surfaces continuously wet for not less than three days with the following materials:
 - a. Water.
 - b. Continuous water-fog spray.
 - c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
 - d. Protect surface from rapid loss of moisture upon termination of wet curing by covering with moisture-retaining covers for the remainder of the curing period.
 - 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive.

- Immediately repair any holes or tears during curing period using cover material and waterproof tape.
3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
 - a. After curing period has elapsed, completely remove curing compound without damaging concrete surfaces using concrete floor cleaner and stripper recommended by curing compound manufacturer.
 4. Curing and Sealing Compound: Apply uniformly to floors and slabs in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.
- F. Wet cure or use moisture-retaining covers on all concrete surfaces for first 24 hours, minimum.
1. Continue curing in this manner for as long as Hot Weather Concreting conditions persist.
 2. Industrial slabs shall be water cured for entire curing period.
- G. Curing Compounds or Curing and Sealing Compounds shall not be used on concrete surfaces to receive adhered coverings or Penetrating Liquid Densifier and Sealer without prior manufacturer certification that it will not interfere with bonding of floor covering and warranties of flooring installer are validated.
- H. Moisture Condition of Slabs – Following placement of concrete and climatization of building, check to see that any specified tests for moisture emission have been made and a written report submitted prior to floor covering or coating installation.
- 3.13 PENETRATING LIQUID DENSIFIER AND SEALER
- A. Penetrating Liquid Densifier and Sealer: Prepare, apply, and finish Penetrating Liquid Densifier and Sealer according to manufacturer's written instructions at concrete floors to remain exposed to view.
1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
 2. Do not apply to concrete that is less than 28 days old unless treatment also functions as a curing aid.
 3. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing. Rinse with water; remove excess material until surface is dry. Apply a second coat in a similar manner if surface is rough or porous.
- B. Protect finish surface during remainder of construction. Repair immediately any staining of finish concrete surfaces by methods recommended by manufacturer.
- C. Dry buff finish floor surfaces per manufacturer's written instructions to achieve final gloss appearance of liquid densifier and sealer just prior to substantial completion after majority of heavy construction and wet work activities have been completed

3.14 JOINT FILLING

- A. Arrange for on-site supervision by manufacturer's personnel.
- B. Coordinate with Owner that adequate protection or spatial separation is provided to ensure there is not contamination of Owner's stored product during joint filling.
- C. Prepare, clean, and install joint filler according to manufacturer's written instructions.
 - 1. Defer joint filling until concrete has cured for 30 to 90 days and space has assumed its normal operating temperature. Do not fill joints until construction traffic has permanently ceased.
- D. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry. Clean inside wall of joints to bare concrete.
- E. Mix filler thoroughly with power equipment according to manufacturer's published instructions.
- F. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.
- G. Protect joint completely from traffic for 8 hours and from vehicular traffic for 24 hours.
- H. Touch Up:
 - 1. Within one year after Substantial Completion, touch up joints with additional material and correct for normal joint movement according to manufacturer's published directions.
 - 2. Coordinate schedule for joint touch up with Owner.
 - 3. Touch up joints during Owner's non-working hours as required by Owner.
 - 4. Coordinate with Owner and Architect to ensure there is no contamination of Owner's stored product.

3.15 JOINT SEALING

- A. When concrete has cured 30 to 90 days, and space has assumed its normal operating temperature, rake out loose debris and clean joint with compressed air.
- B. Install backer rod and sealant according to manufacturer's published recommendations.
- C. Protect joint completely from traffic for 24 hours.

3.16 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval and in accordance with ACI 301. Repair methods for defects affecting the concrete's structural performance shall be closely coordinated between Contractor and Engineer.

- B. Patching Mortar: Submit proposed patching materials for Architect's review and approval.
- C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
 - 1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension in solid concrete, but not less than 1 inch in depth. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
 - 2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
 - 3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.
- D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
 - 1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
 - 2. After concrete has cured at least 14 days, correct high areas by grinding.
 - 3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
 - 4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
 - 5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
 - 6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.
- E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.
- F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.17 FIELD QUALITY CONTROL

- A. The Owner will engage a qualified testing and inspection agency to provide special inspection and testing services and prepare reports in accordance with Division 01Section Structural Tests and Special Inspections", and with IBC 2006 Chapter 17 as adopted by the 2007 MSBC, and the CASE/Mn Guideline for Special Structural Inspection and Testing, and other items which in the professional judgement of the Structural Engineer of Record, are critical to the integrity of the building structure.
- B. Contractor will cooperate with and assist testing agency in obtaining representative concrete samples as concrete is placed for determining slump and air entrainment and casting test cylinders.
 1. Provide suitable space on site for storage for field condition test cylinders.
 2. If testing agency is not available, cast compression test cylinders as concrete is placed, determine and record slump of concrete, determine and record air content of concrete and submit cylinders and information to the testing agency.
- C. Inspections:
 1. Verification of use of required design mixture.
 2. Concrete placement, including conveying and depositing.
 3. Curing procedures and maintenance of curing temperature.
 4. Verification of concrete strength before removal of shores and forms from beams and slabs.
- D. Concrete Tests (Technical 1): Testing of composite samples of fresh concrete obtained according to ASTM C 172 - Practice for Sampling Freshly Mixed Concrete, ASTM C 31 - Practice for Making and Curing Concrete Test Specimens in the Field, and ASTM C 39 - Test Method for Compressive Strength of Cylindrical Concrete Specimens. Evaluation and acceptance of concrete shall be in accordance with ACI 318 and according to the following requirements:
 1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture where less than 50 yd³ is placed, plus one additional set for each additional 100 yd³ or fraction thereof.
 - a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

2. Slump: ASTM C 143; one test at point of discharge for each composite sample.
 - a. Perform additional tests when concrete consistency appears to change.
 - b. For industrial slabs, slump each truck until slump stabilization is reached then decrease slump frequency to one test per 25 cubic yards.
 3. Air Content: When air content is specified, perform test in accordance with ASTM C 231, pressure method, for normal-weight concrete and ASTM C 173, volumetric method, for structural lightweight concrete.
 - a. Where placement is by pump, air content shall be measured at location of placement.
 - b. For concrete exposed to freezing and thawing, concrete from each truck shall be tested and concrete not meeting specified percentages shall not be placed.
 - c. For interior concrete not exposed to freezing and thawing, such as lightweight concrete on metal decking, perform one test for each set of test cylinders.
 - d. Concrete used in performing air content test shall not be used in fabricating test specimens
 4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
 5. Unit Weight: ASTM C 567, equilibrium unit weight of structural lightweight concrete; one test for each composite sample.
 6. Compression Test Specimens: ASTM C 31.
 - a. Cast and laboratory cure one set of three standard cylinder specimens for each composite sample.
 - b. Cast and field cure one cylinder specimen for each composite sample.
 - 1) Store field-cured cylinders as near as possible to location of concrete represented by sample and give cylinder, insofar as practicable, same protection and curing as adjacent concrete.
 - c. If additional specimens are required to verify early strength of concrete, contractor must pay for additional testing.
 7. Compressive-Strength Tests: ASTM C 39.
 - a. Test one cylinder specimen at 7 days for information, and remaining two cylinder specimens at 28 days for acceptance, plus one cylinder to be held until 90 days in the event that the 28 day compressive strengths are not met.
 - b. Deliver field-cured specimens to laboratory at 28 days and test to verify adequacy of curing and protection in field.
 - c. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
- E. Measure floor and slab flatness and levelness according to ASTM E 1155 within 48 hours of finishing when requested by the Owner's Representative(Technical 1):
1. Measurements shall be made prior to removal of forms and shores at elevated structural slabs.
 2. The Contractor shall be notified immediately after the measurements of any section are complete and a written report of the results shall be submitted within 72 hours after finishing operations are complete.
 3. Report deficient areas to Architect to determine repair procedures appropriate for final required finish.

3.18 EVALUATION OF TEST RESULTS

- A. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
- B. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
- C. Test results shall be reported in writing to Architect, concrete supplier, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
- D. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
- E. Additional Tests: Testing and inspecting agency shall make additional tests of concrete at the expense of the Contractor when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42 or by other methods as directed by Architect.
- F. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- G. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.
- H. Fill core holes with concrete specified for location.

END OF SECTION 03300

**NEW PASSENGER TERMINAL
DULUTH INTERNATIONAL AIRPORT
DULUTH, MINNESOTA**

**SECTION 04202 – INTERIOR UNIT
MASONRY**

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. This Section includes unit masonry assemblies consisting of the following:
1. Concrete masonry units (CMUs).
 2. Mortar and grout.
 3. Reinforcing steel.
 4. Masonry joint reinforcement.
 5. Ties and anchors.
 6. Miscellaneous masonry accessories.
 7. Masonry Lintels
- B. Related Sections include the following:
1. Division 07 Section "Through Penetration Firestop Systems" for firestopping at masonry walls.
 2. Division 07 Section "Joint Sealants" for sealing control and expansion joints in unit masonry.

1.3 DEFINITIONS

- A. CMU(s): Concrete masonry unit(s).
- B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.4 PERFORMANCE REQUIREMENTS

- A. Provide structural unit masonry that develops net-area compressive strengths (f'_m) at 28 days as indicated on drawings.
- B. Determine net-area compressive strength (f'_m) of masonry from average net-area compressive strengths of masonry units and mortar types (unit-strength method) according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602 or ASTM C 1314.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For the following:
1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.

2. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement." Show elevations of reinforced walls.
 3. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.
- C. Sustainable Design Submittals:
1. LEED Credit: Product Data for Credit MR 4.1 and Credit MR4.2: For products having recycled content, documentation indicating weights, costs, and percentages by weight of postconsumer and preconsumer recycled content.
 - a. Include statement indicating material weights and costs for each product having recycled content.
 2. LEED Credit: Product Data for Credit MR 5.1 and Credit MR 5.2: For products having Regional content (Extracted, and processed or manufactured within 500 miles of site), documentation indicating total weights, costs and percentages by weight of regional content.
 - a. Include statement indicating material weights, and costs for each product having regional content.

1.6 INFORMATIONAL SUBMITTALS

- A. Material Certificates: Include statements of material properties indicating compliance with requirements including compliance with standards and type designations within standards. Provide for each type and size of the following:
1. Masonry units.
 - a. Include material test reports substantiating compliance with requirements.
 - b. For masonry units used in structural masonry, include data and calculations establishing average net-area compressive strength of units.
 2. Cementitious materials. Include brand, type, and name of manufacturer.
 3. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
 4. Grout mixes. Include description of type and proportions of ingredients.
 5. Reinforcing bars.
 6. Joint reinforcement.
 7. Anchors, ties, and metal accessories.
- B. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.
1. Include test reports, per ASTM C 780, for mortar mixes required to comply with property specification.
 2. Include test reports, per ASTM C 1019, for grout mixes required to comply with compressive strength requirement.
- C. Cold-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with cold-weather requirements.

1.7 QUALITY ASSURANCE

- A. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality from a single manufacturer for each cementitious component and from one source or producer for each aggregate.
- B. Preconstruction Testing Service: Owner will engage a qualified independent testing agency to perform preconstruction testing indicated below. Retesting of materials that fail to meet specified requirements shall be done at Contractor's expense.
 - 1. Concrete Masonry Unit Test: For each type of unit required, per ASTM C 140.
 - 2. Mortar Test (Property Specification): For each mix required, per ASTM C 780.
 - 3. Grout Test (Compressive Strength): For each mix required, per ASTM C 1019.
 - 4. Prism Test: For each type of construction required, per ASTM C 1314.
- C. Fire-Resistance Ratings: Where indicated, provide materials and construction identical to those of assemblies with fire-resistance ratings determined per ASTM E 119 by a testing and inspecting agency, by equivalent concrete masonry thickness, or by other means, as acceptable to authorities having jurisdiction.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.
- B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
- D. Deliver preblended, dry mortar mix in moisture-resistant containers designed for lifting and emptying into dispensing silo. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in a metal dispensing silo with weatherproof cover.
- E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.9 PROJECT CONDITIONS

- A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
 - 1. Extend cover a minimum of 24 inches down both sides and hold cover securely in place.
- B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least 3 days after building masonry walls or columns.
- C. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602 and Section 2104.3 in the Uniform Building Code.
 - 1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and above and will remain so until masonry has dried, but not less than 7 days after completing cleaning.
- D. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
 - 2. Products: Subject to compliance with requirements, provide one of the products specified.
 - 3. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
 - 4. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 MASONRY UNITS, GENERAL

- A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to exceed tolerances and to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects, including dimensions that vary from specified dimensions by more than stated tolerances, will be exposed in the completed Work or will impair the quality of completed work.

2.3 CONCRETE MASONRY UNITS (CMUs)

- A. Shapes: Provide shapes indicated and as follows:
 - 1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
 - 2. Provide square-edged or bullnose units for outside corners, as directed by the Architect.
- B. Integral Water Repellent: Provide units made with integral water repellent where indicated.
 - 1. Integral Water Repellent: Liquid polymeric, integral water-repellent admixture that does not reduce flexural bond strength. Units made with integral water repellent, when tested as a wall assembly made with mortar containing integral water-repellent manufacturer's mortar additive according to ASTM E 514, with test period extended to 24 hours, show no visible water or leaks on the back of test specimen.
 - a. Products:
 - 1) Addiment Incorporated; Block Plus W-10.
 - 2) Grace Construction Products, a unit of W. R. Grace & Co. - Conn.; Dry-Block.
 - 3) Master Builders, Inc.; Rheopel.
- C. Concrete Masonry Units: ASTM C 90.
 - 1. Net Area Compressive Strength of Concrete Masonry Units: Provide units with minimum average net-area compressive strength of 2800 psi to achieve $f'm = 2000$ psi as specified on drawings
 - 2. Weight Classification: Normal weight
 - 3. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions. Faces of unit shall be nominal 8" x 16" unless otherwise shown. Thickness shall be as shown or as required by code.
 - 4. Exposed Faces: Provide color and texture matching the range represented by Architect's sample.

2.4 MASONRY LINTELS

- A. General: Provide built-in-place masonry lintels made from bond beam concrete masonry units with reinforcing bars placed as indicated and filled with coarse grout. Temporarily support built-in-place lintels until cured.

2.5 MORTAR AND GROUT MATERIALS

- A. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction.
- B. Hydrated Lime: ASTM C 207, Type S.
- C. Portland Cement-Lime Mix: Packaged blend of portland cement complying with ASTM C 150, Type I or Type III, and hydrated lime complying with ASTM C 207, Type S.
- D. Masonry Cement: ASTM C 91.

1. Available Manufacturers:
 - a. Capital Materials Corporation.
 - b. Essroc, Italcementi Group.
 - c. Holcim (US) Inc.
 - d. Lafarge North America Inc.
 - e. Lehigh Cement Company.
 - f. National Cement Company, Inc.; Coosa Masonry Cement.
- E. Mortar Cement: ASTM C 1329.
 1. Available Manufacturers:
 - a. Lafarge North America Inc.
- F. Aggregate for Mortar: ASTM C 144.
 1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
 2. For joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.
- G. Aggregate for Grout: ASTM C 404.
- H. Epoxy Pointing Mortar: ASTM C 395, epoxy-resin-based material formulated for use as pointing mortar for structural-clay tile facing units (and approved for such use by manufacturer of units); in color indicated or, if not otherwise indicated, as selected by Architect from manufacturer's colors.
- I. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.
 1. Available Manufacturers:
 - a. Addiment Incorporated.
 - b. Euclid Chemical Company.
 - c. Grace Construction Products, a unit of W. R. Grace & Co.
 - d. Sonneborn, Div. of ChemRex.
- J. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with concrete masonry units, containing integral water repellent by same manufacturer.
 1. Available Manufacturers:
 - a. Addiment Incorporated.
 - b. Grace Construction Products, a unit of W. R. Grace & Co. - Conn.
 - c. Master Builders, Inc
- K. Water: Potable.

2.6 REINFORCEMENT

- A. Uncoated Steel Reinforcing Bars: ASTM A 615 or ASTM A 996, Grade 60.
- B. Masonry Joint Reinforcement, General: ASTM A 951.
 1. Interior Walls: Hot-dip galvanized, carbon steel.
 2. Exterior Walls: Hot-dip galvanized, carbon steel.

3. Wire Size for Side Rods: As indicated on drawings.
 4. Wire Size for Cross Rods: As indicated on drawings.
 5. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches o.c.
 6. Provide in lengths of not less than 10 feet, with prefabricated corner and tee units.
- C. Masonry Joint Reinforcement for Single-Wythe Masonry: Either ladder or truss type with single pair of side rods.

2.7 TIES AND ANCHORS

- A. Materials: Provide ties and anchors specified in subsequent paragraphs that are made from materials that comply with eight subparagraphs below, unless otherwise indicated.
1. Mill-Galvanized, Carbon-Steel Wire: ASTM A 82; with ASTM A 641, Class 1 coating.
 2. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82; with ASTM A 153, Class B-2 coating.
 3. Stainless-Steel Wire: ASTM A 580, Type 304.
 4. Galvanized Steel Sheet: ASTM A 653, Commercial Steel, G60 zinc coating.
 5. Steel Sheet, Galvanized after Fabrication: ASTM A 1008, Commercial Steel, hot-dip galvanized after fabrication to comply with ASTM A 153.
 6. Stainless-Steel Sheet: ASTM A 666, Type 304.
 7. Steel Plates, Shapes, and Bars: ASTM A 36.
 8. Stainless Steel bars: ASTM A 276 or ASTM A 666, Type 304.
- B. Wire Ties, General: Unless otherwise indicated, size wire ties to extend at least halfway through veneer but with at least 5/8-inch cover on outside face. Outer ends of wires are bent 90 degrees and extend 2 inches parallel to face of veneer.
- C. Partition Top anchors: As indicated on drawings.

2.8 MISCELLANEOUS ANCHORS

- A. Anchor Bolts: As indicated on drawings.
- B. Postinstalled Anchors: Provide anchors as indicated on drawings.

2.9 MISCELLANEOUS MASONRY ACCESSORIES

- A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene urethane or PVC.

- B. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D 2000, Designation M2AA-805 or PVC, complying with ASTM D 2287, Type PVC-65406 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.
- C. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).
- D. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells with loops for holding reinforcing bars in center of cells. Units are formed from 0.142-inch steel wire, hot-dip galvanized after fabrication. Provide units with either two loops or four loops as needed for number of bars indicated.
 - 1. Available Manufacturers:
 - a. Dayton Superior Corporation, Dur-O-Wal Division.
 - b. Heckmann Building Products Inc.
 - c. Hohmann & Barnard, Inc.
 - d. Wire-Bond.

2.10 MASONRY CLEANERS

- A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.
 - 1. Available Manufacturers:
 - a. Diedrich Technologies, Inc.
 - b. EaCo Chem, Inc.
 - c. ProSoCo, Inc.

2.11 MORTAR AND GROUT MIXES

- A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.
 - 1. Do not use calcium chloride in mortar or grout.
 - 2. Limit cementitious materials in mortar to portland cement, mortar cement, and lime.
 - 3. Limit cementitious materials in mortar for exterior and reinforced masonry to portland cement, mortar cement, and lime.
 - 4. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.
- B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

- C. Mortar for Unit Masonry: Comply with ASTM C 270 Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated.
 - 1. For interior non-load-bearing partitions, Type N.
 - 2. For all other walls, Type S.
- D. Grout for Unit Masonry: Comply with ASTM C 476.
 - 1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 1.15.1 in ACI 530.1/ASCE 6/TMS 602 for dimensions of grout spaces and pour height.
 - 2. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C 143/C 143M.

2.12 SOURCE QUALITY CONTROL

- A. Owner will engage a qualified independent testing agency to perform source quality-control testing indicated below:
 - 1. Payment for these services will be made by Owner
 - 2. Retesting of materials failing to comply with specified requirements shall be done at Contractor's expense.
- B. Clay Masonry Unit Test: For each type of unit furnished, per ASTM C 67.
- C. Concrete Masonry Unit Test: For each type of unit furnished, per ASTM C 140.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
 - 1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
 - 2. Verify that foundations are within tolerances specified.
 - 3. Verify that reinforcing dowels are properly placed.
- B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Thickness: Build single-wythe walls to actual widths of masonry units, using units of widths indicated.
- B. Build chases and recesses to accommodate items specified in this and other Sections.

- C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.
- D. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.
- E. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures. Mix units from several pallets or cubes as they are placed.
- F. Comply with construction tolerances in ACI 530.1/ASCE 6/TMS 602 and with the following:
 - 1. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
 - 2. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet, or 1/2 inch maximum.
 - 3. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
 - 4. For exposed bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch. Do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
 - 5. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch. Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch.
 - 6. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch except due to warpage of masonry units within tolerances specified for warpage of units.
 - 7. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16 inch from one masonry unit to the next.

3.3 LAYING MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.
- B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.
- C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 4-inches. Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.

- D. Stopping and Resuming Work: Stop work by racking back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.
- E. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.
- F. Fill cores in hollow concrete masonry units with grout 24 inches under bearing plates, beams, lintels, posts, and similar items, unless otherwise indicated.
- G. Build non-load-bearing interior partitions full height of story to underside of solid floor or roof structure above, unless otherwise indicated on architectural drawings. Fasten partitions to structure above with methods indicated on drawings.

3.4 MORTAR BEDDING AND JOINTING

- A. Lay hollow concrete masonry units as follows:
 - 1. With face shells fully bedded in mortar and with head joints of depth equal to bed joints.
 - 2. With webs fully bedded in mortar in all courses of piers, columns, and pilasters.
 - 3. With webs fully bedded in mortar in grouted masonry, including starting course on footings.
 - 4. With entire units, including areas under cells, fully bedded in mortar at starting course on footings where cells are not grouted.
- B. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.
- C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness, unless otherwise indicated.
- D. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint), unless otherwise indicated.

3.5 MASONRY JOINT REINFORCEMENT

- A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches.
 - 1. Space reinforcement not more than 16 inches o.c.
 - 2. Space reinforcement not more than 8 inches o.c. in foundation walls and parapet walls.
 - 3. Provide reinforcement not more than 8 inches above and below wall openings and extending 12 inches beyond openings.
 - a. Reinforcement above is in addition to continuous reinforcement.

- B. Interrupt joint reinforcement at control and expansion joints, unless otherwise indicated.
- C. Provide continuity at wall intersections by using prefabricated T-shaped units.
- D. Provide continuity at corners by using prefabricated L-shaped units.
- E. Cut and bend reinforcing units as directed by manufacturer for continuity at corners, returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.6 CONTROL AND EXPANSION JOINTS

- A. General: Install control and expansion joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.
- B. Form control joints in concrete masonry using one of the following methods:
 - 1. Fit bond-breaker strips into hollow contour in ends of concrete masonry units on one side of control joint. Fill resultant core with grout and rake out joints in exposed faces for application of sealant.
 - 2. Install preformed control-joint gaskets designed to fit standard sash block.
 - 3. Install interlocking units designed for control joints. Install bond-breaker strips at joint. Keep head joints free and clear of mortar or rake out joint for application of sealant.
 - 4. Install temporary foam-plastic filler in head joints and remove filler when unit masonry is complete for application of sealant.
- C. Provide horizontal, pressure-relieving joints by either leaving an air space or inserting a compressible filler of width required for installing sealant and backer rod specified in Division 07 Section "Joint Sealants," but not less than 3/8 inch.
 - 1. Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry.

3.7 LINTELS

- A. Install lintels as indicated on drawings.

3.8 REINFORCED UNIT MASONRY INSTALLATION

- A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.
 - 1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
 - 2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other temporary loads that may be placed on them during construction.

- B. Placing Reinforcement: Comply with requirements in ACI 530.1/ASCE 6/TMS 602.
- C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.
 - 1. Comply with requirements in ACI 530.1/ASCE 6/TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
 - 2. Limit height of vertical grout pours to not more than 60 inches, unless project special inspector is notified in writing 7 days prior to placement that high lift grout procedures will be used.

3.9 FIELD QUALITY CONTROL

- A. Inspectors: Owner will engage qualified independent inspectors to perform inspections and prepare reports. Allow inspectors access to scaffolding and work areas, as needed to perform inspections.
 - 1. Place grout only after inspectors have verified compliance of grout spaces and grades, sizes, and locations of reinforcement.
- B. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections indicated below and prepare test reports:
 - 1. Retesting of materials failing to comply with specified requirements shall be done at Contractor's expense.
- C. Testing Frequency: One set of tests for each 5000 sq. ft. of wall area or portion thereof.
- D. Clay Masonry Unit Test: For each type of unit provided, per ASTM C 67.
- E. Concrete Masonry Unit Test: For each type of unit provided, per ASTM C 140.
- F. Mortar Test (Property Specification): For each mix provided, per ASTM C 780. Test mortar for compressive strength.
- G. Grout Test (Compressive Strength): For each mix provided, per ASTM C 1019.
- H. Prism Test: For each type of construction provided, per ASTM C 1314 at 7 days and at 28 days.

3.10 REPAIRING, POINTING, AND CLEANING

- A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.
- B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners,

openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.

- C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.
- D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
 - 1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
 - 2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
 - 3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
 - 4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
 - 5. Clean brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.
 - 6. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.
 - 7. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.
 - 8. Clean stone trim to comply with stone supplier's written instructions.
 - 9. Clean limestone units to comply with recommendations in ILI's "Indiana Limestone Handbook."

3.11 MASONRY WASTE DISPOSAL

- A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.
- B. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.
 - 1. Crush masonry waste to less than 4 inches in each dimension.
 - 2. Mix masonry waste with at least two parts of specified fill material for each part of masonry waste. Fill material is specified in Division 31 Section "Earth Moving."
 - 3. Do not dispose of masonry waste as fill within 18 inches of finished grade.
- C. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 04202

**NEW PASSENGER TERMINAL
DULUTH INTERNATIONAL AIRPORT
DULUTH, MINNESOTA**

**SECTION 05120 – STRUCTURAL STEEL
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. This Section includes the following:
 - 1. Structural steel framing members and all related accessories such as structural embeds, connections, bolts, welds, fasteners, threaded rods, headed studs, including fabrication, erection and all related work and accessories.
 - 2. Grouting for base plates, seats, and bearing areas.
 - 3. Connections and other performance specified items, including related design by contractor's Qualified Professional Engineer.
 - 4. Temporary bracing and shoring, including related design by contractor's specialty structural engineer.
 - 5. Shop applied finishes and coatings, including preparation, primers, special paint systems or galvanizing on steel exposed to exterior or aggressive environments, and bitumastic coating on steel below grade in soil.
 - 6. The work covered by this Section shall include all labor, material, equipment, permits, engineering and other services necessary for the fabrication and installation of structural steel and related work, complete, in accordance with the drawings and as specified herein.
- B. Related Requirements:
 - 1. Division 01 – Structural Testing and Special Inspections.
 - 2. Division 01 – Submittal Procedures
 - 3. Division 03 – Cast-In-Place Concrete.
 - 4. Division 05 – Steel Decking.
 - 5. Division 05 – Metal Fabrications
 - 6. Division 05 – Metal Stairs and Ladders
 - 7. Division 07 – Applied Fireproofing.
 - 8. Section 09 – Painting and High Performance Coatings

1.3 REFERENCES

- A. AISC Specification for Design, Fabrication, and Erection of Structural Steel for Buildings.
- B. AISC Code of Standard Practice for Steel Buildings and Bridges.
- C. AISC Specification for the Design of Steel Hollow Structural Sections.
- D. AWS D1.1 – Structural Welding Code.
- E. RCSC Specification for Structural Joints Using ASTM A 325 or A 490 Bolts.
- F. ASTM Standards in Building Codes.

G. Steel Structures Painting Council (SSPC) – PS7.01.

1.4 DEFINITIONS

- A. Structural Steel: Elements of structural-steel frame, as classified by AISC's "Code of Standard Practice for Steel Buildings and Bridges," that support design loads.
- B. The terms "for record" and "submit for record" in this specification are defined as Contractor submittals that do not require a response.

1.5 CONNECTION DESIGN PERFORMANCE REQUIREMENTS

- A. Connections: Provide details of simple shear connections, moment connections, axial connections, splice connections, and brace frame tension/compression connections required by the Contract Documents to be selected or completed by structural-steel fabricator to withstand service loads indicated and comply with other information and restrictions indicated.
 - 1. Select and complete connections using schematic details indicated and AISC's "Manual of Steel Construction, Thirteenth Edition Allowable Strength Design." Connection concepts for non-fully detailed connections show only the minimum requirements to convey design intent.
 - 2. Engineering Responsibility: Fabricator's responsibilities include using a Qualified Professional Engineer to prepare structural analysis data for all structural-steel connections that are not completely detailed on the Contract Documents.
 - a. The contractor shall design and provide any stiffener plates, doubler plates, reinforcing plates, etc. and their connections that may be required to develop and/or transfer the forces and/or connection design criteria called for in the Contract Documents.
 - b. Design connections to withstand the combined effects of shears, axial forces, moments and torques and as required by applicable code(s) and the Contract Documents.
 - c. All non-shear forces shown on the drawings are to be assumed reversible unless noted otherwise, and must be checked for both directions. If no transfer/pass-through forces are shown on the Contract Documents, then the most critical combinations of member forces and directions shall be assumed for the connection design.
 - d. All welded connections must utilize pre-qualified joints or joints that have been qualified by AWS D1.1, Section 2.
 - e. Comply with all connection notes on drawings in conjunction with these specifications.
 - f. The connection design calculation submittals shall meet the following criteria:
 - 1. Use a logical numbering system for connections without repeating labels. Cloud all changes to resubmitted calculations.
 - 2. Provide sketches for the results of each calculation, with all the pertinent dimensions to the calculation shown.
 - 3. For repetitive connections a spreadsheet summary may be used, but provide all pertinent input and resulting values plus an example long-hand calculation.
 - 4. Provide drawings/sketches showing the overall locations of the connections that are keyed/referenced to each connection calculation.
 - 5. Provide calculation checks for all forces shown on the drawings. All AISC code requirements apply. "OK by inspection" is not permitted.

1.6 SUBMITTALS – PART A (FOR REVIEW)

- A. Product Data: For each type of product indicated.
- B. Typical Connection Design Submittal: For each classification of connections (shear, axial, moment, truss and braced frame), submit a proposed typical connection and the supporting calculations for review prior to commencing substantial connection design.
- C. Provide placement plan and details for shear studs on all composite steel framing.
- D. Shop Drawings and related submittals: Show complete information for fabrication and erection of structural steel components.
 - 1. Submit shop drawings under provisions of Division 1 Section “Submittal Procedures.” Phase submittals to match sequence of actual construction to avoid delay of work.
 - 2. Include overall floor plans with piece marks labeled and erection detail cuts.
 - 3. Include full height elevations where appropriate for elements such as brace frames.
 - 4. Include details of cuts, connections, splices, camber, holes, and other pertinent erection data.
 - 5. Include embedment, anchor bolt and erection drawings.
 - 6. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld.
 - 7. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical high-strength bolted connections.
 - 8. List paint manufacturer’s name and paint number where painting is required.
 - 9. Indicate items to be galvanized or coated where required.
 - 10. Connection design calculations: Submit connection design calculations and location references indicators at the same time that the shop drawings for the related connections are submitted. These shop drawings will be rejected without the following:
 - a. Complete connection calculations.
 - b. References of connection label and required loads on the shop drawings.
 - c. Signed letter from the Connection Engineer that they have already reviewed and incorporated their comments into the submitted shop drawings. This review shall be for all connections that are required to be designed by the Contractor’s Engineer.
 - 11. Submittal Process and Review:
 - a. Submittal of shop and erection drawings and other submittals by the General Contractor shall constitute General Contractor’s representation that the General Contractor has verified all quantities, dimensions, materials, catalog numbers and similar data with respect thereto and reviewed or coordinated each drawing with other drawings and other trades. The General Contractor shall place their shop drawing stamp on all submittals confirming the above.
 - b. The Contractor shall submit to the Design Team two (2) black-line prints and one (1) electronic copy (pdf) for shop drawing review.
 - c. The Contractor shall allow at least ten (10) working days between receipt and release by the Design Team for the review of shop and erection drawings, other than connection design calculations, which shall be allowed fifteen (15) working days. The size of the submittals is limited to that which is agreed upon during the submittal schedule required below.

- d. Resubmittals: Completely address previous comments prior to resubmitting a drawing. Resubmit only those drawings that require resubmittal. All modifications or revisions to submittals, shop drawings, connection design calculations and erection drawings must be clouded, with an appropriate revision number clearly indicated.
 - e. The Contractor shall deliver to the Design Team at the completion of the job two (2) electronic versions of the final as-built shop drawings on a CD-ROM or other media acceptable to the Design Team.
 - f. The review of connection design and the review and approval of shop and erection drawings shall be for general conformance with the design intent of the work and with the information given in the Contract Documents only and will not in any way relieve the Contractor or the Contractor's Engineer from their responsibilities stated herein.
12. Substitution Request:
- a. Requests for any departure from Contract Documents must be submitted in writing by the Contractor and accepted in writing by the Design Team, prior to receipt of submittals.
 - b. Such substitutions or modifications, if acceptable to the Design Team, shall be coordinated and incorporated in the work at the sole expense of the Contractor.
 - c. Compensation for Additional Services: Should additional work by the Design Team, such as design, drafting, meetings and/or visits be required, which are necessitated for the review and/or incorporation of the Contractor-requested substitution, including indirect effects on other portions of the work, the Contractor is responsible for paying for additional work at the standard billing rates plus out-of-pocket expenses incurred at cost + 10%.
 - d. Contractor is responsible for means and methods and any impacts on other portions of the work that may arise from this substitution.

1.7 SUBMITTALS – PART B (FOR RECORD)

- A. Submittal Schedule for all Part A submittal items.
- B. Welding certificates for all welders that will perform work for this project..
- C. Welding Procedures: Submit for record written welding procedures for all joints not prequalified by Section 2 of AWS D1.1. Submit all welding and qualification procedures to the Testing Agency for Approval before submitting to Design Team.
- D. Qualification Data for the Fabricator, Erector and Connection Engineer
- E. Submittal Letter: The Contractor shall submit for record a letter from the Contractor's Engineer supervising the preparation of connection designs on shop and erection drawings. A letter shall be submitted along with the first submission of Connection design calculations. It shall be signed and sealed by the Contractor's Engineer, and shall include the following:

"All connection design calculations for this project will be designed by me, or by qualified personnel under my direct supervision, to resist the loads and reactions indicated on the Contract Documents, except those connections which are completely designed on the Contract Documents."

- F. Preconstruction Survey: Submit for record. For all steel construction, before steel erection commences, perform and submit a complete survey for position and alignment at all points where construction by other trades will support steel elements, including but not limited to pockets, embedded plates, anchor rods and base plates.
- G. Source quality-control test reports.
- H. Minutes of Pre-Installation conference.
- I. Mill Test Reports: Signed by manufacturers certifying that the following products comply with requirements:
 - 1. Structural steel including chemical and physical properties.
 - 2. Bolts, nuts, and washers including mechanical properties and chemical analysis.
 - 3. Direct-tension indicators.
 - 4. Tension-control, high-strength bolt-nut-washer assemblies.
- J. Sustainable Design Submittals:
 - 1. LEED Credit: Product Data for Credit MR 4.1 and Credit MR 4.2: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.
 - a. Include statement indicating costs for each product having recycled content.

1.8 CLOSEOUT SUBMITTALS

- A. Record Documentation.
- B. Sustainable Design Closeout Documentation.

1.9 QUALITY ASSURANCE

- a. Fabricator Qualifications; A qualified fabricator who participates in the AISC Quality Certification Program and is designated an AISC Certified Plant, Category STD. Fabricator shall be experienced in the preparation of shop drawings using intergrated three-dimensional modeling software parametrically linking all major structural piece marks and overall building framing model.
- b. Installer (erector) Qualifications: A qualified installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category CSE (minimum).
- c. Fabricator's/Contractor's Qualified Professional Engineer/Specialty Structural Engineer Qualifications: Qualified Professional Engineer(s), licensed in the State of Minnesota, with 10 years of experience being in responsible charge to work of this nature. The proposed engineer(s) shall be subject to approval of the Design Team.
- d. Comply with applicable provisions of the following specifications and documents:
 - 1. AISC's "Code of Standard Practice for Steel Buildings and Bridges."
 - 2. AISC's "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design" or "Load and Resistance Factor Design Specification for Structural Steel Buildings."
 - 3. AISC's "Specification for the Design of Steel Hollow Structural Sections."
 - 4. AISC's "Specification for Allowable Stress Design of Single-Angle Members" or "Specification for Load and Resistance Factor Design of Single-Angle Members."
 - 5. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

- e. Contractor shall assign a qualified staff member to perform quality control on their own work in the field on a daily basis, for each day work is performed. The Contractor's quality control staff shall review their own work for compliance with contract documents before the Contractor notifies the design team or others, of readiness for required inspections, tests and observations to be provided by the Owner's Representatives.
- f. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel."
- g. Pre-Design/Detailing Meeting: Prior to starting connection design and detailing, the Fabricator shall hold a meeting to verify all connection design assumptions and procedures and shop drawing preparation and submittal procedures. The Contractor shall prepare an agenda and require responsible representatives of every party who is concerned with the connection design and detailing to attend this meeting. The Contractor shall distribute meeting minutes to all parties within 5 working days of the meeting.
- h. Pre-Installation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination" and Division 01 – "Structural Tests and Special Inspections".

1.10 TEMPORARY SUPPORT OF STRUCTURAL STEEL FRAME

- A. The structure as shown on the Contract Documents is designed to withstand the design loads only when all structural elements are installed and fully connected. The Contractor shall be responsible for the analysis of all components and assemblies for stresses and displacements that may be imposed by fabrication, shipping, handling, erection, temporary conditions, construction loads, etc. The analysis of such shall be performed by the Contractor's Engineer.

1.11 DELIVERY, STORAGE, AND HANDLING

- A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from erosion and deterioration.
- B. Store fasteners in a protected place. Bolts and nuts that become dry or rusty before use shall not be allowed.
- C. Store welding electrodes in hermetically sealed containers. Electrodes exposed to atmosphere for periods greater than those permitted shall be redried in accordance with AWS D1.1.
- D. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

1.12 OBSERVATIONS BY DESIGN TEAM

- A. Review: The Design Team will observe the construction for general compliance with the provisions of the Contract Documents during various phases of construction.

- B. Compensation for Additional Services: Should additional work by the design team such as design, drafting, meetings and/or visits be required which are necessitated by failure of the Contractor to perform the work in accordance with the Contract Documents, the Contractor is responsible for paying for additional work performed at standard billing rates plus out-of-pocket expenses incurred at cost + 10%. Additional costs for testing and inspection by the Owner shall also be compensated by the Contractor.

1.13 COORDINATION

- A. Furnish anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.
- B. Provide structural steel substrate to receive sprayed fire-resistive materials free of paint, lubricants, oils, dirt, or other contaminants which would significantly impair adhesion of sprayed materials.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified. Contractor may submit alternative product for review and approval by the design team.

2.2 STRUCTURAL-STEEL MATERIALS

- A. W-Shapes: ASTM A 992, Grade 50
- B. Channels, Angles: ASTM A 36
- C. Plate and Bar: ASTM A 36 or ASTM A 572 (Fy = 50 ksi) where indicated on drawings
- D. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade B, structural tubing
- E. Steel Pipe: ASTM A53, Type E or S, Grade B.
- F. Welding Electrodes: E 70 XX, minimum. Comply with AWS requirements.

2.3 BOLTS, CONNECTORS, AND ANCHORS

- A. High-Strength Bolts, Nuts, and Washers: ASTM A325 or A490, heavy hex steel structural bolts; All bolts shall be new, not re-used.
 - 1. Finish: Plain – Typical. Mechanically deposited zinc coating, ASTM B 695, Class 50 - exposed to weather.
- B. Direct-Tension Indicators: ASTM F 959, Type 325 compressible-washer type.
 - 1. Finish: Plain – Typical. Mechanically deposited zinc coating, ASTM B 695, Class 50 - exposed to weather.

- C. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852, Type 1, round head steel structural bolts with splined ends; ASTM A 563 heavy hex carbon-steel nuts; and ASTM F 436 hardened carbon-steel washers.
 - 1. Finish: Plain – Typical. Mechanically deposited zinc coating, ASTM B 695, Class 50 – exposed to weather
 - 2. Available Products:
 - a. LeJeune Tension Control Bolts.
 - b. Bethlehem Load Indicator Bolts.
- D. Shear Connectors: ASTM A 108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1, Type B.
- E. Anchor Rods: ASTM F 1554, Grade as indicated on General Structural Notes and Contract Drawings, straight.
 - 1. Nuts: ASTM A 563 heavy hex carbon steel.
 - 2. Plate Washers: ASTM A 36 carbon steel.
 - 3. Washers: ASTM F 436 hardened carbon steel.
 - 4. Finish: Plain, unless noted otherwise on Contract Drawings.
- F. Threaded Rods: ASTM A 36, unless noted otherwise on Contract Drawings.
 - 1. Nuts: ASTM A 563 heavy hex carbon steel.
 - 2. Washers: ASTM A 36 carbon steel.
 - 3. Finish: Plain.
- G. Clevises and Turnbuckles: ASTM A108, Grade 1035, cold-finished carbon steel.

2.4 SHOP COATINGS

- A. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer. Color to be fabricator's standard.
- B. Galvanizing Repair Paint: ASTM A780.
- C. Bituminous Protection Coating: Carboline, Bitumastic 50

2.5 GROUT

- A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time. $F'c = 4000$ psi minimum at 24 hours.
 - 1. Available Products:
 - a. Five Star Products:
 - 1. Five Star Grout
 - b. Master Builders: Embeco.
 - c. Sonneborn Chemrex Inc.: Sonogrout 10K.

2.6 FABRICATION

- A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC's "Specification for Structural Steel Buildings."
 - 1. Camber structural-steel members where indicated.
 - 2. Identify high-strength structural steel according to ASTM A 6 and maintain markings until structural steel has been erected.

3. Mark and match-mark materials for field assembly.
 4. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.
- B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1.
- C. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.
- D. Cleaning: Clean and prepare steel surfaces that are to remain unpainted and/or not exposed to view or exterior conditions according to SSPC-SP 2 - "Hand Tool Cleaning". For interior steel exposed to view, clean and prepare per SSPC-SP 6 - "Commercial Blast Cleaning". For Exterior steel that is not galvanized, prepare to SSPC-SP-6. For members to be hot Dipped Galvanized, prepare to SSPC-SP-3, "Power Tool Cleaning."
- E. Holes: Provide holes required for securing other work to structural steel and for passage of other work through steel framing members.
1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
 2. Base-Plate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
 3. Weld threaded nuts to framing and other specialty items indicated to receive other work.
- F. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1 and manufacturer's written instructions.

2.7 SHOP CONNECTIONS

- A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
1. Joint Type:
 - a. Typical shear connections: Snug Tightened.
 - b. Moment connections: Slip Critical.
 - c. Tension/Compression Connections: Slip Critical.
- B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.
1. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.
 2. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.

2.8 SHOP PRIMING

- A. Structural steel to be unpainted unless noted otherwise on the architectural drawings.

- B. For all steel noted as painted on the architectural drawings, shop prime steel surfaces except the following:
 1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
 2. Surfaces to be field welded.
 3. Surfaces to be high-strength bolted with slip-critical connections.
 4. Surfaces to receive sprayed fire-resistive materials.
 5. Galvanized surfaces.
 6. Surfaces supporting concrete slabs, composite metal deck or shear connectors.
- C. Surface Preparation: Clean surfaces per the requirements in Section 2.6
- D. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a dry film thickness of not less than 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.
 1. Apply two coats of shop paint to inaccessible surfaces after assembly or erection.

2.9 GALVANIZING

- A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123.
 1. Galvanize items indicated in Contract Documents.
 2. Fill vent holes and grind smooth after galvanizing.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify elevations of concrete bearing surfaces and locations of anchor rods, bearing plates, and other embedments, with steel erector present, for compliance with requirements.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place, unless otherwise indicated. See Section 1.10.

3.3 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and according to AISC's "Code of Standard Practice for Steel Buildings and Bridges".
- B. Base Plates: Clean concrete bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting base plates. Clean bottom surface of base plates.
 1. Set base plates for structural members on wedges, shims, or setting nuts as required.
 2. Weld plate washers to top of base plate.

3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of base plate before packing with grout.
 4. Promptly pack grout solidly between bearing surfaces and base plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.
- C. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."
 - D. Align and adjust various members forming part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
 1. Level and plumb individual members of structure.
 2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.
 - E. Splice members only where indicated.
 - F. Do not use thermal cutting during erection.
 - G. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.
 - H. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1 and manufacturer's written instructions. The top flanges of the beams receiving stud shear connectors shall be free of any substances that might interfere with the welding operations. During welding the steel decking panels shall be free of detrimental substances and rest tightly upon the top flange of the beam.
 - I. No trades may field cut or alter structural members without specific approval of the Structural Engineer. Submit dimensioned plan and detail sketch of proposed modification under cover of a "Request for Information" (RFI) or cloud proposed changes on shop drawings.

3.4 FIELD CONNECTIONS

- A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
 1. Joint Type:
 - a. Typical shear connections: Snug Tightened.
 - b. Moment connections: Slip Critical or fully pretensioned.
 - c. Tension/Compression Connections: Slip Critical or fully pretensioned.
- B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.
 1. Comply with AISC's "Code of Standard Practice for Steel Buildings and Bridges" for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.
 2. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.

3. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.
 4. Verify that weld sizes, fabrication sequence, and equipment used for AESS will limit distortions to allowable tolerances.
 - a. Grind butt welds flush.
 - b. Grind or fill exposed fillet welds to smooth profile. Dress exposed welds.
- C. Tension Control Devices:
1. Install using electric power wrench as recommended by bolt manufacturer.
 2. Tighten until splined end of bolt is sheared off.
- D. Shear Connectors:
1. Do not weld when the temperature is below 0 degrees F.
 2. Remove standing water in deck ribs so that water is not trapped between beams and deck during welding.
 3. Ensure that surfaces of steel beams to which studs are to be welded are dry and free of paint, dirt and debris and that deck bottom is in firm contact with beam.
 4. Install studs after steel framing and metal decking are in place.
 5. Use automatic welding equipment powered to weld studs satisfactorily under site conditions.
 6. Prior to starting each day's operations, weld at least two shear studs to determine proper generator control unit and stud welder settings.
 7. Test that studs are capable of being bent 45 degrees from vertical without weld failure.
 8. Weld additional trial shear studs at request of Independent Testing Lab.

3.5 FIELD QUALITY CONTROL

- A. The Owner will engage a qualified testing and inspection agency to provide special inspection and testing services and prepare reports in accordance with Division 1, Section "Structural Tests and Special Inspections", and IBC Chapter 17 as adopted by the current Minnesota State Building Code, and the CASE/Mn Guideline for Special Structural Inspection and Testing, and other items which in the professional judgment of the Structural Engineer of Record, are critical to the integrity of the building structure.
- B. Special Inspection and Testing Criteria. Refer to Division 1, Section "Structural Tests and Special Inspections" for standard requirements and definitions.
1. Special Testing and Inspection Requirements
 - a. High Strength Bolting (Field Installed).
 - 1) General (Technical II)
 - a) Visually inspect mating surfaces and bolt type for all slip-critical bolted connections for general conformance with the contract documents prior to bolting.
 - b) Determine the requirements for bolts, nuts, washers, paint and installation/tightening standards are met.
 - c) Observe calibration procedures when such procedures are required in the contract documents and verify that selected procedure is used to tighten bolts.
 - 2) Slip Critical Bolts and Tension Bolts (Technical II)
 - a) Test bolt tightening in 10% of all bolts. Test a minimum of two bolts in each connection. Verify that all plies of connected elements have been brought into contact, at 100% of connection. Verify all tips are removed from "twist-off" bolts.

- 3) Bearing Bolts (Technical II)
 - a) Visually inspect to conform all plies of connected elements have been brought into contact, at 100% of connections. (Applies only to bolts designed for values not requiring exclusion of threads from failure plane, all other bolts require testing as for tension bolts.)
- 4) Standard
 - a) Test High Strength bolted connections per R.C.S.C. Specifications for Structural Joints Using ASTM A325 or A490 Bolts.
- b. Welding (Field)
 - 1) Fillet Welds (Technical II)
 - a) Visually inspect 100% of all fillet welds for size, length and quality per AWS D1.1.
 - 2) Partial Penetration Welds (Technical II)
 - a) Test 100% of all partial penetration welds exceeding 5/16 inch, using Ultrasonic Tester per AWS D1.1. Test 25% of all partial penetration welds less than 5/16 inch, using Magnetic Particle Testing per ASTM E109, performed on root pass on finished weld.
 - 3) Full Penetration Welds (Technical II)
 - a) Test 100% of all full penetration welds exceeding 5/16 inch, using Ultrasonic Tester per AWS D1.1. Test 25% of all full penetration welds less than 5/16 inch, using Magnetic Particle Testing per ASTM E109, performed on root pass on finished weld.
 - 4) Stud Shear Connector Welds (Technical I)
 - a) Visually inspect 100% of installed studs for full 360 degree flash. Test all questionable studs, not showing full 360 degree flash by bending studs 15 degrees from vertical, away from weld discontinuity, per AWS D1.1. All ceramic welding ferrules shall be removed by contractor. Randomly test all other studs by bending to 15 degrees from vertical as noted:
 - Studs welded through deck: 15%
 - Studs welded to bare steel: 5%
 Alternatively, sound 100% of installed studs, for full penetration weld, using an 8 lb. Maul. Test questionable studs as noted above. Welding ferrules need not be removed.
 - 5) Deck Welds and Fasteners (Technical I)
 - a) Visually inspect size, location, length and burn through for 100% of puddle welds on metal deck designed as a structural element, per AWS D1.3.
 - b) Visually inspect sidelap fasteners to meet spacing and size specified.
 - 6) Welding of Reinforcing Bars (Technical II)
 - a) Be continuously present during welding and visually inspect 100% of all reinforcing bar welds as the welding is performed, per AWS D1.4. Verify proper joint preparation is provided and proper electrodes are used and properly store and dried.
- c. Mechanical Fasteners (Misc.)
 - 1) Fasteners (Technical I)
 - a) Visually inspect specified size, spacing, embedment, and location of expansion bolts and adhesive bonded bolts in connections shown on the structural drawings.

d. Structural Configuration

- 1) Submittals (Structural I)
 - a) Verify mill test reports and other submitted documentation for compliance with contract documents.
- 2) Materials (Technical I)
 - a) Verify materials delivered to site comply with contract documents and approved shop drawings. Materials include bolts, electrodes, mechanical fasteners and deck gauge.
- 3) Detail Compatibility (Structural I) On a periodic basis:
 - a) Review project documents affecting integrity of the structure, including contract documents and pertinent submittals (approved shop drawings)
 - b) Visit site, at intervals appropriate to the stage of construction, to perform review of the structure and visually confirm general compliance with the project documents.
 - c) Inspect the following to verify member orientation, configuration, type and size comply with details indicated on the contract documents and approved shop drawings:
 - Bracing and stiffening members.
 - Proper applications of joint details at connections for structural members.
 - Other work critical to the integrity of the building structure.

e. General (Technical I)

- 1) Verify that all mill certificates and welder certifications comply with the requirements set forth in this specification.

2. Conventional Testing and Inspection Requirements

a. High Strength Bolting

- 1) Bolt Material Test (Technical II)
 - a) Test a minimum of two bolts of each ASTM class specified, for bolt hardness and tensile properties.
- 2) Fabrication and Erection Tolerances (Owner's Construction Manager)
 - a) Verify in-place structure satisfies specified tolerances.

- C. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

3.6 REPAIRS AND PROTECTION

- A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Touchup Painting: After installation, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted joists and accessories, and abutting structural steel.
1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.
 2. Apply a compatible primer of same type as shop primer used on adjacent surfaces.
- C. Touchup Painting: Cleaning and touchup painting are specified in Division 09 painting Sections.

END OF SECTION 05120

**NEW PASSENGER TERMINAL
DULUTH INTERNATIONAL AIRPORT
DULUTH, MINNESOTA**

**SECTION 05310 – STEEL ROOF
DECK**

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. This Section includes the following:
 - 1. Roof deck.
- B. Related Requirements:
 - 1. Division 01 Section "Structural Testing and Special Inspections".
 - 2. Division 05 Section "Structural Steel".
 - 3. Division 07 Sections for thermal and moisture protection, and applied fireproofing.
 - 4. Division 09 Sections for painting and coating of exposed deck.

1.3 SUBMITTALS FOR REVIEW

- A. Product Data: For each type of deck, accessory, and product indicated.
 - 1. Include name of deck manufacturer as well as type, depth, gauge and finish of deck.
- B. Shop Drawings:
 - 1. Show layout and types of deck panels, anchorage details, attachment patterns, field welding requirements, side lap fastenings, pans, cut deck openings, special jointing, accessories, and attachments to other construction required for complete installation of decking.
 - 2. Describe types and locations of acoustical materials and closures.
 - 3. Include deck manufacturer's ICBO Approval Number.
- C. Certificates:
 - 1. Product Certificates: For each type of steel deck, signed by product manufacturer.
 - 2. Welding certificates signed by contractor certifying that welders comply with requirements of Article 1.5 – "Quality Assurance."
- D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that each of the following complies with requirements:
 - 1. Powder-actuated mechanical fasteners.
 - a. Substitute for deck welds at contractor's option. Product data and test reports shall demonstrate fasteners have equal or greater capacity than welds indicated and are suitable for attachment to base material.

- E. FMG Listings for description of roofing products evaluated to meet minimum requirements for Factory Mutual Research Approval recognition.
- F. Sustainable Design Submittals:
 - 1. LEED Credit: Product Data for Credit MR 4.1 and Credit MR4.2 (if required):
For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.
 - a. Include statement indicating costs for each product having recycled content.

1.4 CLOSEOUT SUBMITTALS

- A. Sustainable Design Closeout Documentation.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Fabricate panels to comply with dimensional parameters as defined in "Design Manual for Composite Decks, Form Decks, and Roof Decks" in SDI Publication No. 31. Section properties shall be based in accordance with the AISI Specification for the Design of Cold-Formed Steel Structural Members.
- B. Installer Qualifications: An experienced installer who has completed steel deck similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1 and D1.3 Structural Welding Codes.
- D. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM E 329 for testing indicated.
- E. FMG Listing: Provide steel roof deck evaluated by FMG and listed in its "Approval Guide, Building Materials" for Class 1 fire rating and Class1-90 windstorm ratings.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.
- B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.
 - 1. Protect and ventilate acoustical cellular roof deck with factory-installed insulation to maintain insulation free of moisture.
- C. Keep construction loads and stored materials, including other decking, off steel deck until it is permanently fastened and inspected.
- D. Do not overload deck beyond 75% rated capacity with stored materials or equipment.

1.7 COORDINATION

- A. Coordinate installation of sound-absorbing insulation strips in topside ribs of acoustical deck with roofing installation specified in Division 07 Sections for thermal and moisture protection to ensure protection of insulation strips against damage from effects of weather and other causes.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- 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. Canam Steel Corp.
 2. Epic Metals Corporation.
 3. Nucor Corp.; Vulcraft Division.
 4. United Steel Deck, Inc.
 5. Verco Manufacturing Co.
 6. Wheeling Corrugating Company.

2.2 ROOF DECK

- A. Steel Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 31, and with the following:
 1. Prime-Painted Steel Sheet: ASTM A 1008, Grade 40 minimum, shop primed with manufacturer's standard baked-on, rust-inhibitive primer.
 - a. Color: Manufacturer's standard.
 2. Galvanized Steel Sheet: ASTM A 653, Grade 40 zinc coating.
 3. Galvanized and Shop-Primed Steel Sheet: ASTM A 653, Grade 40, G60 zinc coating; cleaned, pretreated, and primed with manufacturer's standard baked-on, rust-inhibitive primer.
 - a. Color: Manufacturer's Standard.
 4. Deck Profile: As indicated on Drawings.
 5. Profile Depth: As indicated on Drawings.
 6. Design Uncoated-Steel Thickness: As indicated on Drawings.
 7. Design Uncoated-Steel Thicknesses; Deck Unit/Bottom Plate: As indicated on Drawings.
 8. Span Condition: Three span minimum, unless noted otherwise on drawings.
 9. Side Laps: As indicated on drawings.

2.3 ACCESSORIES

- A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.
- B. Mechanical Fasteners: Corrosion-resistant, austempered, powder-actuated or pneumatically driven carbon-steel fasteners with knurled shank.

- C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 minimum diameter.
- D. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.
- E. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 40,000 psi, of same thickness, material and finish as deck; of profile indicated or required for application.
- F. Flat Sump Plate: Single-piece steel sheet, 0.0747 inch thick (14-ga), of same material and finish as deck. For drains, cut holes in the field.
- G. Galvanizing Repair Paint: SSPC-Paint 20 or DOD-P-21035, with dry film containing a minimum of 94 percent zinc dust by weight.
- H. Repair Paint: Manufacturer's standard rust-inhibitive primer of same color as primer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance.

3.2 INSTALLATION, GENERAL

- A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 31, manufacturer's written instructions, and requirements in this Section.
- B. Install temporary shoring before placing deck panels, if required to meet deflection limitations.
- C. Locate deck bundles to prevent overloading of supporting members.
- D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.
 - 1. Align cellular deck panels over full length of cell runs and align cells at ends of abutting panels.
- E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.
- F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.
- G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.

- H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.
- I. Mechanical fasteners may be used in lieu of welding to fasten deck at contractor's option. Locate mechanical fasteners and install according to deck manufacturer's written instructions.

3.3 ROOF-DECK INSTALLATION

- A. Fasten roof-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter that is not less than 1-1/2 inches long, and as follows:
 - 1. Weld Diameter: 5/8 inch, nominal.
 - 2. Weld Spacing: Space welds as indicated on Drawings.
 - 3. Cover weld burn holes with metallic tape.
- B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals as indicated on Drawings, and as follows:
 - 1. Mechanically fasten with self-drilling, No. 10 diameter or larger, carbon-steel screws.
 - 2. If deck is 0.0474 inches thick (18-ga) or more, fastenings may be welded with a minimum of 1-1/2-inch- long welds.
- C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with end joints as follows:
 - 1. End Joints: Lapped 2 inches minimum.
- D. Roof Sump Pans and Sump Plates: Install over openings provided in roof deck and weld flanges to top of deck. Space welds not more than 8 inches apart with at least one weld at each corner.
 - 1. Install reinforcing channels or zees in ribs to span between supports and weld.
- E. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions. Weld to substrate to provide a complete deck installation.
 - 1. Weld cover plates at changes in direction of roof-deck panels, unless otherwise indicated.
- F. Flexible Closure Strips: Install flexible closure strips over partitions, walls, and where indicated. Install with adhesive according to manufacturer's written instructions to ensure complete closure.
- G. Rubber Gaskets: At all roof areas where no roofing materials or insulation is provided over the steel roof decking, such as the canopy area, provide rubber gaskets for all tek screws capable of preventing water leakage through the decking.

3.4 PROTECTION AND REPAIR

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Repair Painting: Wire brush and clean rust spots, welds, and abraded areas on both surfaces of prime-painted deck immediately after installation, and apply repair paint.
 - 1. Apply repair paint, of same color as adjacent shop-primed deck, to bottom surfaces of deck exposed to view.
- C. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.
- D. No hangers, fasteners or loads shall be hung from the underside of the deck unless specifically indicated thus on the structural drawings. Such items as mechanical/electrical equipment, utility lines, architectural bulkheads, ceilings, signage, etc, shall have their own sub-framing designed, supplied and installed by their related trade, as required span to adjacent beams, joists or walls for any support needed.

3.5 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports in accordance with Division 01 Section "Structural Testing and Special Inspections".
- B. Inspections:
 - 1. Visually inspect size, location, length and burn-through for 100% of puddle welds on metal deck, per AWS D1.3, Section 6. (Technical I).
 - 2. Visually inspect size, location, and seating for 100% of powder-actuated or pneumatically driven fasteners on metal deck, per AWS D1.3, Section 6. (Technical I).
 - 3. Report inspection results promptly and in writing to Contractor and Architect.
- C. Inspection Procedure:
 - 1. After five to ten squares of roof deck have been erected, arrange for inspection agency to visually inspect fastening system for size, quality and spacing at interior supporting members, perimeter supports and side laps.
 - 2. Demonstrate corrective procedures for deficiencies found by inspection agency to satisfaction of the Architect and inspection agency before erection of roof deck is resumed.
 - 3. Use approved fastening system, including corrective procedures, as standard for comparison for remaining deck fastening.
 - 4. When erection of roof deck is completed, but before placing roofing materials, arrange for inspection agency to make inspection of complete deck installation and submit written report to Architect.
- D. Deck panels shall be clean, dry, and in firm contact with substrate prior to welding.
- E. Remove and replace work that does not comply with specified requirements.

- F. Additional inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

END OF SECTION 05310

**NEW PASSENGER TERMINAL
DULUTH INTERNATIONAL AIRPORT
DULUTH, MINNESOTA**

**SECTION 05400 – COLD-FORMED
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. This Section includes the following:
 - 1. Exterior and interior load-bearing wall framing.
 - 2. Exterior and interior non-load-bearing wall framing.
 - 3. Engineered design by Contractor's Specialty Structural Engineer.
- B. Related Requirements:
 - 1. Division 01 – Structural Testing and Special Inspections.
 - 2. Division 03 – Cast-In-Place Concrete.
 - 3. Division 05 – Structural Steel Framing.
 - 4. Division 05 – Metal Fabrications.
 - 5. Division 09 Section "Non-Structural Metal Framing" for interior non-load-bearing, metal-stud framing and ceiling-suspension assemblies.
 - 6. Division 09 Section "Gypsum Board Shaft Wall Assemblies" for interior non-load-bearing, metal-stud-framed, shaft-wall assemblies.

1.3 REFERENCES

- A. AISI – North American Specification for the Design of Cold-Formed Steel Structural Members.
- B. AWS D1.1 – Structural Welding Code.
- C. AWS D1.3
- D. LGSEA's Technical Note 551e, "Design Guide for Permanent Bracing of Cold-Formed Steel Trusses."

1.4 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide cold-formed metal framing capable of withstanding design loads within limits and under conditions indicated.
 - 1. Design Loads: As indicated on drawings
 - 2. Deflection Limits: Design framing systems to withstand design loads without deflections greater than indicated on the drawings.

3. Design framing systems to provide for movement of framing members without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F.
 4. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:
 - a. Upward and downward movement of $L/360$ where L is the span in inches.
- B. Cold-Formed Steel Framing, General: Design according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions."
1. Headers: Design according to AISI's "Standard for Cold-Formed Steel Framing - Header Design."
 2. Design exterior non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of cold-formed metal framing product and accessory indicated.
- B. Shop Drawings: Show layout, spacings, sizes, thicknesses, and types of cold-formed metal framing; fabrication; and fastening and anchorage details, including mechanical fasteners. Show reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.
- C. Calculations: For cold-formed metal framing indicated to comply with design loads, include structural analysis data signed and sealed by Qualified Professional Engineer licensed in the State of Minnesota. Submit calculations at the same time as shop drawings.

1.6 INFORMATIONAL SUBMITTALS

- A. Submittal Schedule for all action submittal items.
- B. Welding certificates.
- C. Product Test Reports: From a qualified testing agency, unless otherwise stated, indicating that each of the following complies with requirements, based on evaluation of comprehensive tests for current products:
 1. Steel sheet.
 2. Expansion anchors.
 3. Power-actuated anchors.
 4. Mechanical fasteners.
 5. Vertical deflection clips.
 6. Horizontal drift deflection clips
 7. Miscellaneous structural clips and accessories.
- D. Research/Evaluation Reports: For cold-formed metal framing.

- E. Sustainable Design Submittals:
 1. LEED Credit: Product Data for Credit MR 4.1 and Credit MR 4.2 if required: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.
 2. Include statement indicating costs for each product having recycled content.

1.7 CLOSEOUT SUBMITTALS

- A. Sustainable Design Closeout Documentation.

1.8 QUALITY ASSURANCE

- A. Engineering Responsibility: Preparation of Shop Drawings, design calculations, and other structural data by a qualified professional engineer.
- B. Professional Engineer Qualifications: A professional engineer who is licensed in the State of Minnesota and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of cold-formed metal framing that are similar to those indicated for this Project in material, design, and extent.
- C. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM E 329 to conduct the testing indicated.
- D. Product Tests: Mill certificates or data from a qualified independent testing agency, indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.
- E. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel," and AWS D1.3, "Structural Welding Code--Sheet Steel."
- F. Fire-Test-Response Characteristics: Where indicated, provide cold-formed metal framing identical to that of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.
- G. AISI Specifications and Standards: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" and its "Standard for Cold-Formed Steel Framing - General Provisions."
 1. Comply with AISI's "Standard for Cold-Formed Steel Framing - Truss Design."
 2. Comply with AISI's "Standard for Cold-Formed Steel Framing - Header Design."
- H. Comply with AISI's "Standard for Cold-Formed Steel Framing - Prescriptive Method for One and Two Family Dwellings."
- I. Pre-Installation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling.
- B. Store cold-formed metal framing, protect with a waterproof covering, and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering cold-formed metal framing that may be incorporated into the Work include, but are not limited to, the following:
 - 1. AllSteel Products, Inc.
 - 2. Clark Steel Framing.
 - 3. Dale/Incor.
 - 4. Dietrich Metal Framing; a Worthington Industries Company.
 - 5. MarinoWare, a division of Ware Industries.
 - 6. SCAFCO Corporation
 - 7. The Steel Network.
 - 8. Super Stud Building Products, Inc.
 - 9. United Metal Products, Inc.

2.2 MATERIALS

- A. Steel Sheet: ASTM A 1003, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:
 - 1. Grade: ST33H minimum or as required by structural performance.
 - 2. Coating: G60 or equivalent.
- B. Steel Sheet for Vertical Deflection or Drift Clips: ASTM A 653, structural steel, zinc coated, of grade and coating as follows:
 - 1. Grade: As required by structural performance.
 - 2. Coating: G60.

2.3 LOAD-BEARING WALL FRAMING

- A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
 - 1. Minimum Base-Metal Thickness: 18 gage (0.0428 inch).
 - 2. Flange Width: Minimum 1-5/8 inches with ½ inch returns.
- B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with straight flanges, and as follows:
 - 1. Minimum Base-Metal Thickness: 18 gage (0.0428 inch).
 - 2. Flange Width: 1-1/4 inches.

- C. Steel Box or Back-to-Back Headers: Manufacturer's standard C-shapes used to form header beams, of web depths indicated, punched, with stiffened flanges, and as follows:
 1. Minimum Base-Metal Thickness: 18 gage (0.0428 inch).
 2. Flange Width: Minimum 1-5/8 inches with ½ inch returns.

2.4 NON-LOAD-BEARING WALL FRAMING

- A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
 1. Minimum Base-Metal Thickness: 18 gage (0.0428 inch).
 2. Flange Width: Minimum 1-5/8 inches with ½ inch returns.
- B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:
 1. Minimum Base-Metal Thickness: 18 gage (0.0428 inch).
 2. Flange Width: 1-1/4 inches.
- C. Vertical Deflection Clips: Manufacturer's standard bypass clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.
 1. Available Manufacturers: As per Section 2.1.
- D. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal and lateral loads and transfer them to the primary structure, and as follows:
 1. Available Manufacturers: As per Section 2.1.
 2. Minimum Base-Metal Thickness: 18 gage or (0.0428 inch).
 3. Flange Width: 1 inch plus twice the design gap.
- E. Drift Clips: Manufacturer's standard bypass or head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure.

2.5 FRAMING ACCESSORIES

- A. Fabricate steel-framing accessories from steel sheet, ASTM A 1003, Structural Grade, Type H, metallic coated, of same grade and coating weight used for framing members.
- B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:
 1. Supplementary framing.
 2. Bracing, bridging, and solid blocking.
 3. Web stiffeners.
 4. Anchor clips.
 5. End clips.
 6. Foundation clips.
 7. Gusset plates.
 8. Stud kickers, knee braces, and girts.
 9. Joist hangers and end closures.

- 10. Hole reinforcing plates.
- 11. Backer plates.

2.6 ANCHORS, CLIPS, AND FASTENERS

- A. Steel Shapes and Clips: ASTM A 36, zinc coated by hot-dip process according to ASTM A 123.
- B. Expansion Anchors: Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times design load, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.
- C. Powder-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 10 times design load, as determined by testing per ASTM E 1190 conducted by a qualified independent testing agency.
- D. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping steel drill screws.
 - 1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.
- E. Welding Electrodes: Comply with AWS standards.

2.7 MISCELLANEOUS MATERIALS

- A. Galvanizing Repair Paint: ASTM A 780.
- B. Cement Grout: Portland cement, ASTM C 150, Type I; and clean, natural sand, ASTM C 404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.
- C. Nonmetallic, Nonshrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, and plasticizing and water-reducing agents, complying with ASTM C 1107, with fluid consistency and 30-minute working time.
- D. Shims: Load bearing, high-density multimonomer plastic, nonleaching.
- E. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to match width of bottom track or rim track members.

2.8 FABRICATION

- A. Fabricate cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.
 - 1. Fabricate framing assemblies using jigs or templates.
 - 2. Cut framing members by sawing or shearing; do not torch cut.

3. Fasten cold-formed metal framing members by welding, screw fastening, clinch fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.
 - a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 - b. Locate mechanical fasteners and install according to Shop Drawings, with screw penetrating joined members by not less than three exposed screw threads.
 4. Fasten other materials to cold-formed metal framing by welding, bolting, or screw fastening, according to Shop Drawings.
- B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or permanent distortion.
- C. Fabrication Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:
1. Spacing: Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
 2. Squareness: Fabricate each cold-formed metal framing assembly to a maximum out-of-square tolerance of 1/8 inch.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine supporting substrates and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance.
1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Before sprayed fire-resistive materials are applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials.
- B. After applying sprayed fire-resistive materials, remove only as much of these materials as needed to complete installation of cold-formed framing without reducing thickness of fire-resistive materials below that are required to obtain fire-resistance rating indicated. Protect remaining fire-resistive materials from damage.
- C. Install load bearing shims or grout between the underside of wall bottom track or rim track and the top of foundation wall or slab at stud or joist locations to ensure a uniform bearing surface on supporting concrete or masonry construction.
- D. Install sealer gaskets to isolate the underside of wall bottom track or rim track and the top of foundation wall or slab at stud or joist locations.

3.3 INSTALLATION, GENERAL

- A. Cold-formed metal framing may be shop or field fabricated for installation, or it may be field assembled.
- B. Install cold-formed metal framing according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions" and to manufacturer's written instructions unless more stringent requirements are indicated.
- C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.
 - 1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch.
- D. Install cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened.
 - 1. Cut framing members by sawing or shearing; do not torch cut.
 - 2. Fasten cold-formed metal framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.
 - a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 - b. Locate mechanical fasteners and install according to Shop Drawings, and complying with requirements for spacing, edge distances, and screw penetration.
- E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.
- F. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.
- G. Do not bridge building expansion and control joints with cold-formed metal framing. Independently frame both sides of joints.
- H. Install insulation, specified in Division 07 Section "Thermal Insulation," in built-up exterior framing members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.
- I. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's standard punched openings.
- J. At openings in all exterior or bearing walls, provide additional studs as indicated on drawings.

- K. Erection Tolerances: Install cold-formed metal framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:
 - 1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.4 LOAD-BEARING WALL INSTALLATION

- A. Install continuous top and bottom tracks sized to match studs. Align tracks accurately and securely anchor at corners and ends, and at spacings as follows:
 - 1. Anchor Spacing: As shown on drawings.
- B. Squarely seat studs against top and bottom tracks with gap not exceeding of 1/8 inch between the end of wall framing member and the web of track. Fasten both flanges of studs to top and bottom tracks. Space studs as follows:
 - 1. Stud Spacing: 16 inches on center max spacing. Tighten spacing if required for loads.
- C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar configurations.
- D. Align studs vertically where floor framing interrupts wall-framing continuity. Where studs cannot be aligned, continuously reinforce track to transfer loads.
- E. Align floor and roof framing over studs. Where framing cannot be aligned, continuously reinforce track to transfer loads.
- F. Anchor studs abutting structural columns or walls, including masonry walls, to supporting structure as indicated.
- G. Install headers over wall openings wider than stud spacing. Locate headers above openings as indicated. Fabricate headers of compound shapes indicated or required to transfer load to supporting studs, complete with clip-angle connectors, web stiffeners, or gusset plates.
 - 1. Frame wall openings with not less than a double stud at each jamb of frame as indicated on Shop Drawings. Fasten jamb members together to uniformly distribute loads.
 - 2. Install runner tracks and jack studs above and below wall openings. Anchor tracks to jamb studs with clip angles or by welding, and space jack studs same as full-height wall studs.
- H. Install supplementary framing, blocking, and bracing in stud framing indicated to support fixtures, equipment, services, casework, heavy trim, furnishings, and similar work requiring attachment to framing.
 - 1. If type of supplementary support is not indicated, comply with stud manufacturer's written recommendations and industry standards in each case, considering weight or load resulting from item supported.

- I. Install horizontal bridging in stud system, spaced as indicated on Shop Drawings. Fasten at each stud intersection.
 - 1. Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs with a minimum of 2 screws into each flange of the clip angle for framing members up to 6 inches deep.
- J. Install steel sheet diagonal bracing straps to both stud flanges, terminate at and fasten to reinforced top and bottom tracks. Fasten clip-angle connectors to multiple studs at ends of bracing and anchor to structure.
- K. Install miscellaneous framing and connections, including supplementary framing, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.5 NON-LOAD-BEARING WALL INSTALLATION

- A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure as indicated.
- B. Fasten both flanges of studs to top and bottom track, unless otherwise indicated. Space studs as follows:
 - 1. Stud Spacing: As indicated on drawings to support architectural wall finish.
- C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.
- D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
 - 1. Install single-leg deflection tracks and anchor to building structure
OR
 - 2. Connect vertical deflection clips to bypassing studs and anchor to building structure.
- E. Install horizontal bridging in wall studs, spaced in rows indicated on Shop Drawings but not more than 48 inches apart. Fasten at each stud intersection.
 - 1. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 12 inches of single deflection track. Install a combination of flat, taut, steel sheet straps of width and thickness indicated and stud or stud-track solid blocking of width and thickness matching studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
 - a. Install solid blocking at centers indicated on Shop Drawings.
 - 2. Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
- F. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, fasteners, and stud girts, to provide a complete and stable wall-framing system.

3.6 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage a qualified special inspector and independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Field and shop welds will be subject to testing and inspecting.
- C. Testing agency will report test results promptly and in writing to Contractor and Architect.
- D. Remove and replace work where test results indicate that it does not comply with specified requirements.
- E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.7 REPAIRS AND PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed metal framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer that ensure that cold-formed metal framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION 05400

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**SECTION 05500 – METAL
FABRICATIONS**

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Steel framing and supports for overhead doors.
 - 2. Steel framing and supports for applications where framing and supports are not specified in other Sections.
 - 3. Miscellaneous steel columns.
 - 4. Metal ladders.
 - 5. Metal bollards.
- B. Products furnished, but not installed, under this Section:
 - 1. Loose steel lintels.
 - 2. Anchor bolts, steel pipe sleeves, slotted-channels inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.
 - 3. Steel weld plates and angles for casting into concrete for applications where they are not specified in other Sections.
- C. Related Sections:
 - 1. Division 03 Section "Cast-in-Place Concrete" for installing anchor bolts, steel pipe sleeves, slotted-channel inserts, wedge-type inserts, and other items cast into concrete.
 - 2. Division 04 Section "Unit Masonry" for installing loose lintels, anchor bolts, and other items built into unit masonry.
 - 3. Division 05 Section "Structural Steel."
 - 4. Division 05 Section "Metal Stairs"
 - 5. Division 05 Section "Pipe and Tube Railings."

1.3 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design ladders, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. 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 (67deg C), ambient; 180 deg F (100 deg C), material surfaces.

1.4 ACTION SUBMITTALS

- A. Product Data: For the following:
 - 1. Paint products.
 - 2. Grout
- B. LEED Submittals:
 - 1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.
- C. Shop Drawings: Show fabrication and installation details for metal fabrications.
 - 1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.
- D. Delegated-Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified structural engineer.
- 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."

1.5 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

1.6 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 and steel weld plates and angles for casting into concrete. 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. Delivery such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrication exposed to view in the complete 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.
- D. Slotted Channel Framing: Cold-formed metal box channels (struts) complying with MFMA-4.
 - 1. Size of Channels: 1-5/8 by 1-5/8 inches (41 by 41 mm).
 - 2. Material: Cold-rolled steel, ASTM A 1008/A 1008M, commercial steel, Type B; 0.0677 inch (1.7 mm) minimum thickness; coated with rust-inhibitive, baked-on, acrylic enamel.
- E. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/1 47M, unless otherwise indicated.

2.3 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 (ASTM F 1941M), Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade and class required.
- B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with hex nuts, ASTM A 563 (ASTM A 563M); and, where indicated, flat washers.
- C. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicates; 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. Eyebolts: ASTM A 489.
- E. Machine Screws: ASME B18.6.3 (ASME B18.6.7M).
- F. Lag Screws: ASME B18.2.1 (ASME B18.2.3.8M).
- G. Wood Screws: Flat head, ASME B18.6.1.
- H. Plain Washers: Round, ASME B18.22.1 (ASME B18.22M).

- I. Lock Washers: Helical, spring type, ASME B17.21.1 (ASME B18.21.2M).
- J. Anchors, General: Anchors capable of sustaining, without failure, a load equal to six (6) times the load imposed when installed in unit masonry and four (4) times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
- 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 (ASTM F 194M), Class Fe/Zn 5, unless otherwise indicated.
 - 2. Material for Exterior Locations and Where Stainless Steel is Indicated: Alloy Group 1 (A1) stainless-steel bolts, ASTM F 593 (ASTM F 738M), and nuts, ASTM F 594 (ASTM F 836M).
- L. Slotted-Channel Inserts: Cold-formed, hot-dip galvanized-steel box channels (struts) complying with MFMA-4, 1-5/8 by 7/8 inches (41 by 22mm) by length indicated with anchor straps or studs not less than 3 inches (75 mm) long at not more than 8 inches (200mm) o.c. Provide with temporary filler and tee-head bolts, complete with washers and nuts, all zinc-plated to comply with ASTM B 633, Class Fe/Zn 5, as needed for fastening to inserts.

2.4 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 Division 09 painting Sections and Division 09 Section "High-Performance Coatings."
- C. Galvanized Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.
- E. Non-shrink, Non-metallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- F. Concrete: Comply with requirements in Division 03 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, concrete with a minimum twenty-eight (28) day compressive strength of 3000 psi (20 MPa).

2.5 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble items in the shop to the 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.
- B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) 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 with straight edges.
- E. Weld corners and seams continuously to comply with the following:
 - 1. Use materials and method 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.
 - 1. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches (3.2 by 38 mm), with a minimum 6 inch (150 mm) embedment and 2 inch (50 mm) hook, not less than 8 inches (200 mm) from ends and corners of units and 24 inches (600 mm) o.c., unless otherwise indicated.

2.6 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. Fabricate units from slotted channel framing where indicated.
 - 2. Furnish inserts for units installed after concrete is placed.
- C. Galvanize miscellaneous framing and supports where indicated.
- D. Prime miscellaneous framing and supports with primer specified in Division 09 Section "Painting."

2.7 MISCELLANEOUS STEEL COLUMNS

- A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.

- B. Fabricate steel columns with steel baseplates and top plates as indicated. Drill or punch baseplates and top plates for anchor and connection bolts and weld to pipe with fillet welds all around. Make welds the same size as pipe wall thickness unless otherwise indicated.
- C. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.
- D. Prime miscellaneous steel columns with primer specified in Division 09 Section "Painting."

2.8 LOOSE STEEL LINTELS

- A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Fabricate in single lengths for each opening unless otherwise indicated. Weld adjoining members together to form a single unit where indicated.
- B. Size loose lintels to provide bearing length at each side of opening equal to 1/12 of clear span but not less than 8 inches (200 mm) unless otherwise indicated.
- C. Galvanize loose steel lintels located in exterior walls.

2.9 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.

2.10 STEEL AND IRON FINISHES

- A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.
 - 1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesives.
 - 2. Galvanized Repair Paint: Where shop-applied galvanized coating is damaged, burned, abraded, or otherwise removed from the substrate, provide galvanizing repair compound with minimum 95% zinc content.
 - a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, ZRC Worldwide "Galvtite Galvanizing Repair Compound."
- B. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.
 - 1. Shop prime with primers specified in Division 09 Section, "Painting."

- C. Preparation for Shop Priming: Prepare surfaces to comply with requirements indicated below:
 - 1. Exterior Items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - 2. Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3 "Commercial Blast Cleaning."
 - 3. Items Indicated to Receive Primers Specified in Division 09 Section "High-Performance Coatings:" SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - 4. Other Items: SSPC-SP 3, "Power Tool Cleaning."
- D. Shop Priming: Apply shop primer to comply with SSOPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
 - 1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

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 limitation. 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.

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 MISCELLANEOUS COLUMNS

- A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.
- B. Base Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
 - 1. Set plates for structural members on wedges, shims, or setting nuts as required.
 - 2. Weld plate washers to top of baseplate.
 - 3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plates before packing with grout.
 - 4. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instruction for shrinkage-resistant grouts.
- C. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."

3.4 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erections, clean field welds, bolted connections and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting and 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 (0.05 mm) dry film thickness.
- B. Galvanized Surfaces: Clean field welds, bolted connections and abraded areas and repair galvanizing to comply with ASTM A 780. Apply Galvanizing Repair Compound in accordance with manufacturer's recommendations.
 - 1. Apply by brush or spray to provide a minimum 1.5 mil (0.04 mm) dry film thickness.

END OF SECTION 05500

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**SECTION 05510 - METAL
STAIRS**

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. This Section includes the following:
1. Preassembled steel stairs with concrete-filled treads or terrazzo treads.
 2. Industrial-type stairs with steel floor plate and/or grating treads.
 3. Ornamental steel-framed stairs.
 4. Steel tube railings attached to metal stairs.
 5. Steel tube handrails attached to walls adjacent to metal stairs.
 6. Railing gates at the level of exit discharge.
 7. Complete registered engineering calculations and design related to stair design. Fabricator's responsibilities include engaging a specialty structural engineer to prepare structural analysis data and submit calculations.
- B. Related Requirements:
1. Division 01 – Structural Testing and Special Inspections.
 2. Division 03 – Cast-In-Place Concrete.
 3. Division 05 – Metal Fabrications: For metal treads and nosings not installed in metal stairs and miscellaneous steel fabrications.
 4. Division 90 – Painting and High Performance Coatings
 5. Division 06 Section Rough Carpentry for wood blocking for anchoring railings.
 6. Division 10 Section "Wire Mesh Partitions" for wire mesh security partitions and doors.

1.3 REFERENCES

- A. NAAMM Stair Standards

1.4 PERFORMANCE REQUIREMENTS

- A. Structural Performance of Stairs: Provide metal stairs capable of withstanding the effects of gravity loads and the following non-reducible loads and stresses within limits and under conditions indicated:
1. Uniform Load: 100 lbf/sq. ft..
 2. Concentrated Load: 300 lbf applied on an area of 4 sq. in..
 3. Uniform and concentrated loads need not be assumed to act concurrently.
 4. Stair Framing: Capable of withstanding stresses resulting from railing loads in addition to loads specified above.
 5. Limit deflection of treads, platforms, and framing members to L/360 or 1/4 inch, whichever is less.

- B. Structural Performance of Railings: Provide railings capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
1. Handrails:
 - a. Uniform load of 50 lbf/ ft. applied in any direction.
 - b. Concentrated load of 200 lbf applied in any direction.
 - c. Uniform and concentrated loads need not be assumed to act concurrently.
 2. Top Rails of Guards:
 - a. Uniform load of 50 lbf/ ft. applied in any direction.
 - b. Concentrated load of 200 lbf applied in any direction.
 - c. Uniform and concentrated loads need not be assumed to act concurrently.
 3. Infill of Guards:
 - a. Concentrated load of 200 lbf applied horizontally on an area of 1 sq. ft..
 - b. Uniform load of 25 lbf/sq. ft. applied horizontally.
 - c. Infill load and other loads need not be assumed to act concurrently.

1.5 ACTION SUBMITTALS

- A. Product Data: For metal stairs and the following:
1. Prefilled metal-pan stair treads.
 2. Precast concrete or terrazzo treads.
 3. Epoxy-resin-filled stair treads.
 4. Nonslip aggregates and nonslip-aggregate finishes.
 5. Abrasive nosings.
 6. Metal floor plate treads.
 7. Paint products.
 8. Grout.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
1. Provide templates for anchors and bolts specified for installation under other Sections.
- C. Calculations: For stair stringers, treads and other components, railings, and connections, provide complete design calculations signed and sealed by Qualified Professional Engineer licensed in the State of Minnesota, indicating that all components comply with design requirements set forth in this specification section. Submit design calculations for stair stringers, components, and connections, designed for loads indicated in this specification section, at the same time as shop drawings. Include location references.
- D. Samples for Initial Selection: For products involving selection of color, texture, or design.
- E. Samples for Verification: For the following products, in manufacturer's standard sizes:
1. Precast concrete or terrazzo treads.
 2. Epoxy-resin-filled stair treads.
 3. Stair treads with nonslip-aggregate surface finish.
 4. Metal floor plate treads.
 5. Grating treads.
 6. Abrasive nosings.

- F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for stairs and railings.
 - 1. Test railings according ASTM E 894 and ASTM E 935.

1.6 INFORMATIONAL SUBMITTALS

- A. Submittal Schedule for all action submittal items.
- B. Welding certificates.
- C. Sustainable Design Submittals:
 - 1. LEED Credit: Product Data for Credit MR 4.1 and Credit MR 4.2 if required: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.
 - a. Include statement indicating costs for each product having recycled content.

1.7 CLOSEOUT SUBMITTALS

- A. Sustainable Design Closeout Documentation.

1.8 QUALITY ASSURANCE

- A. Installer Qualifications: Fabricator of products.
- B. NAAMM Stair Standard: Comply with "Recommended Voluntary Minimum Standards for Fixed Metal Stairs" in NAAMM AMP 510, "Metal Stairs Manual," for class of stair designated, unless more stringent requirements are indicated.
 - 1. Preassembled Stairs: Commercial class.
 - 2. Industrial-Type Stairs: Industrial class.
 - 3. Ornamental Stairs: Architectural class.
- C. Welding: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1, "Structural Welding Code--Steel."
 - 2. AWS D1.3, "Structural Welding Code--Sheet Steel."

1.9 COORDINATION

- A. Coordinate installation of anchorages for metal stairs. 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.
- B. Coordinate locations of hanger rods and struts with other work so that they will not encroach on required stair width and will be within the fire-resistance-rated stair enclosure.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
 - 2. Products: Subject to compliance with requirements, provide one of the products specified.
 - 3. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
 - 4. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 METALS, GENERAL

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

2.3 FERROUS METALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36
- B. Steel Tubing: ASTM A500
- C. Steel Bars for Grating Treads: ASTM A 36
- D. Wire Rod for Grating Crossbars: ASTM A 510.

2.4 FASTENERS

- A. General: Provide zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 25 for exterior use, and Class Fe/Zn 5 where built into exterior walls. Select fasteners for type, grade, and class required.
- B. Bolts and Nuts: 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.
 - 1. Provide hot-dip or mechanically deposited, zinc-coated anchor bolts for exterior stairs and stairs indicated to be galvanized.
- D. Machine Screws: ASME B18.6.3.
- E. Lag Bolts: ASME B18.2.1.
- F. Plain Washers: Round, ASME B18.22.1.
- G. Lock Washers: Helical, spring type, ASME B18.21.1.

- H. Expansion Anchors: Anchor bolt and sleeve assembly with capability to sustain, 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 concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
 - 1. Material for Anchors in Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B 633, Class Fe/Zn 5.
 - 2. Material for Anchors in Exterior Locations: Alloy Group 1 stainless-steel bolts complying with ASTM F 593 and nuts complying with 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 Division 09 painting Sections.
- C. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.
- D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.
- E. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- F. Concrete Materials and Properties: Comply with requirements in Division 03 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi, unless otherwise indicated.
- G. Nonslip-Aggregate Concrete Finish: Factory-packaged abrasive aggregate made from fused, aluminum-oxide grits or crushed emery; rustproof and nonglazing; unaffected by freezing, moisture, or cleaning materials.
- H. Welded Wire Fabric: ASTM A 185, 6 by 6 inches--W1.4 by W1.4, unless otherwise indicated.

2.6 FABRICATION, GENERAL

- A. Provide complete stair assemblies, including metal framing, hangers, struts, railings, clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.
 - 1. Fabricate treads and platforms of exterior stairs so finished walking surfaces slope to drain.
- 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 true to line and level with accurate angles and surfaces and straight edges.
- E. Weld connections 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 and contour of welded surface matches that of adjacent surface.
- F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts unless otherwise indicated. Locate joints where least conspicuous.
- G. Fabricate joints that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

2.7 STAIR RAILINGS

- A. Comply with applicable requirements in Division 05 Section Pipe and Tube Railings for railings

2.8 FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish metal stairs after assembly.
- C. Galvanizing: Hot-dip galvanize items as indicated to comply with applicable standard listed below:
 1. ASTM A 123/A 123M, for galvanizing steel and iron products.
 2. ASTM A 153/A 153M, for galvanizing steel and iron hardware.
 3. Fill vent and drain holes that will be exposed in finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal stairs to in-place construction. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.
- B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal stairs. Set units accurately in location, alignment, and elevation, measured from established lines and levels and free of rack.

- C. Install metal stairs by welding stair framing to steel structure or to weld plates cast into concrete, unless otherwise indicated.
- D. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- E. 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.
- F. 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.
- G. Place and finish concrete fill for treads and platforms to comply with Division 03 Section "Cast-in-Place Concrete."
 - 1. Install abrasive nosings with anchors fully embedded in concrete. Center nosings on tread width.
- H. Install precast concrete treads with adhesive supplied by manufacturer.

3.2 INSTALLING METAL STAIRS WITH GROUTED BASEPLATES

- A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of baseplates.
- B. Set steel stair baseplates on wedges, shims, or leveling nuts. After stairs have been positioned and aligned, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.
 - 1. Use nonmetallic, nonshrink grout, unless otherwise indicated.
 - 2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.3 INSTALLING STEEL TUBE RAILINGS

- A. Adjust railing systems before anchoring to ensure matching alignment at abutting joints. Space posts at spacing indicated or, if not indicated, as required by design loads. Plumb posts in each direction. Secure posts and rail ends to building construction as follows:
 - 1. Anchor posts to steel by welding directly to steel supporting members.
 - 2. Anchor handrail ends to concrete and masonry with steel round flanges welded to rail ends and anchored with postinstalled anchors and bolts.

- B. Attach handrails to wall with wall brackets. Provide bracket with 1-1/2-inch clearance from inside face of handrail and finished wall surface. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads. Secure wall brackets to building construction as follows:
1. Use type of bracket with flange tapped for concealed anchorage to threaded hanger bolt.
 2. Use type of bracket with predrilled hole for exposed bolt anchorage.
 3. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
 4. For steel-framed gypsum board assemblies, use hanger or lag bolts set into wood backing between studs. Coordinate with stud installation to locate backing members.
 5. For steel-framed gypsum board assemblies, fasten brackets directly to steel framing or concealed steel reinforcements using self-tapping screws of size and type required to support structural loads.

3.4 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
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 Division 09 painting Sections.
- C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION 05510

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**SECTION 05521
PIPE AND TUBE RAILINGS**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Steel pipe and tube railings.
- B. Related Sections:
 - 1. Division 5 Section "Metal Stairs" for steel tube railings associated with metal stairs.

1.3 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design railings, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. General: In engineering railings to withstand structural loads indicated, determine allowable design working stresses of railing materials based on the following:
 - 1. Steel: 72 percent of minimum yield strength.
 - 2. Aluminum: The lesser of minimum yield strength divided by 1.65 or minimum ultimate tensile strength divided by 1.95.
 - 3. Stainless Steel: 60 percent of minimum yield strength.
- C. Structural Performance: Railings shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 - 1. Handrails and Top Rails of Guards:
 - a. Uniform load of 50 lbf/ ft. applied in any direction.
 - b. Concentrated load of 200 lbf applied in any direction.
 - c. Uniform and concentrated loads need not be assumed to act concurrently.
 - 2. Infill of Guards:

- a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft.
 - b. Infill load and other loads need not be assumed to act concurrently.
- D. 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.
- E. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1.4 ACTION SUBMITTALS

- A. Product Data: For the following:
 - 1. Manufacturer's product lines of mechanically connected railings.
 - 2. Railing brackets.
 - 3. Grout, anchoring cement, and paint products.
- B. LEED Submittals:
 - 1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.
- C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
- D. Delegated-Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified professional engineer.
- B. Mill Certificates: Signed by manufacturers of stainless-steel products certifying that products furnished comply with requirements.
- C. Welding certificates.
- D. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats.
- E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, according to ASTM E 894 and ASTM E 935.

1.6 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of railing from single source from single manufacturer.
- B. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - 2. 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.

1.8 COORDINATION AND SCHEDULING

- 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 for railings. 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. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not satisfy structural performance requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Steel Pipe and Tube Railings:
 - a. Pisor Industries, Inc.
 - b. Wagner, R & B, Inc.; a division of the Wagner Companies.
 - c. Approved local and regional fabricators.

2.2 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

- B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails unless otherwise indicated.

2.3 STEEL AND IRON

- A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- B. Tubing: ASTM A 500 (cold formed) or ASTM A 513.
- C. Pipe: ASTM A 53/A 53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.
 - 1. Provide galvanized finish for exterior installations and where indicated.
- D. Plates, Shapes, and Bars: ASTM A 36/A 36M.
- E. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/A 47M, unless otherwise indicated.

2.4 FASTENERS

- A. General: Provide the following:
 - 1. Ungalvanized-Steel Railings: Plated steel fasteners complying with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5 for zinc coating.
 - 2. Hot-Dip Galvanized Railings: Type 304 stainless-steel or hot-dip zinc-coated steel fasteners complying with ASTM A 153/A 153M or ASTM F 2329 for zinc coating.
- B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.
- C. Fasteners for Interconnecting Railing Components:
 - 1. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless exposed fasteners are unavoidable or are the standard fastening method for railings indicated.
- D. Post-Installed Anchors: Torque-controlled expansion anchors or chemical 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 concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
 - 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.
 - 1. Provide type and alloy as recommended by producer of metal to be welded and as required for color match, strength, and compatibility in fabricated items.
- B. Etching Cleaner for Galvanized Metal: Complying with MPI#25.
- C. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- D. Shop Primers: Provide primers that comply with Division 9 painting Sections and Division 9 Section "High-Performance Coatings."
- E. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
- F. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.
- G. Intermediate Coats and Topcoats: Provide products that comply with Division 9 painting Sections and Division 9 Section "High-Performance Coatings."
- H. Epoxy Intermediate Coat: Complying with MPI #77 and compatible with primer and topcoat.
- I. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.
- J. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- K. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound.
 - 1. Water-Resistant Product: Provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended by manufacturer for exterior use.

2.6 FABRICATION

- A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.
- B. Assemble railings in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.

- C. 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.
- D. Form work true to line and level with accurate angles and surfaces.
- E. Fabricate connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.
- G. Connections: Fabricate railings with welded connections unless otherwise indicated.
- H. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
 - 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 flux immediately.
 - 4. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.
- I. Nonwelded Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.
 - 1. Fabricate splice joints for field connection using an epoxy structural adhesive if this is manufacturer's standard splicing method.
- J. Form changes in direction as follows:
 - 1. As detailed or by bending or inserting prefabricated elbow fittings.
- K. Bend members in jigs to produce uniform curvature for each configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.
- L. Close exposed ends of railing members with prefabricated end fittings.
- M. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch or less.
- N. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.

1. At brackets and fittings fastened to gypsum board partitions, provide crush-resistant fillers, or other means to transfer loads through wall finishes to structural supports and prevent bracket or fitting rotation and crushing of substrate.
- O. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.
- P. For railing posts set in concrete, provide steel and stainless-steel for stainless-steel rails, sleeves not less than 6 inches long with inside dimensions not less than 1/2 inch greater than outside dimensions of post, with metal plate forming bottom closure.
- Q. Woven-Wire Mesh Infill Panels: Fabricate infill panels from woven-wire mesh crimped into 1-by-1/2-by-1/8-inch metal channel frames. Make wire mesh and frames from same metal as railings in which they are installed.
1. Orient wire mesh with wires horizontal and vertical.
- R. Toe Boards: Where indicated, provide toe boards at railings around openings and at edge of open-sided floors and platforms. Fabricate to dimensions and details indicated.

2.7 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

2.8 STEEL AND IRON FINISHES

- A. Galvanized Railings:
1. Hot-dip galvanize exterior steel and iron railings, including hardware, after fabrication.
 2. Comply with ASTM A 123/A 123M for hot-dip galvanized railings.
 3. Comply with ASTM A 153/A 153M for hot-dip galvanized hardware.
 4. Fill vent and drain holes that will be exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.
- B. For galvanized railings, provide hot-dip galvanized fittings, brackets, fasteners, sleeves, and other ferrous components.
- C. For nongalvanized steel railings, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves, except galvanize anchors to be embedded in exterior concrete or masonry.

- D. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
- E. Primer Application: Apply shop primer to prepared surfaces of railings unless otherwise indicated. Comply with requirements in SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.
- F. Shop-Painted Finish: Comply with Division 9 Section "High-Performance Coatings."
 - 1. Color: As selected by Architect from manufacturer's full range.
- G. High-Performance Coating: Apply epoxy intermediate and polyurethane topcoats to prime-coated surfaces. Comply with coating manufacturer's written instructions and with requirements in SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting. Apply at spreading rates recommended by coating manufacturer.
 - 1. Color: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine gypsum board assemblies, where reinforced to receive anchors, to verify that locations of concealed reinforcements have been clearly marked for Installer. Locate reinforcements and mark locations if not already done.

3.2 INSTALLATION, GENERAL

- A. Fit exposed connections together to form tight, hairline joints.
- B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.
 - 1. Do not weld, cut, or abrade surfaces of railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
 - 2. Set posts plumb within a tolerance of 1/16 inch in 3 feet (2 mm in 1 m).
 - 3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet (5 mm in 3 m).
- C. Corrosion Protection: Coat concealed surfaces of aluminum that will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.
- D. Adjust railings before anchoring to ensure matching alignment at abutting joints.

- E. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.3 RAILING CONNECTIONS

- A. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article whether welding is performed in the shop or in the field.

3.4 ANCHORING POSTS

- A. Use metal sleeves preset and anchored into concrete for installing posts. After posts have been inserted into sleeves, fill annular space between post and sleeve with nonshrink, nonmetallic grout or anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions.
- B. Form or core-drill holes not less than 5 inches deep and 3/4 inch larger than OD of post for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink, nonmetallic grout or anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions.
- C. Cover anchorage joint with flange of same metal as post, attached to post with set screws.
- D. Leave anchorage joint filler sloped away from post.
- E. Anchor posts to metal surfaces with oval flanges, angle type, or floor type as required by conditions, connected to posts and to metal supporting members as follows:
 - 1. For steel pipe railings, weld flanges to post and bolt to metal supporting surfaces.
- F. Install removable railing sections, where indicated, in slip-fit metal sockets cast in concrete.

3.5 ATTACHING RAILINGS

- A. Anchor railing ends at walls with round flanges anchored to wall construction and welded to railing ends or connected to railing ends using nonwelded connections.
- B. Attach railings to wall with wall brackets, except where end flanges are used. Provide brackets with 1-1/2-inch clearance from inside face of handrail and finished wall surface. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.
 - 1. Use type of bracket with flange tapped for concealed anchorage to threaded hanger bolt.

2. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.
- C. Secure wall brackets and railing end flanges to building construction as follows:
1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
 2. For hollow masonry anchorage, use toggle bolts.
 3. For steel-framed partitions, use self-tapping screws fastened to steel framing or to concealed steel reinforcements.

3.6 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.
 2. Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 9 painting Sections.
- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

3.7 PROTECTION

- A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.

END OF SECTION 05521

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**SECTION 05700 - ORNAMENTAL
METAL**

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 finned-tube enclosures.
 - 2. Metal trim and perforated metal base at paneled and glazed walls.
 - 3. Ornamental annunciator panel enclosure.
- B. Related Sections:
 - 1. Section 05500 "Metal Fabrications" for non-decorative metal fabrications.
 - 2. Section 05720 "Ornamental Handrails and Railings" for decorative metal railings.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. LEED Submittals:
 - 1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.
- C. Shop Drawings: Show fabrication and installation details for decorative metal.
 - 1. Include plans, elevations, component details, and attachments to other work.
 - 2. Indicate materials and profiles of each decorative metal member, fittings, joinery, finishes, fasteners, anchorages, and accessory items.
 - 3. Include details of support-framing systems.
 - 4. Indicate relative locations of adjacent materials
- D. Samples for Verification: For each type of exposed finish required.
 - 1. Stainless steel sheet: 12" x 12"
 - 2. Stainless steel bar or extrusion: 12" length.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified fabricator.

1.5 QUALITY ASSURANCE

- A. Fabricator Qualifications: A firm experienced in producing decorative metal similar to that indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- B. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
 - 1. Build mockups for the following types of decorative metal:
 - a. Landside Pavilion finned-tube enclosure.
 - b. Boarding Lounge finned-tube enclosure.
 - 2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store decorative metal in a well-ventilated area, away from uncured concrete and masonry, and protected from weather, moisture, soiling, abrasion, extreme temperatures, and humidity.
- B. Deliver and store cast-metal products in wooden crates surrounded by sufficient packing material to ensure that products will not be cracked or otherwise damaged.

1.7 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with decorative metal by field measurements before fabrication and indicate measurements on Shop Drawings.

1.8 COORDINATION

- A. Coordinate installation of anchorages for decorative metal items. 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.

PART 2 - PRODUCTS

2.1 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. Provide materials without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

2.2 STAINLESS STEEL

- A. Tubing: ASTM A 554, Grade MT 304.
- B. Pipe: ASTM A 312, Grade TP 304.
- C. Castings: ASTM A 743, Grade CF 8 or CF 20.
- D. Sheet, Strip, Plate, and Flat Bar: ASTM A 666, Type 304.
- E. Bars and Shapes: ASTM A 276, Type 304.

2.3 STEEL AND IRON

- A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- B. Tubing: ASTM A 500 (cold formed) or ASTM A 513, Type 5 (mandrel drawn).
- C. Bars: Hot-rolled, carbon steel complying with ASTM A 29, Grade 1010.
- D. Plates, Shapes, and Bars: ASTM A 36.
- E. Cast Iron: Either gray iron, ASTM A 48, or malleable iron, ASTM A 47 unless otherwise indicated.
- F. Steel Sheet, Cold Rolled: ASTM A 1008, either commercial steel or structural steel, exposed.

2.4 FASTENERS

- A. Fastener Materials: Unless otherwise indicated, provide the following:
 - 1. Stainless-Steel Items: Type 304 stainless-steel fasteners.
 - 2. Dissimilar Metals: Type 304 stainless-steel fasteners.
- B. Fasteners for Anchoring to Other Construction: Unless otherwise indicated, select fasteners of type, grade, and class required to produce connections suitable for anchoring indicated items to other types of construction indicated.

- C. Provide concealed fasteners for interconnecting components and for attaching decorative metal items to other work unless otherwise indicated.
 - 1. Provide hex socket flat-head machine screws for exposed fasteners unless otherwise indicated.

2.5 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- B. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.6 FABRICATION, GENERAL

- A. Assemble items in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.
- B. Form decorative metal to required shapes and sizes, true to line and level with true curves and accurate angles and surfaces. Finish exposed surfaces to smooth, sharp, well-defined lines and arris.
- C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing the Work.
- D. 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.
- E. Mill joints to a tight, hairline fit. Cope or miter corner joints. Fabricate connections that will be exposed to weather in a manner to exclude water.
- F. Carefully match exposed work to produce continuity of line and design.
- G. Except where otherwise indicated, the method of assembly shall be the fabricator's option provided the results are acceptable to the Authority
 - 1. Fabricate and fasten metal Work so that the Work will not be distorted or fasteners overstressed from expansion and contraction of the metal.
 - 2. Conceal fasteners unless otherwise detailed on the Drawings. Where exposed in finished surfaces, finish shall match adjacent metal
- H. Comply with AWS for recommended practices in shop welding. Weld behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded joints of flux, and dress exposed and contact surfaces.
 - 1. Where welding cannot be concealed behind finished surfaces, finish joints to comply with NOMMA's "Voluntary Joint Finish Standards" for Type 1 Welds: no evidence of a welded joint.

- I. Wherever dissimilar metals are in contact, paint contact surfaces with a heavy brush coat of bituminous paint or separate contact surfaces by use of preformed tape.
 - 1. Paint contact surfaces of metals, except stainless steel, which will be in contact with concrete, mortar, plaster, or other masonry, with a heavy brush coat of bituminous paint

2.7 MECHANICAL FINNED-TUBE ENCLOSURES

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Architectural Grille; Division of Giumenta Corporation.
 - 2. Binzel Industries, Inc.
 - 3. Environmental Interiors, Inc.
 - 4. Harrington & King Perforating Company, Inc.
 - 5. Kees, Inc.
 - 6. Metalworks, a WSM Enterprise Co.
 - 7. Register & Grille Mfg. Co., Inc.
 - 8. Sterling Hydronics.
 - 9. Tesko Enterprises.
 - 10. Vulcan Radiator, a Mestek Company.
- B. Fabricate finned-tube enclosures from stainless-steel sheet of thickness, size, and pattern indicated. Form perforations by punching, cutting, or drilling to produce openings of sizes and shapes indicated. Roll, press, and grind perforated metal to flatten and to remove burrs and deformations.
- C. Provide framing, braces, and supports required for anchoring the assemblies.

2.8 METAL TRIM AND PERFORATED METAL BASE AT PANELED AND GLAZED WALLS

- A. Manufacturers: Subject to compliance with requirements, available manufacturer/fabricators qualified to produce the Work include, but are not limited to, the following:
 - 1. Binzel Industries, Inc.
 - 2. Environmental Interiors, Inc.
 - 3. Metalworks, a WSM Enterprise Co.
 - 4. Schluter Systems, L.P.
- B. Fabricate metal corner trim for paneled walls from stainless-steel sheet, plate, bars or extruded sections to produce the profile indicated. Trim must be capable of withstanding a concentrated load of 200 lbf at any point without permanent deformation or noticeable damage.

- C. Fabricate perforated metal base from 16 ga. stainless steel sheet to produce profile and pattern indicated.

2.9 MISCELLANEOUS

- A. Provide other metal work of ornamental nature shown or noted on the Drawings and not specified elsewhere.
 - 1. Items shall be fabricated as detailed of indicated metals.
 - 2. Provide anchors and fasteners necessary to complete the Work.

2.10 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

2.11 STAINLESS-STEEL FINISHES

- A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
- B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
 - 1. Run grain of directional finishes with long dimension of each piece.
- C. Directional Satin Finish: No. 4.
- D. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of decorative metal.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Provide anchorage devices and fasteners where needed to secure decorative metal to in-place construction.
- B. Perform cutting, drilling, and fitting required to install decorative metal. Set products accurately in location, alignment, and elevation, measured from established lines and levels. Provide temporary bracing or anchors in formwork for items to be built into concrete, masonry, or similar construction.
- C. Fit exposed connections accurately together to form tight, hairline joints or, where indicated, uniform reveals and spaces for sealants and joint fillers. Where cutting, welding, and grinding are required for proper shop fitting and jointing of decorative metal, restore finishes to eliminate evidence of such corrective work.
- D. Do not cut or abrade finishes that cannot be completely restored in the field. Return items with such finishes to the shop for required alterations, followed by complete refinishing, or provide new units as required.
- E. Install concealed gaskets, joint fillers, insulation, and flashings as work progresses.
- F. Restore protective coverings that have been damaged during shipment or installation. Remove protective coverings only when there is no possibility of damage from other work yet to be performed at same location.
 - 1. Retain protective coverings intact; remove coverings simultaneously from similarly finished items to preclude nonuniform oxidation and discoloration.
- G. Field Welding: Comply with applicable AWS specification for procedures of manual shielded metal arc welding and requirements for welding and for finishing welded connections in "Fabrication, General" Article. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations.
- H. Field Brazing: Comply with requirements for brazing and for finishing brazed connections in "Fabrication, General" Article. Braze connections that are not to be left as exposed joints but cannot be shop brazed because of shipping size limitations.

3.3 INSTALLING MECHANICAL FINNED-TUBE ENCLOSURES

- A. Mount decorative grilles in positions indicated.
 - 1. Secure to framing and blocking with specified fasteners.
 - 2. On marble, brick, and other solid surfaces, secure with wood screws in lead plugs.

3.4 INSTALLING METAL TRIM AT PANELED WALLS

- A. Install metal corner trim at paneled walls before paneling is installed. Secure to wood grounds with specified screws.

3.5 CLEANING AND PROTECTION

- A. Unless otherwise indicated, clean metals by washing thoroughly with clean water and soap, rinsing with clean water, and drying with soft cloths.
- B. Clean stainless steel according to metal finisher's written instructions in a manner that leaves an undamaged and uniform finish matching approved Sample.
- C. Protect finishes of decorative metal from damage during construction period with temporary protective coverings approved by decorative metal fabricator. Remove protective covering at time of Substantial Completion.
- D. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION 05700

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**SECTION 06100 - ROUGH
CARPENTRY**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This section includes the following:
 - 1. Wood blocking, cants and nailers.

1.3 DEFINITIONS

- A. Rough Carpentry: Carpentry work not specified in other sections and generally not exposed, unless otherwise specified.
- B. Dimension Lumber: Lumber of 2 inches nominal (38 mm actual) or greater but less than 5 inches nominal (114 mm actual) in least dimension.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
 - 1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
 - 2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
 - 3. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5664.
 - 4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
 - 5. Include copies of warranties from chemical treatment manufacturers for each type of treatment.
- B. LEED Submittals:

1. Certificates for Credit MR 7: Chain-of-custody certificates indicating that products specified to be made from certified wood comply with forest certification requirements. Include documentation that manufacturer is certified for chain of custody by an FSC-accredited certification body. Include statement indicating cost for each certified wood product.
2. Product Data for Credit IEQ 4.1: For adhesives, documentation including printed statement of VOC content.

1.5 INFORMATIONAL SUBMITTALS

- A. Material Certificates: For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the American Lumber Standards Committee's (ALSC) Board of Review.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Keep materials under cover and dry. Protect from weather and contact with damp or wet surfaces. Stack lumber, plywood, and other panels. Provide for air circulation within and around stacks and under temporary coverings including polyethylene and similar materials.
 1. For lumber and plywood pressure treated with waterborne chemicals, place spacers between each bundle to provide air circulation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Wood-Preservative-Treated Materials:
 - A. Baxter: J. H. Baxter Co.
 - B. Chemical Specialties, Inc.
 - C. Continental Wood Preservers, Inc.
 - D. Hickson Corp.
 - E. Hoover Treated Wood Products, Inc.
 - F. Osmose Wood Preserving, Inc.

2.2 LUMBER, GENERAL

- A. Certified Wood: Materials shall be produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."
- B. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
 1. Factory mark each piece of lumber with grade stamp of grading agency.

- B. Inspection Agencies: Inspection agencies, and the abbreviations used to reference them, include the following:
 - 1. SPIB - Southern Pine Inspection Bureau.
 - 2. WWPA - Western Wood Products Association.
 - 3. NELMA - Northeastern Lumber Manufacturers Association.
- C. Grade Stamps: Provide lumber with each piece factory marked with grade stamp of inspection agency evidencing compliance with grading rule requirements and identifying grading agency, grade, species, moisture content at time of surfacing, and mill.
- D. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
 - 1. Provide dressed lumber, S4S, unless otherwise indicated.
 - 2. Provide dry lumber with 19 percent maximum moisture content at time of dressing for 2-inch nominal thickness or less, unless otherwise indicated.

2.3 WOOD-PRESERVATIVE-TREATED MATERIALS

- A. General: Where lumber or plywood is indicated as preservative treated or is specified to be treated, comply with applicable requirements of AWPA C2 (lumber) and AWPA C9 (plywood). Mark each treated item with the Quality Mark Requirements of an inspection agency approved by ALSC's Board of Review.
 - 1. Do not use chemicals containing chromium or arsenic.
- B. Pressure treat aboveground items with waterborne preservatives to a minimum retention of 0.25 lb/cu. ft. After treatment, kiln-dry lumber and plywood to a maximum moisture content of 19 and 15 percent, respectively. Treat indicated items and the following:
 - 1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
 - 2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
- C. Complete fabrication of treated items before treatment, where possible. If cut after treatment, apply field treatment complying with AWPA M4 to cut surfaces. Inspect each piece of lumber or plywood after drying and discard damaged or defective pieces.
- D. Do not use oil borne pentachlorophenol for surfaces that are to be painted and surfaces in contact with roofing.

2.4 MISCELLANEOUS LUMBER

- A. General: Provide lumber for support or attachment of other construction, including rooftop equipment curbs and support bases, cant strips, bucks, nailers, blocking, furring, grounds, stripping, and similar members.
- B. Fabricate miscellaneous lumber from dimension lumber of sizes indicated and into shapes shown.

- C. Moisture Content: 19 percent maximum for lumber items not specified to receive wood preservative treatment.
- D. Grade: For dimension lumber sizes, provide No. 3 or Standard grade lumber per ALSC's NGRs of Southern pine-SPIB or Douglas fir south-WWPA, unless otherwise indicated.

2.5 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
 - 1. Where rough carpentry is exposed to weather, in ground contact, or in area of high relative humidity, provide fasteners with a hot-dip zinc coating per ASTM A153 or of Type 304 stainless steel.
- B. Nails, Brads, and Staples: ASTM F 1667
- C. Power-Driven Fasteners: NES NER-272.
- D. Wood Screws: ASME B18.6.1.
- E. Lag Bolts: ASME B18.2.1.
- F. Bolts: Steel bolts complying with ASTM A307, Grade A; with ASTM A563 hex nuts and, where indicated, flat washers.

2.6 MISCELLANEOUS MATERIALS

- A. Water-Repellent Preservative: NWWDA-tested and -accepted formulation containing 3-iodo-2-propynyl butyl carbamate, combined with an insecticide containing chloropyrifos as its active ingredient.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
 - 1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches (406 mm) o.c.
- B. Discard units of material with defects that impair quality of rough carpentry construction and that are too small to use in fabricating rough carpentry with minimum number of joints or optimum joint arrangement.
- C. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted.

- D. Fit rough carpentry to other construction; scribe and cope as required for accurate fit. Correlate location of furring, nailers, blocking, grounds, and similar supports to allow attachment of other construction.
- E. Comply with AWPAC M4 for applying field treatment to cut surfaces of preservative-treated lumber.
 - 1. Use inorganic boron for items that are continuously protected from liquid water.
 - 2. Use copper naphthenate for items not continuously protected from liquid water.
- F. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
 - 1. NES NER-272 for power-driven fasteners.
 - 2. "Recommended Nailing Schedule" of referenced framing standard and with AFPA's "National Design Specifications for Wood Construction." Comply with requirements of applicable codes and of authorities having jurisdiction.
- G. Use hot-dip galvanized nails, unless otherwise indicated. Use finishing nails for finish work. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood; predrill as required.

3.2 WOOD BLOCKING AND NAILERS

- A. Install wood blocking and nailers where shown and where required for screeding or attaching other work. Form to shapes shown and cut as required for true line and level of attached work. Coordinate locations with other work involved.
- B. Attach to substrates to support applied loading. Recess bolts and nuts flush with surfaces, unless otherwise indicated.
- C. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.

END OF SECTION 06100

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**SECTION 07131 – SELF-ADHERING
SHEET WATERPROOFING**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Bonded HDPE or polyethylene sheet waterproofing.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, and tested physical and performance properties of waterproofing.
 - 2. Include manufacturer's written instructions for evaluating, preparing, and treating substrate.
- B. LEED Submittals:
 - 1. Product Certificates for Credit MR 5: For products and materials required to comply with requirements for regional materials, certificates indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating distance to Project, cost for each regional material, and fraction by weight that is considered regional.
- C. Shop Drawings: Show locations and extent of waterproofing and details of substrate joints and cracks, sheet flashings, penetrations, inside and outside corners, tie-ins with adjoining waterproofing, and other termination conditions.
- D. Samples: For each exposed product and for each color and texture specified, including the following products:
 - 1. 8-by-8-inch square of waterproofing and flashing sheet.
 - 2. 8-by-8-inch square of insulation.
 - 3. 4-by-4-inch square of drainage panel.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.

- B. Field quality-control reports.
- C. Sample Warranties: For special warranties.

1.5 QUALITY ASSURANCE

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

1.6 FIELD CONDITIONS

- A. Environmental Limitations: Apply waterproofing within the range of ambient and substrate temperatures recommended by waterproofing manufacturer. Do not apply waterproofing to a damp or wet substrate.
 - 1. Do not apply waterproofing in snow, rain, fog, or mist.
- B. Maintain adequate ventilation during preparation and application of waterproofing materials.

1.7 WARRANTY

- A. Manufacturer's Warranty: Manufacturer's standard materials-only warranty in which manufacturer agrees to furnish replacement waterproofing material for waterproofing that does not comply with requirements or that fails to remain watertight within specified warranty period.
 - 1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Source Limitations for Waterproofing System: Obtain waterproofing materials, protection course, and molded-sheet drainage panels from single source from single manufacturer.

2.2 BONDED HDPE OR POLYETHYLENE SHEET WATERPROOFING

- A. Bonded HDPE Sheet for Vertical Applications: Uniform, flexible, multilayered-composite sheet membrane consisting of either a HDPE film coated with a pressure-sensitive adhesive and protective release liner, min. 32-mil thickness, or an HDPE film coated with a modified asphalt layer and a nonwoven geotextile-fabric final layer, min. 73-mil thickness; with the following physical properties:
 - 1. Tensile Strength, Film: 4000 psi minimum; ASTM D 412.
 - 2. Low-Temperature Flexibility: Pass at minus 10 deg F; ASTM D 1970.
 - 3. Peel Adhesion to Concrete: 5 lbf/in. minimum; ASTM D 903, modified.

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4. Lap Adhesion: 2.5 lbf/in. minimum; ASTM D 1876, modified.
 5. Hydrostatic-Head Resistance: 231 feet; ASTM D 5385, modified.
 6. Puncture Resistance: 100 lbf minimum; ASTM E 154.
 7. Water Vapor Permeance: 0.01 perms maximum; ASTM E 96/E 96M, Water Method.
 8. Water Absorption: 0.5 percent maximum; ASTM D 570.
- B. Mastic, Adhesives, and Detail Tape: Liquid mastic and adhesives, and adhesive tapes recommended by waterproofing manufacturer.

2.3 AUXILIARY MATERIALS

- A. General: Furnish auxiliary materials recommended by waterproofing manufacturer for intended use and compatible with sheet waterproofing.
1. Furnish liquid-type auxiliary materials that comply with VOC limits of authorities having jurisdiction.
- B. Primer: Liquid primer recommended for substrate by sheet-waterproofing material manufacturer.
- C. Surface Conditioner: Liquid, waterborne surface conditioner recommended for substrate by sheet-waterproofing material manufacturer.
- D. Liquid Membrane: Elastomeric, two-component liquid, cold fluid applied, of trowel grade or low viscosity.
- E. Substrate Patching Membrane: Low-viscosity, two-component, modified asphalt coating.
- F. Metal Termination Bars: Aluminum bars, approximately 1 by 1/8 inch thick, predrilled at 9-inch centers.

2.4 INSULATION

- A. Insulation, General: Comply with Division 7 Section "Thermal Insulation."
- B. Board Insulation: Extruded-polystyrene board insulation complying with ASTM C 578, square or shiplap edged.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. DiversiFoam Products.
 - b. Dow Chemical Company (The).
 - c. Owens Corning Insulating Systems LLC.
 - d. Pactiv Building Products.
 - e. T. Clear Corporation, a subsidiary of Fin Pan Inc.
 2. Type IV, 25-psi minimum compressive strength.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the waterproofing.
 - 1. Verify that concrete has cured and aged for minimum time period recommended in writing by waterproofing manufacturer.
 - 2. Verify that substrate is visibly dry and within the moisture limits recommended in writing by manufacturer. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SURFACE PREPARATION

- A. Clean, prepare, and treat substrates according to manufacturer's written instructions. Provide clean, dust-free, and dry substrates for waterproofing application.

3.3 INSULATION INSTALLATION

- A. Install one or more layers of board insulation to achieve required thickness over waterproofed surfaces. Cut and fit to within 3/4 inch of projections and penetrations.
- B. On vertical surfaces, set insulation units in adhesive or tape applied according to manufacturer's written instructions.
- C. On horizontal surfaces, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.

3.4 PROTECTION, REPAIR, AND CLEANING

- A. Protect waterproofing from damage and wear during remainder of construction period.
- B. Protect installed board insulation from damage due to UV light, harmful weather exposures, physical abuse, and other causes. Provide temporary coverings where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.
- C. Correct deficiencies in or remove waterproofing that does not comply with requirements; repair substrates, reapply waterproofing, and repair sheet flashings.

- D. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 07131

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**SECTION 07210 – THERMAL
INSULATION**

PART 1 - GENERAL

1. RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Concealed building insulation.
 - 2. Vapor retarders.
- B. Related Sections include the following:
 - 1. Division 07 Section "Self-Adhering Sheet Waterproofing" for insulation and insulated drainage panels installed with waterproofing.
 - 2. Division 07 Section "Ethylene-Propylene-Diene-Monomer_Roofing" for insulation specified as part of roofing construction.

1.3 DEFINITIONS

- A. Mineral-Fiber Insulation: Insulation composed of rock-wool fibers, slag-wool fibers, or glass fibers; produced in boards and blanket with latter formed into batts (flat-cut lengths) or rolls.

1.4 PERFORMANCE REQUIREMENTS

- A. R-Values: Unless otherwise indicated, provide the following minimum R-values:
 - 1. Roof decks: R-23.0 continuous insulation.
 - 2. Walls above grade: R-13.0+3.8 continuous insulation.
 - 3. Walls below grade: R-10.0 continuous insulation.
 - 4. Perimeter Slab-on-Grade: R-10.0.
- B. Plenum Rating: Provide glass-fiber insulation where indicated in ceiling plenums whose test performance is rated as follows for use in plenums as determined by testing identical products per "Erosion Test" and "Mold Growth and Humidity Test" described in UL 181, or on comparable tests from another standard acceptable to authorities having jurisdiction.
 - 1. Erosion Test Results: Insulation shows no visible evidence of cracking, flaking, peeling, or delamination of interior surface of duct assembly, after testing for four (4) hours at 2500-fpm (13-m/s) air velocity.
 - 2. Mold Growth and Humidity Test Results: Insulation shows no evidence of mold growth, delamination, or other deterioration due to the effects of high humidity, after inoculation with Chaetomium globosium on all

surfaces and storing for 60 days at 100 percent relative humidity in the dark.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. LEED Submittals:
 - 1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.

1.6 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each product.

1.7 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of building insulation through one source from a single manufacturer.
- B. Fire-Test-Response Characteristics: Provide insulation and related materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.
 - 1. Surface-Burning Characteristics: ASTM E84.
 - 2. Fire-Resistance Ratings: ASTM E119.
 - 3. Combustion Characteristics: ASTM E136.

1.8 DELIVERY, STORAGE AND HANDLING

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

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
1. Products: Subject to compliance with requirements, provide one of the products specified.
 2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 FOAM-PLASTIC BOARD INSULATION

- A. Extruded-Polystyrene Board Insulation: ASTM C 578, of type and minimum compressive strength indicated below, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a) DiversiFoam Products.
 - b) Dow Chemical Company (The).
 - c) Owens Corning.
 - d) Pactiv Building Products.
 2. Type IV, 25 psi (173 kPa).

2.3 GLASS-FIBER BLANKET INSULATION

- A. Manufacturers:
1. Certain Teed Corporation.
 2. Guardian Fiberglass, Inc.
 3. Johns Manville.
 4. Knauf Fiber Glass.
 5. Owens Corning.
- A. Unfaced, Glass-Fiber Blanket Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.
- B. Where glass-fiber blanket insulation is indicated by the following thicknesses, provide blankets in batt or roll form with thermal resistances indicated:
1. 3-5/8 inches (92 mm) thick with a thermal resistance of 11 deg F x h x sq. ft. / Btu at 75 deg F (1.9 K x sq. m/W at 24 deg C).
 2. 5-1/2 inches (140 mm) thick with a thermal resistance of 19 deg F x h x sq. ft. / Btu at 75 deg F (3.3 K x sq. m/W at 24 deg C).

2.5 SPRAY POLYURETHANE FOAM INSULATION

- A. Closed-Cell Polyurethane Foam Insulation: ASTM C 1029, Type II, with maximum flame-spread and smoke-developed indexes of 75 and 450,

respectively, per ASTM E 84.

1. Minimum density of 1.5 lb/cu. ft., thermal resistivity of 6.2 deg F x h x sq. ft./Btu x in. at 75 deg F.

2.6 VAPOR RETARDERS

- A. Fire-Retardant, Reinforced-Polyethylene Vapor Retarders: Two (2) outer layers of polyethylene film laminated to an inner reinforcing layer consisting of either nonwoven grid of nylon cord or polyester scrim and weighing not less than 22 lb. / 1000 sq. ft. (10kg/100 sq. m), with maximum permeance rating of 0.1317 per (7.56 ng/Pa x s x sq. m) and with flame-spread and smoke-developed indexes of not more than 5 and 60, respectively.
 1. Products:
 - a. Raven Industries Inc.; DURA-SKRIM 2FR.
 - b. Reef Industries, Inc.; Griffolyn T-55 FR.
- B. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.

2.7 AUXILIARY INSULATING MATERIALS

- A. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by insulation manufacturer for sealing joints and penetrations in vapor-retarder facings.
- B. Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation securely to substrates indicated without damaging insulation and substrates.

2.8 INSULATION FASTENERS

- A. Adhesively Attached, Spindle-Type Anchors: Plate welded to projecting spindle; capable of holding insulation of thickness indicated securely in position indicated with self-locking washer in place; and complying with the following requirements:
 1. Products"
 - a. AGM Industries, Inc.; Series R RACTOO Insul-Hangers.
 - b. Eckel Industries of Canada; Stic-Klip Type N Fasteners.
 - c. Gemco; Spindle Type.
 2. Plate: Perforated galvanized carbon-steel sheet, 0.030 inch (.0762 mm) thick by 2 inches (50 mm) square.
 3. Spindle: Copper-coated, low carbon steel; fully annealed; 0.105 inch (2.67 mm) in diameter; length to suit depth of insulation indicated.
- B. Anchor Adhesive: Product with demonstrated capability to bond insulation anchors securely to substrates indicated without damaging insulation, fasteners, and substrates:
 1. Products:
 - a. AGM Industries, Inc.; TACTT Adhesive.
 - b. Eckel Industries of Canada; Stic-Klip Type S Adhesive.
 - c. Gemco; Tuff Bond Hanger Adhesive.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements of Sections in which substrates and related work are specified and for other conditions affecting performance.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

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

3.3 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instruction applicable to products and application indicated.
- B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed at any time to ice, rain and snow.
- C. Extend insulation in thickness indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- D. Water-Piping Coordination: If water piping is located within insulated exterior walls, coordinate location of piping to ensure that it is placed on warm side of insulation and insulation encapsulates piping.
- E. For performed insulating units, provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to product thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.

3.4 INSTALLATION OF GENERAL BUILDING INSULATION

- A. Seal joints between foam-plastic insulation units by applying adhesive, mastic, or sealant to edges of each unit to form a tight seal as units are shoved into place. Fill voids in completed installation with adhesive, mastic, or sealant as recommended in insulation manufacturer.
- B. Install mineral-fiber insulation in cavities formed by framing members according to the following requirements
 - 1. Remove below-grade construction, including basements, foundation walls, and footings, to depths indicated.
 - 2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
 - 3. Maintain 3-inch (76-mm) clearance of insulation around recessed lighting fixtures.
 - 4. For wood-framed construction, install mineral-fiber blankets according to ASTM c 1320 and as follows:

- a. With faced blankets having stapling flanges, secure insulation by inset, stapling flanges to sides of framing members.
- b. With faced blankets having stapling flanges, lap blanket flange over flange of adjacent blanket to maintain continuity of vapor retarded once finish material is installed over it.

3.5 INSTALLATION OF VAPOR RETARDERS

- A. General: Extend vapor retarder to extremities of areas to be protected from vapor transmission. Secure in place with adhesives or other anchorage system as indicated. Extend vapor retarder to cover miscellaneous voids in insulated substrates, including those filled with loose-fiber insulation.
- B. Firmly attach vapor retarders to metal framing and solid substrates with vapor-retarder fasteners as recommended by vapor-retarder manufacture.
- C. Seal joints caused by pipes, conduit, electrical boxes, and similar items penetrating vapor retarders with vapor-retarder tape to create an airtight seal between penetrating objects and vapor retarder.
- D. Repair tears or punctures in vapor retarders immediately before concealment by other work. Cover with vapor-retarder tape or another layer of vapor retarder.

3.6 PROTECTION

- A. Protect installed insulation and vapor retarders 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 07210

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**SECTION 07415 – COMPOSITE
WALL PANELS**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes:
 - 1. Metal-faced composite wall panels.
- B. Related Sections:
 - 1. Division 5 Section "Cold-Formed Metal Framing" for cold-formed metal framing supporting metal-faced composite wall panels.
 - 2. Division 7 Section "Sheet Metal Flashing and Trim" for field-formed flashings and other sheet metal work not part of metal-faced composite wall panel assemblies.

1.3 DEFINITION

- A. Metal-Faced Composite Wall Panel Assembly: Metal-faced composite wall panels, attachment system components, miscellaneous metal framing, and accessories necessary for a complete weathertight wall system.

1.4 PERFORMANCE REQUIREMENTS

- A. General Performance: Metal-faced composite wall and soffit panel assemblies shall comply with performance requirements without failure due to defective manufacture, fabrication, installation, or other defects in construction.
- B. Structural Performance: Provide metal-faced composite wall and soffit panel assemblies capable of withstanding the effects of the following loads and stresses within limits and under conditions indicated, based on testing according to ASTM E 330:
 - 1. Wind Loads: Determine loads based on the following minimum design wind pressures:
 - a. Uniform pressure of 20 lbf/sq. ft., acting inward or outward.
 - b. Uniform pressure as indicated on Drawings.
 - 2. Deflection Limits: Metal-faced composite wall and soffit panel assemblies shall withstand wind loads with horizontal deflections no greater than

1/240 of the span at the perimeter and 1/100 of the span anywhere in the panel.

- C. 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.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of metal-faced composite or soffit panel and accessory.
- B. Shop Drawings: Show fabrication and installation layouts of metal-faced composite and soffit panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details. Distinguish among factory-, shop-, and field-assembled work.
 - 1. Accessories: Include details of the following items, at a scale of not less than 1-1/2 inches per 12 inches:
 - a. Flashing and trim.
 - b. Anchorage systems.
- C. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:
 - 1. Metal-Faced Composite Wall Panels: Minimum 12 x 12 inches. Include fasteners, closures, and other metal-faced composite wall panel accessories.

1.6 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Exterior elevations, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 - 1. Wall panels and attachments.
 - 2. Girts, Stud framing.

1.7 CLOSEOUT SUBMITTALS

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

1.8 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of metal-faced composite wall or soffit panel from single source from single manufacturer.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver components, sheets, metal-faced composite wall and soffit panels, and other manufactured items so as not to be damaged or deformed. Package metal-faced composite panels for protection during transportation and handling.
- B. Unload, store, and erect metal-faced composite panels in a manner to prevent bending, warping, twisting, and surface damage.
- C. Store metal-faced composite panels vertically, covered with suitable weathertight and ventilated covering. Store metal-faced composite panels to ensure dryness, with positive slope for drainage of water. Do not store metal-faced composite panels in contact with other materials that might cause staining, denting, or other surface damage. Do not allow storage space to exceed 120 deg F.
- D. Retain strippable protective covering on metal-faced composite panel for period of panel installation.

1.10 PROJECT CONDITIONS

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

1.11 COORDINATION

- A. Coordinate metal-faced composite panel assemblies with rain drainage work, flashing, trim, and construction of studs, soffits, 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 metal wall panel assemblies 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 wall 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: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PANEL MATERIALS

- A. Aluminum Sheet: Coil-coated sheet, ASTM B 209, alloy as standard with manufacturer, with temper as required to suit forming operations and structural performance required.
1. Surface: Smooth, flat finish.
 2. Exposed Coil-Coated Finishes:
 - a. Mica Fluoropolymer: AAMA 620. 2-coat fluoropolymer finish with suspended mica flakes containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
- B. Panel Sealants:
1. Joint Sealant: ASTM C 920; elastomeric polyurethane, polysulfide, or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal-faced composite wall panels and remain weathertight; and as recommended in writing by panel manufacturer.

2.2 MISCELLANEOUS METAL FRAMING

- A. Miscellaneous Metal Framing, General: ASTM C 645, cold-formed metallic-coated steel sheet, or coating with equivalent corrosion resistance unless otherwise indicated.
- B. Subgirts: Manufacturer's standard C- or Z-shaped sections 0.064-inch nominal thickness.
- C. Zee Clips: 0.079-inch nominal thickness.
- D. Base or Sill Channels: 0.079-inch nominal thickness.

- E. Hat-Shaped, Rigid Furring Channels:
 - 1. Nominal Thickness: 0.040 inch.
- F. Cold-Rolled Furring Channels: Minimum 1/2-inch-wide flange.
 - 1. Nominal Thickness 0.064 inch.
 - 2. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with nominal thickness of 0.040 inch.
 - 3. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch-diameter wire, or double strand of 0.048-inch-diameter wire.
- G. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches, wall attachment flange of 7/8 inch, and depth required to fit insulation thickness indicated.
 - 1. Nominal Thickness: 0.025 inch.
- H. Fasteners for Miscellaneous Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten miscellaneous metal framing members to substrates.

2.3 MISCELLANEOUS MATERIALS

- A. Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads.

2.4 METAL-FACED COMPOSITE PANELS

- A. General: Provide factory-formed and -assembled, metal-faced composite wall and soffit panels fabricated from two metal facings bonded, using no glues or adhesives, to solid, extruded thermoplastic core; formed into profile for installation method indicated. Include attachment system components using concealed fasteners and accessories required for weathertight system.
 - 1. Fire-Retardant Core: Noncombustible, with the following surface-burning characteristics as determined by testing identical products per ASTM E 84 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
 - a. Flame-Spread Index: 25 or less.
 - b. Smoke-Developed Index: 450 or less.
 - 2. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Alcan Composites USA Inc.; Alucobond, Alucobond Plus.
 - b. Alcoa Inc.; Reynobond.
 - c. ALPOLIC, Division of Mitsubishi Chemical America, Inc.; ALPOLIC.
 - d. CENTRIA Architectural Systems; Formabond Wall System.
 - e. Citadel Architectural Products, Inc., Envelope 2000.

- f. Protean Construction Products, Inc.; ACM 100.
- B. Aluminum-Faced Composite Wall Panels Formed with 0.020-inch-thick, coil-coated aluminum sheet facings.
 - 1. Panel Thickness: min. 0.157 inch.
 - 2. Core: Fire retardant.
 - 3. Exterior Finish: 3-coat fluoropolymer.
 - a. Color: Match Architect's samples.
- C. Attachment System Components: Formed from material compatible with panel facing.

2.5 ACCESSORIES

- A. Wall Panel Accessories: Provide components required for a complete metal-faced composite wall panel assembly including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal-faced composite wall panels unless otherwise indicated.
 - 1. Closures: Provide closures at eaves and rakes, fabricated of same metal as metal wall panels.
 - 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; minimum 1-inch-thick, flexible closure strips; cut or premolded to match metal wall panel profile. Provide closure strips where necessary to ensure weathertight construction.
- B. Flashing and Trim: Formed from 0.018-inch-minimum thickness, zinc-coated (galvanized) steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating. Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal-faced composite wall panels.

2.6 FABRICATION

- A. General: Fabricate and finish metal-faced composite panels and accessories at the factory to greatest extent possible, 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. Fabricate metal-faced composite panels in a manner that eliminates condensation on interior side of panel and with joints between panels designed to form weathertight seals.

- C. Metal-Faced Composite Panels: Factory form panels in a continuous process with no glues or adhesives between dissimilar materials. Trim and square edges of sheets with no displacement of face sheets or protrusion of core material.
1. Form panel lines, breaks, and angles to be sharp and true, with surfaces free from warp and buckle.
 2. Fabricate panels with sharply cut edges, with no displacement of face sheets or protrusion of core material.
 3. Fabricate panels with panel stiffeners, as required to comply with deflection limits, attached to back of panels with structural silicone sealant or bond tape.
 4. Dimensional Tolerances:
 - a. Panel Bow: 0.8 percent maximum of panel length or width.
 - b. Squareness: 0.25 inch maximum.
- D. Sheet Metal Accessories: Fabricate flashing and trim to comply with 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. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
 3. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
 4. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant 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 by metal-faced composite wall panel manufacturer.
 - a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal-faced composite wall panel manufacturer for application, but not less than thickness of metal being secured.

2.7 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. 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-faced composite wall panel supports, and other conditions affecting performance of the Work.
 - 1. 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-faced composite wall panel manufacturer.
 - 2. Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal-faced composite wall panel manufacturer.
- B. Examine roughing-in for components and systems penetrating metal-faced composite wall panels to verify actual locations of penetrations relative to seam locations of panels before panel installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Miscellaneous Framing: Install subgirts, base angles, sills, furring, and other miscellaneous wall panel support members and anchorage according to ASTM C 754 and metal-faced composite wall panel manufacturer's written instructions.
 - 1. Soffit Framing: Wire-tie or clip furring channels to supports, as required to comply with requirements for assemblies indicated.

3.3 METAL-FACED COMPOSITE WALL PANEL INSTALLATION

- A. General: Install metal-faced composite panels according to manufacturer's written instructions in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to girts and subgirts unless otherwise indicated. Anchor panels and other components of the Work securely in place, with provisions for thermal and structural movement.
 - 1. Commence metal-faced composite soffit panel installation and install minimum of 300 sq. ft. in presence of factory-authorized representative.
 - 2. Shim or otherwise plumb substrates receiving metal-faced composite wall panels.
 - 3. Flash and seal metal-faced composite panels at perimeter of all openings. Do not begin installation until weather barrier and flashings that will be concealed by panels are installed.

4. Install flashing and trim as metal-faced composite panel work proceeds.
 5. Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete, and elsewhere as indicated or, if not indicated, as necessary for waterproofing.
 6. Provide weathertight escutcheons for pipe and conduit penetrating exterior walls.
- B. Fasteners:
1. Aluminum Wall Panels: Use aluminum or stainless-steel fasteners for surfaces exposed to the exterior and aluminum or galvanized-steel fasteners for surfaces exposed to the interior.
- C. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action as recommended by metal-faced composite wall panel manufacturer.
- D. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weathertight performance of metal-faced composite panel assemblies. Provide types of gaskets, fillers, and sealants indicated or, if not indicated, types recommended by panel manufacturer.
1. Prepare joints and apply sealants to comply with requirements in Division 7 Section "Joint Sealants."
- E. Attachment System Installation, General: Install attachment system required to support metal-faced composite panels and to provide a complete weathertight system, including subgirts, perimeter extrusions, tracks, drainage channels, panel clips, and anchor channels.
1. Include attachment to supports, panel-to-panel joinery, panel-to-dissimilar-material joinery, and panel-system joint seals.
 2. Do not begin installation until weather barrier and flashings that will be concealed by composite panels are installed.
- F. Clip Installation: Attach panel clips to supports at each metal-faced composite wall panel joint at locations, spacings, and with fasteners recommended by manufacturer. Attach routed-and-turned flanges of wall panels to panel clips with manufacturer's standard fasteners.
1. Seal horizontal and vertical joints between adjacent panels with sealant backing and sealant. Install sealant backing and sealant according to requirements specified in Division 7 Section "Joint Sealants."

3.4 ACCESSORY INSTALLATION

- A. General: 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-faced composite panel assembly including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.

- B. 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 as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
 - 1. Install exposed flashing and trim that is without excessive oil canning, 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 to result in waterproof and weather-resistant 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 weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

3.5 ERECTION TOLERANCES

- A. Installation Tolerances: Shim and align metal-faced composite wall panel units within installed tolerance of 1/4 inch in 20 feet, nonaccumulative, on level, plumb, and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.6 FIELD QUALITY CONTROL

- A. Water-Spray Test: After completing the installation of 300 sq. ft. minimum area of metal-faced composite soffit panel assembly, test assembly for water penetration according to AAMA 501..
- B. Metal-faced composite panels will be considered defective if they do not pass tests and inspections.
- C. Additional tests and inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- D. Prepare test and inspection reports.

3.7 CLEANING

- A. Remove temporary protective coverings and strippable films, if any, as metal-faced composite panels are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of metal-faced composite panel installation, clean finished surfaces as recommended by panel manufacturer. Maintain in a clean condition during construction.
- B. After metal-faced composite panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

- C. Replace metal-faced composite panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07415

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**SECTION 07531 – ETHYLENE-PROPYLENE-
DIENE-MONOMER (EPDM) ROOFING**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Adhered EPDM membrane roofing system.
 - 2. Vapor retarder.
 - 3. Roof insulation.
- B. Related Sections:
 - 1. Division 06 Section "Rough Carpentry" for wood nailers, curbs and blocking.
 - 2. Division 07 Section "Sheet Metal Flashing and Trim" for metal roof penetration flashings, flashings and counterflashings.
 - 3. Division 07 Section "Roof Specialties" for proprietary manufactured roof specialties.
 - 4. Division 07 Section "Joint Sealants" for joint sealants, joint fillers and joint preparation.
 - 5. Division 15 Section "Sanitary, Vent and Storm Drainage Piping" for roof drains.

1.3 DEFINITIONS

- A. Roofing Terminology: See ASTM D 1079 and glossary in NRCA's "The NRCA Roofing and Waterproofing Manual" for definitions and terms related to roofing work in this Section.

1.4 PERFORMANCE REQUIREMENTS

- A. General Performance: Installed membrane roofing and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrications, installation or other defects in construction. Membrane roofing and base flashings shall remain watertight.
- B. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by membrane roofing manufacturer bases on testing and field experience.
- C. Roofing System Design: Provide membrane roofing system that is identical to systems that have been successfully tested by a qualified testing and inspecting agency to resist uplift pressure calculated according to ASCE/SEI 7.

- D. Thermal Performance: Provide roofing system with U-value less than or equal to 0.043; R-23.0 continuous insulation.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. LEED Submittals:
 - 1. Product Data for Credit IEQ 4.1: For adhesives and sealants used inside the weatherproofing system, documentation including printed statement of VOC content.
- C. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Base flashings and membrane terminations.
 - 2. Tapered insulation, including slopes.
 - 3. Roof plan showing orientation of steel roof deck and orientation of membrane roofing and fastening spacings and patterns for mechanically fastened membrane roofing.
 - 4. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.
- D. Samples for Verification: For the following products:
 - 1. Sheet roofing, of color specified, including T-shaped side and end lap seam.
 - 2. Roof insulation.
 - 3. Metal termination bars.
 - 4. Battens.
 - 5. Six insulation fasteners of each type, length, and finish.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer and manufacturer.
- B. Manufacturer Certificates: Signed by roofing manufacturer certifying that roofing system complies with requirements specified in "Performance Requirements" Article.
 - 1. Submit evidence of compliance with performance requirements.
- C. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for components of membrane roofing system.
- D. Field quality-control reports.
- E. Warranties: Sample of special warranties.

1.7 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For roofing system to include in maintenance manuals.

1.8 QUALITY ASSURANCE

- A. **Manufacturer Qualification:** A qualified manufacturer that is UL listed for membrane roofing system identical to that used for this Project.
- B. **Installer Qualifications:** A qualified firm that is approved, authorized or licensed by membrane roofing system manufacturer to install manufacturer's products and that is eligible to receive manufacturer's special warranty. Minimum five (5) years in business.
- C. **Source Limitations:** Obtain all components including, but not limited to, roof insulation and fasteners for membrane roofing system from same manufacturer as membrane roofing or approved by membrane roofing manufacturer.
- D. **Exterior Fire-Test Exposure:** ASTM 3 108, Class A; for application and roof slopes indicated, as determined by testing identical membrane roofing materials by a qualified testing agency. Materials shall be identified with appropriate markings of applicable testing agency.
- E. **Fire-Resistance Ratings:** Where indicated, provide fire-resistance-rated roof assemblies identical to those of assemblies tested for fire resistance per ASTM E 119 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
- F. **Preinstallation Roofing Conference:** Conduct conference at Project site.
 - 1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing installer, roofing system manufacturer's representative, deck installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
 - 2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
 - 3. Review and finalize construction schedule and verify availability of materials, installer's personnel, equipment and facilities needed to make progress and avoid delays.
 - 4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
 - 5. Review structural loading limitations of roof deck during and after roofing.
 - 6. Review base flashing, special roofing details, roof drainage, roof penetrations, equipment curbs and condition of other construction that will affect roofing system.
 - 7. Review governing regulations and requirements for insurance and certifications, if applicable.
 - 8. Review temporary protection requirements for roofing system during and after installation.
 - 9. Review roof observation and repair procedures after roofing installation.

1.9 DELIVERY, STORAGE AND HANDLING

- A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.

- B. Store liquid materials in their original undamaged containers in a clean, dry, protected locations within the temperature range required by roofing system manufacturer. Protection stored liquid material from direct sunlight.
 - 1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.
- C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling and others sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.
- D. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.

1.10 PROJECT CONDITIONS

- A. Weather Limitations: proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

1.11 WARRANTY

- A. Special Warranty: Manufacturer's standard or customized form, with monetary limitation, in which manufacturer agrees to repair or replace components of membrane roofing system that fail in materials or workmanship within specified warranty period.
- B. Special warranty includes membrane roofing, base flashings, roof insulation, fasteners, substrate boards, roofing accessories, and other components of membrane roofing system.
- C. Warranty Period: Twenty (20) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 EPDM MEMBRANE ROOFING

- A. EPDM: ASTM D 4637, Type I, non-reinforced, uniform, flexible EPDM sheet.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Carlisle SynTec Incorporated.
 - b. Firestone Building Products Company.
 - c. GenFlex Roofing Systems.
 - d. Johns Manville.
 - e. Versico Incorporated.
 - 2. Thickness: 90 mils, nominal.
 - 3. Exposed Face Color: Black.

2.2 AUXILIARY MEMBRANE ROOFING MATERIALS

- A. General: Auxiliary membrane roofing materials (including Cover Board) as recommended by roofing system manufacturer for intended use, and compatible with membrane roofing.
 - 1. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.
 - 2. Adhesives and sealants that are not on the exterior side of weather barrier shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - a. Plastic Foam Adhesives: 50 g/L.
 - b. Gypsum Board and Panel Adhesives: 50 g/L.
 - c. Multipurpose Construction Adhesives: 70 g/L.
 - d. Fiberglass Adhesives: 80 g/L.
 - e. Single-Ply Roof Membrane Adhesives: 250 g/L.
 - f. Other Adhesives: 250 g/L.
 - g. Single-Ply Roof Membrane Sealants: 450 g/L.
 - h. Nonmembrane Roof Sealants: 300 g/L.
 - i. Sealant Primers for Nonporous Substrates: 250 g/L.
 - j. Sealant Primers for Porous Substrates: 775 g/L.
- B. Sheet Flashing: 60-mil-thick EPDM, partially cured or cured, according to application.
- C. Bonding Adhesive: Manufacturer's standard, water based.
- D. Seaming Material: Manufacturer's standard, synthetic-rubber polymer primer and 3-inch-wide minimum, butyl splice tape with release film.
- E. Lap Sealant: Manufacturer's standard, single-component sealant, colored to match membrane roofing.
- F. Water Cutoff Mastic: Manufacturer's standard butyl mastic sealant.
- G. Metal Termination Bars: Manufacturer's standard, predrilled stainless-steel or aluminum bars, approximately 1 by 1/8 inch thick; with anchors.
- H. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provision in FM Approvals 4470, designed for fastening membrane to substrate, and acceptable to membrane roofing system manufacturer.
- I. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, reinforced EPDM securement strips, T-joint covers, in-seam sealants, termination reglets, cover strips, and other accessories.

2.3 SUBSTRATE BOARDS

- A. Substrate Board: ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum substrate, Type X, 5/8 inch thick.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Georgia-Pacific Corporation; DensDeck.

- b. Temple-Inland Inc.; GreenGlass
 - c. United States Gypsum Co.; Securock.
- B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening substrate board to roof deck.

2.4 VAPOR RETARDER

- A. Reinforced-Polyethylene Vapor Retarders: Two outer layers of polyethylene film laminated to an inner reinforcing layer consisting of either nylon cord or polyester scrim and weighing not less than 25 lb / 1000 sq. ft. (12 kg/100 sq. m), with maximum permeance rating of 0.0507 perm (2.9 ng/Pa x s x sq. m).
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Raven Industries, Inc.; DURA-SKRIM 6WW.
 - b. Reef Industries, Inc.; Griffolyn T-6.
 - 2. Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.
 - 3. Adhesive: Manufacturer's standard lap adhesive.

2.5 ROOF INSULATION

- A. General: Preformed roof insulation boards manufactured or approved by EPDM membrane roofing manufacturer, selected from manufacturer's standard sizes suitable for application, of thicknesses indicated and that product FM Approvals-approved roof insulation.
- B. Polyisocyanurate Board Insulation: ASTM C 1289, Type II, Class 1, Grade 2, felt or glass-fiber mat facer on both major surfaces.
- C. Tapered Insulation: Provide factory-tapered insulation boards fabricated to slope of 1/4 inch per 12 inches unless otherwise indicated.
- D. Provide pre-formed saddles, crickets, tapered edge strips and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

2.6 INSULATION ACCESSORIES

- A. General: Furnish roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with membrane roofing.
- B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roof insulation to substrate, and acceptable to roofing system manufacturer.
- C. Full-Spread Applied Insulation Adhesive: Insulation manufacturer's recommended spray-applied, low-rise, two-component urethane adhesive formulated to attach roof insulation to substrate or to another insulation layer.

2.7 PIPE BOOTS

- A. Provide pipe boots for single and multiple pipe penetrations. Size and configuration to be appropriate for each specific penetration location. Material to be compatible with roofing systems and to include stainless steel compression ring for each pipe.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Commercial Products Group; PortalsPlus C-412.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with the following requirements and other conditions affecting performance of roofing system:
 - 1. Verify that roof openings and penetrations are in place and curbs are set and braced and that roof drain bodies are securely clamped in place.
 - 2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
 - 3. Verify that surface plan flatness and fastening of steel roof deck complies with requirements of Division 95 Section "Steel Decking."
 - 4. Verify that minimum concrete drying period recommended by roofing system manufacturer is passed.
 - 5. Verify that concrete substrate is visible dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
 - 6. Verify that concrete curing compounds that will impair adhesion of roofing components to roof deck have been removed.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean substrate of dust, debris, moisture and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projection.
- B. Prevent materials from entering or clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.
- C. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.

3.3 SUBSTRATE BOARD

- A. Install substrate board with long joints in continuous straight lines, perpendicular to roof slopes with end joints staggered between rows. Tightly butt substrate boards together.

3.4 VAPOR-RETARDER INSTALLATION

- A. Laminate Sheet: Loosely lay polyethylene-film vapor retarder in a single layer over area to receive vapor retarder, side and end lapping each sheet a minimum 2 inches and 6 inches respectively.
 - 1. Apply adhesive at rate recommended by vapor-retarder manufacturer. Continuously seal side and end laps with adhesive.
- B. Completely seal vapor retarder at terminations, obstruction, and penetrations to prevent air movement into membrane roofing system.

3.5 INSULATION INSTALLATION

- A. Coordinate installing membrane roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.
- B. Comply with membrane roofing system and insulation manufacturer's written instructions for installing roof insulation.
- C. Install tapered insulation under area of roofing to conform to slopes indicated.
- D. Install insulation under area of roofing to achieve required thickness. Where overall insulation thickness is 2.7 inches (68 mm) or greater, install two or more layers with joints of each succeeding layer staggered from joints to previous layer a minimum of 6 inches (150 mm) in each direction.
- E. Where installing composite and non-composite insulation in two or more layers, install non-composite board insulation for bottom layer and intermediate layers, if applicable, and install composite board insulation for top layer.
- F. Trim surface of insulation where necessary at roof drains so complete surface is flush and does not restrict flow of water.
- G. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding ¼ inch (6 mm) with insulation.
- H. Cut and fit insulation within ¼ inch (6 mm) of nailers, projections and penetrations.
- I. Adhered Insulation: Install each layer of insulation and adhere to substrate as follows:
 - 1. Set each layer of insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.

3.6 ADHERED MEMBRANE ROOFING INSTALLATION

- A. Adhere membrane roofing over area to receive roofing and install according to membrane roofing system manufacturer's written instructions. Unroll membrane roofing and allow to relax before installing.
- B. Start installation of membrane roofing in presence of membrane roofing system manufacturer's technical personnel.
- C. Accurately align membrane roofing and maintain uniform side and end laps of minimum dimensions required by manufacture. Stagger end laps.
- D. Bonding Adhesive: Apply to substrate and underside of membrane roofing at rate required by manufacturer and allow to partially dry before installing membrane roofing. Do not apply to splice area of membrane roofing.
- E. In addition to adhering, mechanically fasten membrane roofing securely at terminations, penetrations and perimeter of roofing.
- F. Apply membrane roofing with side laps shingled with slope of roof deck where possible.
- G. Tape Seam Installation: Clean and prime both faces of splice areas, apply splice tape, and firmly roll side and end laps of overlapping membrane roofing according to manufacturer's written instructions to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of membrane roofing terminations.
- H. Repair tears, voids, and lapped seams in roofing that does not comply with requirements.
 - 1. Spread sealant bed over deck drain flange at roof drains and securely seal membrane roofing in place with clamping ring.

3.7 BASE FLASHING INSTALLATION

- A. Install sheet flashing and preformed flashing accessories and adhere to substrates according to membrane roofing system manufacturer's written instructions.
- B. Apply bonding adhesive to substrate and underside of sheet flashing at required rate and allow to partially dry. Do not apply to seam area of flashing.
- C. Flash penetrations and field-formed inside and outside corners with cured and uncured sheet flashing.
- D. Clean splice areas, apply splicing cement, and firmly roll side and end laps of overlapping sheets to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of sheet flashing terminations.
- E. Terminate and seal top of sheet flashing and mechanically anchor to substrate through termination bars.

3.8 FIELD QUALITY CONTROL

- A. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion.
- B. Repair or remove and replace components of membrane roofing system where inspections indicate that they do not comply with specified requirements.
- C. Additional inspections, at Contractor's expense, will be performed to determine compliance of replaced or addition work with specified requirements.

3.9 PROTECTION AND CLEANING

- A. Protect membrane roofing system from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to the Architect and the Owner.
- B. Correct deficiencies in or remove membrane roofing system that does not comply with requirements; repair substrates; and repair or reinstall membrane roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.
- C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacture or affected construction.

END OF SECTION 07531

**NEW PASSENGER TERMINAL
DULUTH INTERNATIONAL AIRPORT
DULUTH, MINNESOTA**

**SECTION 07620
SHEET METAL FLASHING
AND TRIM**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following sheet metal flashing and trim:
 - 1. Formed roof drainage sheet metal fabrications.
 - 2. Formed low-slope roof sheet metal fabrications.
 - 3. Formed wall sheet metal fabrications.
- B. Related Sections include the following:
 - 1. Division 6 Section "Rough Carpentry" for wood nailers, curbs, and blocking.
 - 2. Division 7 Section "EPDM Roofing" for installing sheet metal flashing and trim integral with roofing membrane.
 - 3. Division 7 Section "Composite Wall Panels" for sheet metal flashing and trim integral with composite metal wall panels.
 - 4. Division 7 Section "Roof Specialties" for manufactured roof specialties not part of sheet metal flashing and trim.
 - 5. Division 7 Section "Joint Sealants" for field-applied sheet metal flashing and trim sealants.

1.3 PERFORMANCE REQUIREMENTS

- A. General: Sheet metal flashing and trim assemblies as indicated 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. Fabricate and install flashing capable of resisting the wind forces according to requirements of the International Building Code for 120 mph wind.
- C. Thermal Movements: Provide sheet metal flashing and trim that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of sheet metal and trim thermal movements. Base engineering

calculation 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.
2. Water Infiltration: Provide sheet metal flashing and trim that do not allow water infiltration to building interior.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each manufactured product and accessory.
- B. Shop Drawings: Show fabrication and installation layouts of sheet metal flashing and trim, including plans, elevations, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled work. Include the following:
 1. Identification of material, thickness, weight, and finish for each item and location in Project.
 2. Details for forming sheet metal flashing and trim, including profiles, shapes, seams, and dimensions.
 3. Details for joining, supporting, and securing sheet metal flashing and trim, including layout of fasteners, cleats, clips, and other attachments. Include pattern of seams.
 4. Details of termination points and assemblies, including fixed points.
 5. Details of expansion joints and expansion-joint covers, including showing direction of expansion and contraction.
 6. Details of edge conditions, including eaves, ridges, valleys, rakes, crickets, and counterflashings as applicable.
 7. Details of special conditions.
 8. Details of connections to adjoining work.
 9. Detail formed flashing and trim at a scale of not less than 1-1/2 inches per 12 inches.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified fabricator.
- B. Warranty: Sample of special warranty.

1.6 CLOSEOUT SUBMITTALS

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

1.7 QUALITY ASSURANCE

- A. Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual." Conform to dimensions and profiles shown unless more stringent requirements are indicated.
- B. Preinstallation Conference: Conduct conference at Project site.
 - 1. Meet with Owner, Architect, Owner's insurer if applicable, Installer, and installers whose work interfaces with or affects sheet metal flashing and trim including installers of roofing materials, roof accessories, unit skylights, and roof-mounted equipment.
 - 2. Review methods and procedures related to sheet metal flashing and trim.
 - 3. Examine substrate conditions for compliance with requirements, including flatness and attachment to structural members.
 - 4. Review special roof details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect sheet metal flashing.
 - 5. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver sheet metal flashing materials and fabrications undamaged. Protect sheet metal flashing and trim materials and fabrications during transportation and handling.
- B. Unload, store, and install sheet metal flashing materials and fabrications in a manner to prevent bending, warping, twisting, and surface damage.
- C. Stack materials on platforms or pallets, covered with suitable weathertight and ventilated covering. Do not store sheet metal flashing and trim 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.

1.9 COORDINATION

- A. Coordinate installation of sheet metal flashing and trim with interfacing and adjoining construction to provide a leakproof, secure, and noncorrosive installation.

PART 2 - PRODUCTS

2.1 SHEET METALS

- A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying a strippable, temporary protective film before shipping.

- B. Aluminum Sheet: ASTM B 209, Alloy 3003, 3004, 3105, or 5005, Temper suitable for forming and structural performance required, but not less than H14, finished as follows:
1. Mill Finish: One-side bright. Use at concealed locations.
 2. Factory Prime Coating: Where painting after installation is indicated, provide pretreatment and white or light-colored, factory-applied, baked-on epoxy primer coat; with a minimum dry film thickness of 0.2 mil.
 3. High-Performance Organic Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - a. Fluoropolymer 2-Coat System: Manufacturer's standard 2-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA 2605.
 - 1) Color: As selected by Architect from manufacturer's full range.
- C. Stainless-Steel Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304, dead soft, fully annealed.
1. Finish: 2D (dull, cold rolled)
 2. Surface: Smooth, flat

2.2 UNDERLAYMENT MATERIALS

- A. Composite Sheet: 40-mil thick, self-adhering, polymer modified bitumen bonded to polyethylene sheet complying with ASTM D 1970.

2.3 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation.
- B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads.
1. Exposed Fasteners: Heads matching color of sheet metal by means of plastic caps or factory-applied coating.
 2. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws, gasketed, with hex washer head.
 3. Blind Fasteners: High-strength aluminum or stainless-steel rivets.
 4. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.

- C. Solder for Lead: ASTM B 32, Grade Sn50, 50 percent tin and 50 percent lead.
- D. Sealing Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealing tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape.
- E. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane or 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.
- G. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.
- H. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil (0.4-mm) dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.
- I. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.4 FABRICATION, GENERAL

- A. General: Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal thicknesses, and other characteristics of item indicated. Shop fabricate items where practicable. Obtain field measurements for accurate fit before shop fabrication.
- B. 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.
- C. Fabricate sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.
 - 1. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
 - 2. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
- D. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA recommendations.

- E. Expansion Provisions: Where lapped or bayonet-type expansion provisions in the Work cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
- F. Conceal fasteners and expansion provisions where possible on exposed-to-view sheet metal flashing and trim, unless otherwise indicated.
- G. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
 - 1. Thickness: As recommended by SMACNA's "Architectural Sheet Metal Manual" and FMG Loss Prevention Data Sheet 1-49 for application but not less than thickness of metal being secured.

2.5 ROOF DRAINAGE SHEET METAL FABRICATIONS

- A. Parapet Scuppers: Fabricate scuppers of dimensions required with closure flange trim to exterior, 4-inch-wide wall flanges to interior, and base extending 4 inches beyond cant or tapered strip into field of roof. Fabricate from the following materials:
 - 1. Stainless Steel: 0.019 inch thick.

2.6 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

- A. Roof-Edge Flashing (Gravel Stop) and Fascia Cap: Fabricate in minimum 96-inch-long, but not exceeding 10-foot-long, sections.
 - 1. Joint Style: Butt, with 12-inch-wide, concealed backup plate.
 - 2. Fabricate with scuppers as indicated, of dimensions required with 4-inch-wide flanges and base extending 4 inches beyond cant or tapered strip into field of roof. Fasten gravel guard angles to base of scupper.
 - 3. Fabricate from the following materials:
 - a. Aluminum: 0.050 inch thick.
- B. Copings: Fabricate in minimum 96-inch-long, but not exceeding 10-foot-long, sections. Fabricate joint plates of same thickness as copings. Furnish with continuous cleats to support edge of external leg and interior leg. Miter corners, seal, and solder or weld watertight.
 - 1. Joint Style: Butt, with 12-inch-wide, concealed backup plate.
 - 2. Fabricate from the following materials:
 - a. Aluminum: 0.050 inch thick.

2.7 MISCELLANEOUS SHEET METAL FABRICATIONS

- A. Equipment Support Flashing: Fabricate from the following material:
 - 1. Stainless Steel: 0.0187 inch thick.

2.8 FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- 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 the 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, to verify actual locations, dimensions and other conditions affecting performance of work.
 - 1. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
 - 2. 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, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
 - 1. Torch cutting of sheet metal flashing and trim is not permitted.
- B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by fabricator or manufacturers of dissimilar metals.
 - 1. Coat side of uncoated aluminum, stainless-steel, and lead sheet metal flashing and trim with bituminous coating where flashing and trim will contact wood, ferrous metal, or cementitious construction.
 - 2. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet or install a course of polyethylene underlayment.
 - 3. Bed flanges in thick coat of asphalt roofing cement where required for waterproof performance.
- C. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.

- D. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and butyl sealant.
- E. 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.
 - 1. Space cleats not more than 12 inches apart. Anchor each cleat with two fasteners. Bend tabs over fasteners.
- F. 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 or bayonet-type expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
- G. Fasteners: Use fasteners of sizes that will penetrate substrate not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws.
 - 1. Aluminum: Use aluminum or stainless-steel fasteners.
 - 2. Stainless Steel: Use stainless-steel fasteners.
- H. Seal joints with butyl sealant as required for watertight construction.
 - 1. Where sealant-filled joints are used, 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 moderate, between 40 and 70 deg F, set joint members for 50 percent movement either 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 Division 7 Section "Joint Sealants."

3.3 ROOF FLASHING INSTALLATION

- A. General: Install sheet metal roof flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, set units true to line, and level as indicated. Install work with laps, joints, and seams that will be permanently watertight.
- B. Copings: Anchor to resist uplift and outward forces according to recommendations in FMG Loss Prevention Data Sheet 1-49 for specified wind zone and as indicated.
 - 1. Interlock exterior bottom edge of coping with continuous cleats anchored to substrate at 24-inch centers.
 - 2. Anchor interior leg of coping with screw fasteners and washers at 24-inch centers.

- C. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for butyl sealant, extending a minimum of 4 inches over base flashing. Install stainless-steel draw band and tighten.
- D. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Install flashing as follows:
 - 1. Turn lead flashing down inside vent piping, being careful not to block vent piping with flashing.
 - 2. Seal with butyl sealant and clamp flashing to pipes penetrating roof except for lead flashing on vent piping.

3.4 MISCELLANEOUS FLASHING INSTALLATION

- A. Equipment Support Flashing: Coordinate installation of equipment support flashing with installation of roofing and equipment. Weld or seal flashing with butyl sealant to equipment support member.

3.5 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- B. Clean and neutralize flux materials. Clean off excess solder and sealants.
- C. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain in a 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 07620

**NEW PASSENGER TERMINAL
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SECTION 07710 – ROOF SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Copings.
 - 2. Roof-edge flashings.
 - 3. Roof-edge drainage systems.
 - 4. Reglets and counterflashings.
- B. Related Sections:
 - 1. Division 6 Section 06100 "Rough Carpentry" for wood nailers, curbs, and blocking.
 - 2. Division 7 Section 07620 "Flashing and Trim" for custom- and site-fabricated sheet metal flashing and trim.
 - 3. Division 7 Section 07710 "Roof Accessories" for set-on-type curbs, equipment supports, roof hatches, vents, and other manufactured roof accessory units.
 - 4. Division 7 Section 07920 "Joint Sealants" for field-applied sealants between roof specialties and adjacent materials.

1.3 PERFORMANCE REQUIREMENTS

- A. General Performance: Roof specialties shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.
- B. FM Approvals' Listing: Manufacture and install copings and roof-edge flashings that are listed in FM Approvals' "RoofNav" and approved for windstorm classification Class 1-120. Identify materials with FM Approvals' markings.
- C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of thermal movements. 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.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: For roof specialties. Include plans, elevations, expansion-joint locations, keyed details, and attachments to other work. Distinguish between plant- and field-assembled work. Include the following:
 1. Details for expansion and contraction; locations of expansion joints, including direction of expansion and contraction.
 2. Pattern of seams and layout of fasteners, cleats, clips, and other attachments.
 3. Details of termination points and assemblies, including fixed points.
 4. Details of special conditions.
- C. Samples for Initial Selection: For each type of roof specialty indicated with factory-applied color finishes.
- D. Samples for Verification: For copings and roof-edge drainage systems made from 12-inch lengths of full-size components including fasteners, cover joints, accessories, and attachments.

1.5 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for copings and roof-edge flashings.
- B. Warranty: Sample of special warranty.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For roofing specialties to include in maintenance manuals.

1.7 QUALITY ASSURANCE

- A. Preinstallation Conference: Conduct conference at Project site.
 1. Meet with Owner's Representatives, Installer, and installers whose work interfaces with or affects roof specialties including installers of roofing materials and accessories.
 2. Examine substrate conditions for compliance with requirements, including flatness and attachment to structural members.
 3. Review special roof details, roof drainage, and condition of other construction that will affect roof specialties.

1.8 DELIVERY, STORAGE, AND HANDLING

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

1.9 COORDINATION

- A. Coordinate installation of manufactured roof specialties with interfacing and adjoining construction to provide a leakproof, secure and noncorrosive installation.

1.10 WARRANTY

- A. Special Warranty on Painted Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace roof specialties that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Fluoropolymer 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 EXPOSED METALS

- A. Aluminum Sheet: ASTM B 209, alloy as standard with manufacturer for finish required, with temper to suit forming operations and performance required.
 - 1. Surface: Smooth, flat finish.
 - 2. Mill Finish: As manufactured.
 - 3. Exposed Coil-Coated Finishes: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - a. Two-Coat Fluoropolymer: AAMA 620. System consisting of primer and fluoropolymer color topcoat containing not less than 70 percent PVDF resin by weight.

- B. Aluminum Extrusions: ASTM B 221 alloy and temper recommended by manufacturer for type of use and finish indicated, finished as follows:
 - 1. Exposed High-Performance Organic Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - a. Two-Coat Fluoropolymer: AAMA 2605. System consisting of primer and fluoropolymer color topcoat containing not less than 70 percent PVDF resin by weight.
 - 2. Clear Anodic Finish, Coil Coated: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

2.2 CONCEALED METALS

- A. Aluminum Sheet: ASTM B 209, alloy and temper recommended by manufacturer for type of use and structural performance indicated, mill finished.
- B. Aluminum Extrusions: ASTM B 221, alloy and temper recommended by manufacturer for type of use and structural performance indicated, mill finished.
- C. Stainless-Steel Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304.
- D. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 coating designation.

2.3 UNDERLAYMENT MATERIALS

- A. Felt: ASTM D 226, Type II (No. 30), asphalt-saturated organic felt, nonperforated.
- B. Self-Adhering, High-Temperature Sheet: Minimum 30 to 40 mils thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.
 - 1. Thermal Stability: ASTM D 1970; stable after testing at 240 deg F.
 - 2. Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus 20 deg F.
 - 3. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Carlisle Coatings & Waterproofing; CCW WIP 300HT.
 - b. Grace Construction Products, a unit of W. R. Grace & Co.; Ultra.
 - c. Henry Company; Blueskin PE200 HT.
 - d. Metal-Fab Manufacturing, LLC; MetShield.
 - e. Owens Corning; WeatherLock Metal High Temperature Underlayment.
- C. Polyethylene Sheet: 6-mil-thick polyethylene sheet complying with ASTM D 4397.

- D. Slip Sheet: Building paper, 3-lb/100 sq. ft. minimum, rosin sized.

2.4 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.
- B. Fasteners: Manufacturer's recommended fasteners, suitable for application and designed to meet performance requirements. Furnish the following unless otherwise indicated:
1. Exposed Penetrating Fasteners: Gasketed screws with hex washer heads matching color of sheet metal.
 2. Fasteners for Aluminum: Aluminum or Series 300 stainless steel.
 3. Fasteners for Stainless-Steel Sheet: Series 300 stainless steel.
 4. Fasteners for Zinc-Coated (Galvanized) Steel Sheet: Series 300 stainless steel or hot-dip zinc-coated steel according to ASTM A 153/A 153M or ASTM F 2329.
- C. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant of type, grade, class, and use classifications required by roofing-specialty manufacturer for each application.
- D. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.5 COPINGS

- A. Copings: Manufactured coping system consisting of formed-metal coping cap in section lengths not exceeding 12 feet, concealed anchorage; corner units, end cap units, and concealed splice plates with same finish as coping cap.
1. Coping-Cap Material: Formed aluminum, 0.080 inch thick.
 - a. Finish Two-coat fluoropolymer.
 - b. Color: Match Architect's samples.
 2. Corners: Factory mitered and soldered.
 3. Coping-Cap Attachment Method: Face leg hooked to continuous cleat with back leg fastener exposed, fabricated from coping-cap material.
 4. Face Leg Cleats: Concealed, continuous galvanized-steel sheet.

2.6 ROOF-EDGE FLASHINGS

- A. Canted Roof-Edge Fascia and Gravel Stop: Manufactured, two-piece, roof-edge fascia consisting of snap-on metal fascia cover in section lengths not exceeding 12 feet and a continuous formed galvanized-steel sheet cant, 0.028 inch thick, minimum, with extended vertical leg terminating in a drip-edge cleat. Provide matching corner units.
1. Fascia Cover: Fabricated from the following exposed metal:

- a. Formed Aluminum: 0.063 inch thick.
 - 2. Corners: Factory mitered and soldered.
 - 3. Splice Plates: Concealed, of same material, finish, and shape as fascia cover.
 - 4. Fascia Accessories: Overflow scuppers.
- B. Roof-Edge Fascia: Manufactured, two-piece, roof-edge fascia consisting of snap-on metal fascia cover in section lengths not exceeding 12 feet and a continuous formed- or extruded-aluminum anchor bar with integral drip-edge cleat to engage fascia cover. Provide matching corner units.
- 1. Fascia Cover: Fabricated from the following exposed metal:
 - a. Formed Aluminum: 0.063 inch thick.
 - 2. Corners: Factory mitered and soldered.
 - 3. Splice Plates: Concealed, of same material, finish, and shape as fascia cover.
 - 4. Fascia Accessories: Overflow scuppers.
- C. One-Piece Gravel Stops: Manufactured, one-piece, metal gravel stop in section lengths not exceeding 12 feet, with a horizontal flange and vertical leg, drain-through fascia terminating in a drip edge, and concealed splice plates of same material, finish, and shape as gravel stop. Provide matching corner units.
- 1. Fabricate from the following exposed metal:
 - a. Formed Aluminum: 0.050 inch thick.
 - 2. Corners: Factory mitered and soldered.
- D. Aluminum Finish: Two-coat fluoropolymer.
- 1. Color: Match Architect's sample.

2.7 ROOF-EDGE DRAINAGE SYSTEMS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Castle Metal Products.
 - 2. Merchant & Evans, Inc.
 - 3. Metal-Era, Inc.
- B. Gutters: Manufactured in uniform section lengths not exceeding 16 feet, with matching corner units, ends, outlet tubes, and other accessories. Elevate back edge at least 1 inch above front edge. Furnish flat-stock gutter straps, gutter brackets, expansion joints, and expansion-joint covers fabricated from same metal as gutters.
 - 1. Fabricate from the following exposed metal: Formed Aluminum: 0.050 inch thick.
 - 2. Gutter Profile: Box.

3. Gutter Supports: Manufacturer's standard supports as selected by Architect with finish matching the gutters.
- C. Downspouts: Plain rectangular complete with elbows, manufactured from the following exposed metal. Furnish with metal hangers, from same material as downspouts, and anchors.
1. Fabricate from the following exposed metal: Formed Aluminum: 0.050 inch thick.

2.8 REGLETS AND COUNTERFLASHINGS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Castle Metal Products.
 2. Cheney Flashing Company.
 3. Fry Reglet Corporation.
 4. Heckmann Building Products Inc.
 5. Hickman Company, W. P.
 6. Keystone Flashing Company, Inc.
 7. Metal-Era, Inc.
 8. Metal-Fab Manufacturing, LLC.
 9. MM Systems Corporation.
 10. National Sheet Metal Systems, Inc.

2.9 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. 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.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.
- B. Examine walls, roof edges, and parapets for suitable conditions for roof specialties.
- C. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.

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

3.2 UNDERLAYMENT INSTALLATION

- A. Felt Underlayment: Install with adhesive for temporary anchorage to minimize use of mechanical fasteners under roof specialties. Apply in shingle fashion to shed water, with lapped joints of not less than 2 inches).
- B. Self-Adhering Sheet Underlayment: Install wrinkle free. Apply primer if required by underlayment manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation; use primer rather than nails for installing underlayment at low temperatures. Apply in shingle fashion to shed water. Overlap edges not less than 3-1/2 inches. Roll laps with roller. Cover underlayment within 14 days.
- C. Slip Sheet: Install with tape or adhesive for temporary anchorage to minimize use of mechanical fasteners under roof specialties. Apply in shingle fashion to shed water, with lapped joints of not less than 2 inches.

3.3 INSTALLATION, GENERAL

- A. General: Install roof specialties according to manufacturer's written instructions. Anchor roof specialties 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 roof-specialty systems.
 - 1. Install roof specialties level, plumb, true to line and elevation; with limited oil-canning and without warping, jogs in alignment, buckling, or tool marks.
 - 2. Provide uniform, neat seams with minimum exposure of solder and sealant.
 - 3. Install roof specialties to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before manufacture.
 - 4. Torch cutting of roof specialties is not permitted.
 - 5. Do not use graphite pencils to mark metal surfaces.
- B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
 - 1. Coat concealed side of uncoated aluminum roof specialties with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
 - 2. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of self-adhering, high-temperature sheet underlayment.
 - 3. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof specialties for waterproof performance.

- C. Expansion Provisions: Allow for thermal expansion of exposed roof specialties.
 - 1. Space movement joints at a maximum of 12 feet with no joints within 18 inches of corners or intersections unless otherwise shown on Drawings.
 - 2. 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.
- D. Fastener Sizes: Use fasteners of sizes that will penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.
- E. Seal joints with sealant as required by roofing-specialty manufacturer.
- F. Seal joints as required for watertight construction. Place sealant to be completely concealed in joint. Do not install sealants at temperatures below 40 deg F.

3.4 COPING INSTALLATION

- A. Install cleats, anchor plates, and other anchoring and attachment accessories and devices with concealed fasteners.
- B. Anchor copings to meet performance requirements.
 - 1. Interlock face leg drip edge into continuous cleat anchored to substrate at manufacturer's required spacing that meets performance requirements. Anchor back leg of coping with screw fasteners and elastomeric washers at manufacturer's required spacing that meets performance requirements.

3.5 ROOF-EDGE FLASHING INSTALLATION

- A. Install cleats, cants, and other anchoring and attachment accessories and devices with concealed fasteners.
- B. Anchor roof edgings with manufacturer's required devices, fasteners, and fastener spacing to meet performance requirements.

3.6 CLEANING AND PROTECTION

- A. Clean and neutralize flux materials. Clean off excess solder and sealants.
- B. Remove temporary protective coverings and strippable films as roof specialties are installed. On completion of installation, clean finished surfaces including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain roof specialties in a clean condition during construction.
- C. Replace roof specialties that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 07710

**NEW PASSENGER TERMINAL
DULUTH INTERNATIONAL AIRPORT
DULUTH, MINNESOTA**

**SECTION 07841 – THROUGH - PENETRATION
FIRESTOP SYSTEMS**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Provide firestopping penetration sealing system which shall have a continuous bond between substrate and penetrating item to assure a positive and effective fire and smoke seal. Provide sealing system for all penetrations through floor slabs (not in protected enclosures), fire walls and other fire-rated partitions or assemblies.
- B. This section includes firestop systems for the following:
 - 1. Penetrations through fire-resistance-rated walls and partitions including both empty openings and openings containing cables, pipes, ducts, conduits, and other penetrating items.
 - 2. Penetrations through smoke barriers and construction enclosing compartmentalized areas involving both empty openings and openings containing penetrating items.
 - 3. Sealant joints in fire-resistance-rated construction.
 - 4. Construction-gap firestop systems at connections of same or different materials in fire-rated construction.
 - 5. Construction-gap firestop systems occurring within fire-rated wall assemblies.
 - 6. Construction-gap firestop systems occurring at the top of fire-rated walls.
- C. Coordinate all sleeves (sizes and locations) specified in Divisions 15 and 16 of these specifications.
- D. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Division 3, Section 03300 - CAST-IN-PLACE CONCRETE for construction of openings in concrete slabs.
 - 2. Division 4, Section 04202 – INTERIOR UNIT MASONRY for joint fillers for non-fire-resistive-rated masonry construction.
 - 3. Division 7, Section 07920 - JOINT SEALANTS for non-fire-resistive-rated joint sealants.
 - 4. Division 15 sections specifying ducts and piping penetrations.
 - 5. Division 16 sections specifying cable and conduit penetrations.

1.3 SYSTEM PERFORMANCE REQUIREMENTS

- A. General: Provide firestop systems that are produced and installed to resist the spread of fire, according to requirements indicated, resist passage of smoke and other gases, and maintain original fire resistance rating of assembly penetrated.
- B. F-Rated Through-Penetration Firestop Systems: Provide through-penetration firestop systems with F ratings indicated, as determined per ASTM E814, but not less than that equaling or exceeding the fire-resistance rating of the constructions penetrated.
- C. T-Rated Through-Penetration Firestop Systems: Provide through-penetration firestop systems with T ratings, in addition to F ratings, as determined per ASTM E814, where indicated and where systems protect penetrating items exposed to contact with adjacent materials in occupiable floor areas. T-rated assemblies are required where the following conditions exist:
 - 1. Where firestop systems protect penetrations located outside of wall cavities and fire-resistive shaft enclosures.
 - 2. Where firestop systems protect penetrations located in construction containing doors required to have a temperature-rise rating.
 - 3. Where firestop systems protect penetrating items larger than a 4-inch-diameter nominal pipe or 16 sq. in. in overall cross-sectional area.
- D. Fire-Resistive Joint Sealants: Provide joint sealants with fire-resistance ratings indicated, as determined per ASTM E119, but not less than that equaling or exceeding the fire-resistance rating of the construction in which the joint occurs.
- E. For firestop systems exposed to view, traffic, moisture, and physical damage, provide products that do not deteriorate when exposed to these conditions.
 - 1. For piping penetrations for plumbing and wet-pipe sprinkler systems, provide moisture-resistant through-penetration firestop systems.
 - 2. For penetrations involving insulated piping, provide through-penetration firestop systems not requiring removal of insulation.
 - 3. For floor penetrations with annular spaces exceeding 4 inches or more in width and exposed to possible loading and traffic, provide firestop systems capable of supporting the floor loads involved either by installing plates or by other means.
- F. For through-penetration firestop systems exposed to view, provide products with flame-spread ratings of less than 25 and smoke-developed ratings of less than 450, as determined per ASTM E84.

1.4 ACTION SUBMITTALS

- A. Product data for each type of product specified. Data shall include product characteristics, typical uses, performance and limitation criteria and test data.
- B. LEED Submittals:
 - 1. Product Data for Credit IEQ 4.1: For penetration firestopping sealants and sealant primers, documentation including printed statement of VOC content.
- C. Product certificates signed by manufacturers of firestop systems products certifying that their products comply with specified requirements.

- D. Shop Drawings: Indicate dimensions, description of materials and finishes, specific modifications, component connections, anchorage methods, hardware and installation procedures.
 - 1. Include detail drawings of each proposed assembly identifying intended products and applicable UL, GA or FM system number or UL classified devices. Indicate which firestop materials will be used and thickness for different hourly ratings.
- E. Engineering Judgments: Submit manufacturer's drawings for all nonstandard applications where no UL, GA or FM tested system exists. All drawings must indicate the "tested" UL, GA or FM system upon which the judgment is based so as to assess the relevance of the judgment to some known performance.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
 - 1. A firm that has been approved by FM Global according to FM Global 4991, "Approval of Firestop Contractors," or been evaluated by UL and found to comply with its "Qualified Firestop Contractor Program Requirements."
 - 2. A firm experienced in installing penetration firestopping similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful performance. Qualifications include having the necessary experience, staff, and training to install manufacturer's products per specified requirements.
- B. Installer Certificates: From Installer indicating penetration firestopping has been installed in compliance with requirements and manufacturer's written recommendations.
- C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for penetration firestopping

1.6 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: Provide firestop systems that comply with the following requirements and those specified under the "System Performance Requirements" article:
 - 1. Firestop systems tests are performed by a qualified testing and inspecting agency. A qualified testing and inspecting agency is UL, Warnock Hersey, or another agency performing testing and follow-up inspection services for firestop systems that is acceptable to authorities having jurisdiction.
 - 2. Through-penetration firestop systems are identical to those tested per ASTM E814 under conditions where positive furnace pressure differential of at least 0.01 inch of water is maintained at a distance of 0.78 inch below the fill materials surrounding the penetrating items in the test assembly. Provide rated systems complying with the following requirements:
 - a. Through-penetration firestop system products bear classification marking of qualified testing and inspecting agency.
 - b. Through-penetration firestop systems correspond to those indicated by reference to through-penetration firestop system

designations listed by UL, GA or FM in their "Fire Resistance Directory," or Warnock Hersey.

3. Fire-resistive joint sealant systems are identical to those tested for fire-response characteristics per ASTM E 119 under conditions where the positive furnace pressure differential is at least 0.01 inch of water, as measured 0.78 inch from the face exposed to furnace fire. Provide systems complying with the following requirements:
 - a. Fire-Resistance Ratings of Joint Sealants: As indicated by reference to design designations listed by UL in their "Fire Resistance Directory" or by another qualified testing and inspecting agency.
 - b. Joint sealants, including backing materials, bear classification marking of qualified testing and inspection agency.
- B. Single-Source Responsibility: Obtain through-penetration firestop systems for each kind of penetration and construction condition indicated from a single manufacturer.
- C. Coordinating Work: Coordinate construction of openings and penetrating items to ensure that designated through-penetration firestop systems are installed per specified requirements.
- D. Do not use any product containing solvents that require hazardous waste disposal or which after curing dissolve in water.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver firestop system products to Project site in original, unopened containers or packages with intact and legible manufacturers' labels identifying product and manufacturer; date of manufacture; lot number; shelf life, if applicable; qualified testing and inspecting agency's classification marking applicable to Project; curing time; and mixing instructions for multicomponent materials.
- B. Store and handle firestop system materials to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install penetration firestopping when ambient or substrate temperatures are outside limits permitted by penetration firestopping manufacturers or when substrates are wet because of rain, frost, condensation, or other causes.
- B. Install and cure penetration firestopping per manufacturer's written instructions using natural means of ventilations or, where this is inadequate, forced-air circulation.

1.8 SEQUENCING AND SCHEDULING

- A. Coordinate the work of this section with the work of other trades.

- B. Do not cover up those firestopping installations that will become concealed behind other construction until authorities having jurisdiction, if required, have examined each installation.

1.9 WARRANTY

- A. Provide written warranty, signed by manufacturer of firestopping materials and his authorized installer, agreeing to replace/repair defective materials and workmanship as required to maintain firestopping conditions. Warranty shall state that the firestopping materials have been installed and used properly and for the purpose which intended.
 - 1. Warranty period is 2 years after date of Substantial Completion.
- B. If products offered have a manufacturer's warranty that states that Owner/user shall test application/determine suitability then Contractor shall have independently monitored tests performed on conditions identical to proposed construction, and shall submit copies of these tests for review. Submittals made without this testing will not be considered or approved.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with requirements, provide firestop system products by one of the following:
 - 1. 3M Fire Protection Products.
 - 2. Cafco Through Penetration Systems; Isolatak International.
 - 3. Hilti Firestop Systems.
 - 4. International Protective Coatings Corporation.
 - 5. SpecSeal Firestop Products; Specified Technologies, Inc.
 - 6. Dow Corning Corp.

2.2 FIRESTOP SYSTEMS, GENERAL

- A. Compatibility: Provide firestop systems composed of components that are compatible with each other, the substrates forming openings, and the items, if any, penetrating the firestop systems under conditions of service and application, as demonstrated by firestop systems manufacturer based on testing and field experience.
- B. Accessories: Provide components for each firestop systems system that are needed to install fill materials and to comply with "System Performance Requirements" article in Part 1. Use only components specified by the firestop systems manufacturer and approved by the qualified testing and inspecting agency for the designated fire-resistance-rated systems. Accessories include but are not limited to the following items:
 - 1. Permanent forming/damming/backing materials including the following:
 - a. Semirefractory fiber (mineral wool) insulation.
 - b. Ceramic fiber.
 - c. Sealants used in combination with other forming/damming materials to prevent leakage of fill materials in liquid state.

- d. Fire-rated formboard.
 - e. Joint fillers for joint sealants.
- 2. Temporary forming materials.
- 3. Substrate primers.
- 4. Collars.
- 5. Steel sleeves.
- C. Penetration seals shall be of the type and shape required to continuously fill the annular space between the pipe, conduit, cable, etc., and the wall or floor opening with or without sleeves.
- D. Seal shall be constructed to provide electrical insulation between the pipe and wall, thus reducing the chances of cathodic reaction between these members.
- E. Provide materials as required for all blank openings through floor and walls where a fire rating is required.
- F. Provide metal sleeves, collars and plates not specified in other sections as required to meet the fire resistance ratings in which the penetrations occur.

2.3 FILL MATERIALS FOR THROUGH-PENETRATION FIRESTOP SYSTEMS

- A. Ceramic-Fiber and Mastic Coating: Ceramic fibers in bulk form formulated for use with mastic coating, and ceramic fiber manufacturer's mastic coating.
- B. Ceramic-Fiber Sealant: Single-component formulation of ceramic fibers and inorganic binders.
- C. Endothermic, Latex Compound Sealant: Single-component, endothermic, latex formulation.
- D. Intumescent, Latex Sealant: Single-component, intumescent, latex formulation.
- E. Intumescent Putty: Nonhardening, dielectric, water-resistant putty containing no solvents, inorganic fibers, or silicone compounds.
- F. Intumescent Wrap Strips: Single-component, elastomeric sheet with aluminum foil on one side.
- G. Job-Mixed Vinyl Compound: Prepackaged vinyl-based powder product for mixing with water at Project site to produce a paintable compound, passing ASTM E136, with flame-spread and smoke-developed ratings of zero per ASTM E84.
- H. Mortar: Prepackaged dry mix composed of a blend of inorganic binders, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogenous mortar.
- I. Pillows / Bags: Re-usable, heat-expanding pillows / bags composed of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents and fire-retardant additives.

- J. Silicone Foam: Two-component, silicone-based liquid elastomer that, when mixed, expands and cures in place to produce a flexible, nonshrinking foam.
- K. Silicone Sealant: Moisture-curing, single-component, silicone-based, neutral-curing elastomeric sealant of grade indicated below:
 - 1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces and nonsag formulation for openings in vertical and other surfaces requiring a nonslumping / gunnable sealant, unless indicated firestop system limits use to nonsag grade for both opening conditions.
- L. Solvent-Release-Curing Intumescent Sealant: Solvent-release- curing, single-component, synthetic-polymer-based sealant of grade indicated below:
 - 1. Grade: Pourable (self-leveling) formulation for openings in horizontal surfaces and nonsag formulation for openings in vertical and other surfaces requiring a nonslumping / gunnable sealant, unless indicated firestop system limits use to nonsag grade for both opening conditions.

2.4 FIRE-RESISTIVE ELASTOMERIC JOINT SEALANTS

- A. Elastomeric Sealant Standard: Provide manufacturer's standard chemically curing, elastomeric sealants of base polymer indicated that complies with ASTM C920 requirements, including those referenced for Type, Grade, Class, and Uses, and requirements specified in this Section applicable to fire-resistive joint sealants.
- B. Sealant Colors: Provide color of exposed joint sealants as selected by Architect from manufacturer's standards.
- C. Single-Component, Neutral-Curing Silicone Sealant: Type S; Grade NS; Class 25; exposure-related Use NT, and joint-substrate-related Uses M, G, A, and (as applicable to joint substrates indicated) O.
 - 1. Additional Movement Capability: Provide sealant with the capability to withstand the following percentage changes in joint width existing at time of installation, when tested for adhesion and cohesion under maximum cyclic movement per ASTM C719, and remain in compliance with other requirements of ASTM C920 for uses indicated:
 - a. 100 percent movement in extension and 50 percent movement in compression for a total of 150 percent movement.
- D. Multicomponent, Nonsag, Urethane Sealant: Type M; Grade NS; Class 25; exposure-related Use NT, and joint-substrate-related Uses M, A, and (as applicable to joint substrates indicated) O.
 - 1. Additional Movement Capability: Provide sealant with the capability to withstand the following percentage change in joint width existing at time of installation, when tested for adhesion and cohesion under maximum cyclic movement per ASTM C719, and remain in compliance with other requirements of ASTM C920 for uses indicated:
 - a. 50 percent movement in both extension and compression for a total of 100 percent movement.
- E. Single-Component, Nonsag, Urethane Sealant: Type S; Grade NS; Class 25; and Uses NT, M, A, and (as applicable to joint substrates indicated) O.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of the Work. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning: Clean out openings and joints immediately prior to installing firestop systems to comply with recommendations of firestop systems manufacturer and the following requirements:
 - 1. Remove all foreign materials from surfaces of opening and joint substrates and from penetrating items that could interfere with adhesion of firestop systems.
 - 2. Clean opening and joint substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with firestop systems. Remove loose particles remaining from cleaning operation.
 - 3. Remove laitance and form release agents from concrete.

3.3 INSTALLING THROUGH-PENETRATION FIRESTOPS

- A. General: Comply with the "System Performance Requirements" article in Part 1 and the through-penetration firestop manufacturer's installation instructions and drawings pertaining to products and applications indicated.
- B. Install forming / damming materials and other accessories of types required to support fill materials during their application and in the position needed to produce the cross-sectional shapes and depths required to achieve fire ratings of designated through-penetration firestop systems. After installing fill materials, remove combustible forming materials and other accessories not indicated as permanent components of firestop systems.
- C. Install fill materials for through-penetration firestop systems by proven techniques to produce the following results:
 - 1. Completely fill voids and cavities formed by openings, forming materials, accessories, and penetrating items.
 - 2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
 - 3. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.
- D. Any material found to be defective shall be removed and replaced by the applicator.

3.4 INSTALLING FIRE-RESISTIVE JOINT SEALANTS

- A. General: Comply with the "System Performance Requirements" article in Part 1, with ASTM C 1193, and with the sealant manufacturer's installation instructions and drawings pertaining to products and applications indicated.
- B. Install joint fillers to provide support of sealants during application and at position required to produce the cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability and develop fire-resistance rating required.
- C. Install sealants by proven techniques that result in sealants directly contacting and fully wetting joint substrates, completely filling recesses provided for each joint configuration, and providing uniform, cross-sectional shapes and depths relative to joint width that optimum sealant movement capability. Install sealants at the same time joint fillers are installed.
- D. Tool nonsag sealants immediately after sealant application and prior to the time skinning or curing begins. Form smooth, uniform beads of configuration indicated or required to produce fire-resistance rating, as well as to eliminate air pockets, and to ensure contact and adhesion of sealants with sides of joint. Remove excess sealant from surfaces adjacent to joint. Do not use tooling agents that discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.
- E. Any material found to be defective shall be removed and replaced by the applicator.

3.5 CLEANING

- A. Clean off excess fill materials and sealants adjacent to openings and joints as work progresses by methods and with cleaning materials approved by manufacturers of firestop systems products and of products in which opening and joints occur.
- B. Protect firestop systems during and after curing period from contact with contaminating substances or from damage resulting from construction operations or other causes so that they are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated firestop systems immediately and install new materials to produce firestop systems complying with specified requirements.

END OF SECTION 07841

**NEW PASSENGER TERMINAL
DULUTH INTERNATIONAL AIRPORT
DULUTH, MINNESOTA**

SECTION 07920 – JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes:
 - 1. Elastomeric sealants.
 - 2. Latex joint sealants.
 - 3. Acoustical joint sealants.
 - 4. Preformed joint sealants and compressible fillers.
- B. Related Sections include the following:
 - 1. Division 4 Section 04202 "Interior Unit Masonry" for masonry control and expansion joint fillers and gaskets.
 - 2. Section 07842 "Through-Penetration Firestop Systems" for sealing joints in fire-resistance-rated construction.
 - 3. Division 8 Section 08801 "Interior Glazing" for glazing sealants.
 - 4. Division 8 Section 08460 "Automatic Entrance Doors" for structural and other glazing sealants.

1.3 PERFORMANCE REQUIREMENTS

- A. Provide joint sealants for interior applications that establish and maintain airtight and water-resistant continuous joint seals without staining or deteriorating joint substrates.

1.4 ACTION SUBMITTALS

- A. Product Data: For each joint-sealant product indicated.
- B. LEED Submittals:
 - 1. Product Data for Credit IEQ 4.1: For sealants and sealant primers used inside the weatherproofing system, documentation including printed statement of VOC content.

- C. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.
- D. Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint sealants in 3/8-inch-wide joints formed between two 6-inch-long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.
- E. Joint-Sealant Schedule: Include the following information:
 - 1. Joint-sealant application, joint location, and designation.
 - 2. Joint-sealant manufacturer and product name.
 - 3. Joint-sealant formulation.
 - 4. Joint-sealant color.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Product Certificates: For each kind of joint sealant and accessory, from manufacturer.
- C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that sealants comply with requirements.
- D. Preconstruction Compatibility and Adhesion Test Reports: From sealant manufacturer, indicating the following:
 - 1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
 - 2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.
- E. Field-Adhesion Test Reports: For each sealant application tested.
- F. Warranties: Sample of special warranties.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized Installer who is approved or licensed for installation of elastomeric sealants required for this Project.
- B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.
- C. Product Testing: Test joint sealants using a qualified testing agency.
 - 1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.

2. Test elastomeric joint sealants for compliance with requirements specified by reference to ASTM C 920, and where applicable, to other standard test methods.
3. Test other joint sealants for compliance with requirements indicated by referencing standard specifications and test methods.

1.7 PROJECT CONDITIONS

- A. Do not proceed with installation of 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. Contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.8 WARRANTY

- A. Special Installer's Warranty: Installer's standard form in which Installer agrees to repair or replace elastomeric 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.
- B. Special Manufacturer's Warranty: Manufacturer's standard form in which elastomeric sealant manufacturer agrees to furnish elastomeric joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.
1. Warranty Period: Five years from date of Substantial Completion.
- C. Special warranties specified in this Article exclude deterioration or failure of elastomeric joint sealants from the following:
1. Movement of the structure resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression caused by structural settlement or errors attributable to design or construction.
 2. Disintegration of joint substrates from natural causes exceeding design specifications.
 3. Mechanical damage caused by individuals, tools, or other outside agents.
 4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 MATERIALS, 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 sealant manufacturer, based on testing and field experience.
- B. VOC Content of Interior Sealants: Sealants and sealant primers used inside the weatherproofing system shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - 1. Architectural Sealants: 250 g/L.
 - 2. Sealant Primers for Nonporous Substrates: 250 g/L.
 - 3. Sealant Primers for Porous Substrates: 775 g/L
- C. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.2 ELASTOMERIC JOINT SEALANTS

- A. Elastomeric Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.
- B. Single-Component Pourable Neutral-Curing Silicone Sealant:
 - 1. Products:
 - a. Dow Corning Corporation; 890-SL.
 - b. Pecora Corporation; 300 Pavement Sealant (Self Leveling).
 - c. Dow Corning Corporation; SL Parking Structure Sealant.
 - 2. Type and Grade: S (single component) and P (pourable).
 - 3. Class: 100/50.
 - 4. Use Related to Exposure: T (traffic).
 - 5. Uses Related to Joint Substrates: M, A, and O, as applicable to joint substrates indicated.
 - a. Use O Joint Substrates: Ceramic tile.
- C. Single-Component Neutral-Curing Silicone Sealant:
 - 1. Products:
 - a. Dow Corning Corporation; 799.
 - b. GE Silicones; UltraGlaze SSG4000.
 - c. GE Silicones; UltraGlaze SSG4000AC.
 - d. Polymeric Systems Inc.; PSI-631.

- e. Schnee-Morehead, Inc.; SM5731 Poly-Glaze Plus.
- f. Tremco; Proglaze SG.
- g. Tremco; Spectrem 2.
- h. Tremco; Tremsil 600.

- 2. Type and Grade: S (single component) and NS (nonsag).
- 3. Class: 25.
- 4. Use Related to Exposure: NT (nontraffic).
- 5. Uses Related to Joint Substrates: M, G, A, and, as applicable to joint substrates indicated, O.
 - a. Use O Joint Substrates: Aluminum coated with a high-performance coating and ceramic tile.

D. Single-Component Mildew-Resistant Neutral-Curing Silicone Sealant:

- 1. Products:
 - a. Pecora Corporation; 898.
 - b. Tremco; Tremsil 600 White.
- 2. Type and Grade: S (single component) and NS (nonsag).
- 3. Class: 25.
- 4. Use Related to Exposure: NT (nontraffic).
- 5. Uses Related to Joint Substrates: M, G, A, and, as applicable to joint substrates indicated, O.
 - a. Use O Joint Substrates: Color anodic aluminum, aluminum coated with a high-performance coating and ceramic tile.

E. Single-Component Nonsag Urethane Sealant:

- 1. Products:
 - a. Sika Corporation, Inc.; Sikaflex - 1a.
 - b. Sonneborn, Division of ChemRex Inc.; Ultra.
 - c. Sonneborn, Division of ChemRex Inc.; NP 1.
 - d. Tremco; Vulkem 116.
- 2. Type and Grade: S (single component) and NS (nonsag).
- 3. Class: 25.
- 4. Uses Related to Exposure: T (traffic) and NT (nontraffic).
- 5. Uses Related to Joint Substrates: M, G, A, and, as applicable to joint substrates indicated, O.
 - a. Use O Joint Substrates: Color anodic aluminum, aluminum coated with a high-performance coating and ceramic tile.

F. Single-Component Nonsag Urethane Sealant:

- 1. Products:
 - a. Bostik Findley; Chem-Calk 900.

- b. Pecora Corporation; Dynatrol I-XL.
 - c. Polymeric Systems Inc.; Flexiprene 1000.
 - d. Tremco; DyMonic.
- 2. Type and Grade: S (single component) and NS (nonsag).
- 3. Class: 25.
- 4. Use Related to Exposure: NT (nontraffic).
- 5. Uses Related to Joint Substrates: M, G, A, and, as applicable to joint substrates indicated, O.
 - a. Use O Joint Substrates: Color anodic aluminum, aluminum coated with a high-performance coating and ceramic tile.
- G. Single-Component Pourable Urethane Sealant:
 - 1. Products:
 - a. Bostik Findley; Chem-Calk 950.
 - b. Pecora Corporation; Urexpan NR-201.
 - c. Polymeric Systems Inc.; Flexiprene 952.
 - d. Tremco; Vulkem 45.
 - 2. Type and Grade: S (single component) and P (pourable).
 - 3. Class: 25.
 - 4. Use Related to Exposure: T (traffic).
 - 5. Uses Related to Joint Substrates: M, G, A, and, as applicable to joint substrates indicated, O.
 - a. Use O Joint Substrates: Color anodic aluminum, aluminum coated with a high-performance coating and ceramic tile.
- H. Butyl-Rubber-Based Solvent-Release Joint Sealant (Roofing only): Comply with ASTM C 1085.
 - 1. Products:
 - a. Bostik Findley; Bostik 300.
 - b. Fuller, H. B. Company; SC-0296.
 - c. Pecora Corporation; BC-158.
 - d. Polymeric Systems Inc.; PSI-301
 - e. Sonneborn, Division of ChemRex Inc.; Sonneborn Multi-Purpose Sealant.
 - f. Tremco; Tremco Butyl Sealant.

2.3 LATEX JOINT SEALANTS

- A. Latex Sealant: Comply with ASTM C 834, Type P, Grade NF.
- B. Products:
 - 1. Bostik Findley; Chem-Calk 600.
 - 2. Pecora Corporation; AC-20+.

3. Schnee-Morehead, Inc.; SM 8200.
4. Sonneborn, Division of ChemRex Inc.; Sonolac.
5. Tremco; Tremflex 834.

2.4 ACOUSTICAL JOINT SEALANTS

- A. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834 and the following:
 1. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
 2. Products:
 - a. Pecora Corporation; AC-20 FTR Acoustical and Insulation Sealant.
 - b. United States Gypsum Co.; SHEETROCK Acoustical Sealant.
- B. Acoustical Sealant for Concealed Joints: Manufacturer's standard, nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber sealant recommended for sealing interior concealed joints to reduce airborne sound transmission.
 1. Products:
 - a. Pecora Corporation; BA-98.
 - b. Tremco; Tremco Acoustical Sealant.

2.5 PREFORMED JOINT SEALANTS AND COMPRESSIBLE FILLERS

- A. Precompressed Sealant: Silicone pre-coated, preformed, pre-compressed, self-expanding, sealant system.
 1. Expanding foam to be open-cell polyurethane foam impregnated with a water-based, non-drying, polymer-modified acrylic adhesive. Seal shall combine factory-applied, low-modulus silicone and a backing of acrylic-impregnated expanding foam into a unified hybrid sealant system. Silicone must be proved to have been tested for hardness according to ASTM D2240 (Shore-A hardness not to exceed 25). Silicone external color facings to be factory-applied to the foam while it is partially pre-compressed to a width greater than maximum joint extension and cured before final compression. When compressed to final supplied dimension, distinct and uniform folds must be created in the silicone coating.
 2. Material shall be capable of movements of +50%, -50% (100% total) of nominal material size. Sealant must be supplied precompressed to less than the joint size, packaged in shrink-wrapped lengths (sticks) with a mounting adhesive on one face. End to end joins of consecutive lengths of material to be butted and joined bellows surfaces to be lightly coated with silicone. To obtain identical color sealant, use sealant supplied by manufacturer.
 3. Basis of Design: SEISMIC COLORSEAL-DS (Double-Sided) by EMSEAL

- B. Compressible Fillers: Expanded closed-cell Ethylene Propylene Diene (EPDM) sponge rubber.
 - 1. Basis of Design: Everlastic EPDM Sponge 3000 by Williams Products, Inc.

2.6 JOINT-SEALANT BACKING

- A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are 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), 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. Elastomeric Tubing Sealant Backings: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D 1056, nonabsorbent to water and gas, and capable of remaining resilient at temperatures down to minus 26 deg F. Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and to otherwise contribute to optimum sealant performance.
- D. 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 where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.7 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: Nonstaining, 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 joint-sealant performance.
- 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, blast cleaning, 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.
 - b. Masonry.
 - c. Unglazed surfaces of ceramic tile.
 - 3. Remove laitance and form-release agents from concrete.
 - 4. Clean nonporous 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.
 - c. Glazed surfaces of ceramic tile.
- B. Joint Priming: Prime joint substrates, where recommended in writing by joint-sealant manufacturer, based on 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 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. Acoustical Sealant Application Standard: Comply with recommendations in ASTM C 919 for use of joint sealants in acoustical applications as applicable to materials, applications, and conditions indicated.
- D. Install sealant backings of type indicated 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.
- E. 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.
- F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified 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.
 - 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 configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.
 - 4. Provide flush joint configuration where indicated per Figure 5B in ASTM C 1193.
 - 5. Provide recessed joint configuration of recess depth and at locations indicated per Figure 5C 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 elastomeric sealant joints as follows:
 - a. Perform 1 test for each day of sealant application.
 2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab in Appendix X1 in ASTM C 1193.
 - a. For joints with dissimilar substrates, verify adhesion to each substrate separately; do this by extending cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
 3. Inspect joints for complete fill, for absence of voids, and for joint configuration complying with specified requirements. Record results in a field-adhesion-test log.
 4. Inspect tested joints and report on the following:
 - a. 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 type of product and joint substrate. Compare these results to determine if adhesion passes sealant manufacturer's field-adhesion hand-pull test criteria.
 - b. Whether sealants filled joint cavities and are free of voids.
 - c. Whether sealant dimensions and configurations comply with specified requirements.
 5. 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 fill, sealant configuration, and sealant dimensions.
 6. 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 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 and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

END OF SECTION 07920

**NEW PASSENGER TERMINAL
DULUTH INTERNATIONAL AIRPORT
DULUTH, MINNESOTA**

**SECTION 08110 – STEEL 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 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Standard hollow metal work.
- B. Related Sections
 - 1. Division 4 Section 04202 "Interior Unit Masonry" for embedding anchors for hollow metal work into masonry construction.
 - 2. Division 8 Section 08710 "Finish Hardware" for door hardware for hollow metal doors and frames.
 - 3. Division 9 Section 09900 "Painting" for field painting hollow metal doors and frames
 - 4. Division 16 Sections for electrical connections including conduit and wiring for door controls and operators.

1.3 DEFINITIONS

- A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or SDI A250.8.
- B. Standard Hollow Metal Work: Hollow metal work fabricated according to ANSI/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 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
 - 1. Include construction details, material descriptions, core descriptions, fire-resistance rating, temperature-rise ratings, and finishes.
- B. LEED Submittals:

1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.
- C. 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. 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. Details of conduit and preparations for power, signal, and control systems.
- D. Samples for Verification:
1. For each type of exposed finish required, prepared on Samples of not less than 3 by 5 inches.
 2. For "Doors" and "Frames" subparagraphs below, prepare Samples about 12 by 12 inches to demonstrate compliance with requirements for quality of materials and construction:
 - a. Doors: Show vertical-edge, top, and bottom construction; core construction; and hinge and other applied hardware reinforcement. Include separate section showing glazing if applicable.
 - b. Frames: Show profile, corner joint, floor and wall anchors, and silencers. Include separate section showing fixed hollow metal panels and glazing if applicable.
- E. 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 door hardware schedule.

1.6 INFORMATIONAL SUBMITTALS

- A. Oversize Construction Certification: For assemblies required to be fire rated and exceeding limitations of labeled assemblies.
- B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each type of hollow metal door and frame assembly.

1.7 QUALITY ASSURANCE

- A. Source Limitations: Obtain hollow metal work from single source from single manufacturer.

- B. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at as close to neutral pressure as possible according to NFPA 252 or UL 10B.
 - 1. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.
 - 2. Temperature-Rise Limit: At vertical exit enclosures and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F (250 deg C) above ambient after 30 minutes of standard fire-test exposure.
- C. Fire-Rated, Borrowed-Light Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled, by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257 or UL 9. Label each individual glazed lite.
- D. Smoke-Control Door Assemblies: Comply with [FPA 105 or UL 1784.
- E. Preinstallation Conference: Conduct conference at Project site.
- F. Design pressure certification up to +/- 80 psf.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.
 - 1. Provide additional protection to prevent damage to factory-finished units.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Store hollow metal work under cover at Project site.
 - 1. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch-high wood blocking. Do not store in a manner that traps excess humidity.
 - 2. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

1.9 PROJECT CONDITIONS

- A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Amweld International, LLC.
 2. Ceco Door Products; an Assa Abloy Group company.
 3. Curries Company; an Assa Abloy Group company.
 4. Pioneer Industries, Inc.
 5. Steelcraft; an Ingersoll-Rand company.

2.2 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; with minimum G90 (Z180) metallic coating.
- D. Frame Anchors: ASTM A 591/A 591M, Commercial Steel (CS), 40Z (12G) 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: Manufacturer's standard units:
1. For exterior walls use hot-dip galvanized according to ASTM A 153/A 153M.
 2. Fasteners for glazing stops: oval head spanner screws, unless otherwise indicated.
- F. Powder-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. Grout: ASTM C 476, except with a maximum slump of 4 inches, as measured according to ASTM C 143/C 143M.
- H. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool with 6- to 12-lb/cu. Ft. density; with maximum flame-spread and smoke-development indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.
- I. Glazing: Comply with requirements in Division 8 Section "Glazing."
- J. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.3 STANDARD HOLLOW METAL DOORS

- A. General: Provide doors of design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces unless otherwise indicated. Comply with ANSI/SDI A250.8.
 - 1. Design: Flush panel.
 - 2. Core Construction: Manufacturer's standard, polystyrene or, polyurethane, core.
 - a. Fire Door Core: As required to provide fire-protection and temperature-rise ratings indicated.
 - b. Thermal-Rated (Insulated) Doors: Where indicated, provide doors fabricated with thermal-resistance value (R-value) of not less than 6.0 deg F x h x sq. ft./Btu when tested according to ASTM C 1363.
 - 1) Locations: Exterior doors and interior doors where indicated.
 - 3. Vertical Edges for Single-Acting Doors: Beveled edge.
 - a. Beveled Edge: 1/8 inch in 2 inches.
 - 4. Vertical Edges for Double-Acting Doors: Round vertical edges with 2-1/8-inch radius.
 - 5. Top and Bottom Edges: Closed with flush or inverted 0.042-inch-thick, end closures or channels of same material as face sheets.
 - 6. Tolerances: Comply with SDI 117, "Manufacturing Tolerances for Standard Steel Doors and Frames."
- B. Exterior Doors: Face sheets fabricated from metallic-coated steel sheet. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:
 - 1. Level 3 and Physical Performance Level A (Extra Heavy Duty), Model 2 (Seamless).
- C. Interior Doors: Face sheets fabricated from cold-rolled steel sheet unless metallic-coated sheet is indicated. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:
 - 1. Level 2 and Physical Performance Level B (Heavy Duty), Model 2 (Seamless).
- D. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.
- E. Fabricate concealed stiffeners and hardware reinforcement from either cold- or hot-rolled steel sheet.
- F. Pre conduit frames and doors with UL rated Electro Lynx conduit and back boxes as required for electro mechanical hardware specified in Section 08710.

2.4 STANDARD HOLLOW METAL FRAMES

- A. General: Comply with ANSI/SDI A250.8 and with details indicated for type and profile.

- B. Exterior Frames: Fabricated from metallic-coated steel sheet.
 - 1. Fabricate frames with mitered or coped corners.
 - 2. Fabricate frames as full profile welded unless otherwise indicated.
 - 3. Frames for Level 3 Steel Doors: 0.067-inch-thick steel sheet.
- C. Interior Frames: Fabricated from cold-rolled steel sheet unless metallic-coated sheet is indicated.
 - 1. Fabricate frames with mitered or coped corners.
 - 2. Fabricate frames as face welded unless otherwise indicated.
 - 3. Frames for Level 2 Steel Doors: 0.053-inch-thick steel sheet.
 - 4. Frames for Wood Doors: 0.053-inch-thick steel sheet.
 - 5. Frames for Borrowed Lights: Same as adjacent door frame.
 - 6. Frames for all door openings over 3'6": 0.067-inch-thick steel sheet.
- D. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcement plates from same material as frames.
- E. Pre conduit frames and doors with UL rated Electro Lynx conduit and back boxes as required for electro mechanical hardware specified in Section 08710.

2.5 FRAME ANCHORS

- A. Jamb Anchors:
 - 1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches (250 mm) long; or wire anchors not less than 0.177 inch thick.
 - 2. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch thick.
 - 3. Compression Type for Drywall Slip-on Frames: Adjustable compression anchors.
 - 4. Postinstalled Expansion Type for In-Place Concrete or Masonry: Minimum 3/8-inch-diameter bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.
- B. Floor Anchors: Formed from same material as frames, not less than 0.042 inch thick, and as follows:
 - 1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.
 - 2. Separate Topping Concrete Slabs: Adjustable-type anchors with extension clips, allowing not less than 2-inch height adjustment. Terminate bottom of frames at finish floor surface.

2.6 HOLLOW METAL PANELS

- A. Provide hollow metal panels of same materials, construction, and finish as specified for adjoining hollow metal work.

2.7 STOPS AND MOLDINGS

- A. Moldings for Glazed Lites in Doors: Minimum 0.032 inch thick, fabricated from same material as door face sheet in which they are installed.
- B. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch high unless otherwise indicated.
- C. Loose Stops for Glazed Lites in Frames: Minimum 0.032 inch thick, fabricated from same material as frames in which they are installed.

2.8 LOUVERS

- A. Provide louvers for interior doors, where indicated, that comply with SDI 111C, with blades or baffles formed of 0.020-inch-thick, cold-rolled steel sheet set into 0.032-inch-thick steel frame.
 - 1. Sightproof Louver: Stationary louvers constructed with inverted V-shaped or Y-shaped blades.
 - 2. Lightproof Louver: Stationary louvers constructed with baffles to prevent light from passing from one side to the other, any angle.
 - 3. Fire-Rated Automatic Louvers: Louvers constructed with movable blades closed by actuating fusible link, and listed and labeled for use in fire-rated door assemblies of type and fire-resistance rating indicated by same testing and inspecting agency that established fire-resistance rating of door assembly.

2.9 ACCESSORIES

- A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.
- B. Ceiling Struts: Minimum 1/4-inch-thick by 1-inch-wide steel.
- C. Grout Guards: Formed from same material as frames, not less than 0.016 inch thick.

2.10 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 thickness of metal. 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. Tolerances: Fabricate hollow metal work to tolerances indicated in SDI 117.
- C. Hollow Metal Doors:
 - 1. Exterior Doors: Provide weep-hole openings in bottom of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
 - 2. All steel doors and frames receiving electro-mechanical hardware shall be factory pre wired with UL approved conduit and junction boxes with ElectroLynx quick connect system Option 3 or approved equal.

3. Glazed Lites: Factory cut openings in doors.
 4. Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted.
- D. 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. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
 2. All steel doors and frames receiving electro-mechanical hardware shall be factory pre wired with UL approved conduit and junction boxes with ElectroLynx quick connect system Option 3 or approved equal.
 3. Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
 4. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
 5. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
 6. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
 7. Jamb Anchors: Provide number and spacing of anchors as follows:
 8. Masonry 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) Two anchors per jamb up to 60 inches high.
 - 2) Three anchors per jamb from 60 to 90 inches high.
 - 3) Four anchors per jamb from 90 to 120 inches high.
 - 4) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.
 - 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:
 - 5) Three anchors per jamb up to 60 inches high.
 - 6) Four anchors per jamb from 60 to 90 inches high.
 - 7) Five anchors per jamb from 90 to 96 inches high.
 - 8) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
 - 9) Two anchors per head for frames above 42 inches wide and mounted in metal-stud partitions.
 - a) Compression Type: Not less than two anchors in each jamb.
 - b) Postinstalled Expansion Type: Locate anchors not more than 6 inches from top and bottom of frame. Space anchors not more than 26 inches o.c.
 9. Door Silencers: Except on weather-stripped doors, 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.
 - b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.

- E. Fabricate concealed stiffeners, edge channels, and hardware reinforcement from either cold- or hot-rolled steel sheet.
- F. Hardware Preparation: Factory prepare hollow metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Division 8 Section "Door Hardware."
 - 1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
 - 2. Reinforce doors and frames to receive nontemplated, mortised and surface-mounted door hardware.
 - 3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
 - 4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 16 Sections.
- G. Stops and Moldings: Provide stops and moldings around glazed lites 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 type of glazing and type of installation indicated.

2.11 STEEL FINISHES

- A. Prime Finish: Apply manufacturer's standard primer immediately after cleaning and pretreating.
 - 1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10 acceptance criteria; 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. For the record, 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. Prior to installation, adjust and securely brace welded hollow metal frames for squareness, alignment, twist, and plumbness to the following tolerances:
 - 1. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - 2. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
 - 3. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - 4. Plumbness: Plus or minus 1/16 inch, measured at jambs on a perpendicular line from head to floor.
- C. Drill and tap doors and frames to receive nontemplated, 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 of size and profile indicated. Comply with ANSI/SDI A250.11.
 - 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. At fire-protection-rated openings, install frames according to NFPA 80.
 - b. 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.
 - c. Install frames with removable glazing stops located on secure side of opening.
 - d. Install door silencers in frames before grouting.
 - e. Remove temporary braces necessary for installation only after frames have been properly set and secured.
 - f. Check plumbness, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
 - g. Field apply bituminous coating to backs of frames that are filled with grout containing antifreezing agents.
 - 2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.
 - a. Floor anchors may be set with powder-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.

3. Metal-Stud Partitions: Solidly pack mineral-fiber insulation behind frames.
 4. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
 5. Concrete Walls: Solidly fill space between frames and concrete with grout. Take precautions, including bracing frames, to ensure that frames are not deformed or damaged by grout forces.
 6. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
 7. In-Place Gypsum Board Partitions: Secure frames in place with postinstalled expansion anchors through floor anchors at each jamb. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
 8. Ceiling Struts: Extend struts vertically from top of frame at each jamb to overhead structural supports or substrates above frame unless frame is anchored to masonry or to other structural support at each jamb. Bend top of struts to provide flush contact for securing to supporting construction. Provide adjustable wedged or bolted anchorage to frame jamb members.
 9. 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 Standard Steel Doors:
 - a. Jambs and Head: 1/8 inch plus or minus 1/16 inch.
 - b. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch.
 - c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.
 - d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch.
 2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
 3. Smoke-Control Doors: Install doors according to NFPA 105.
- D. Glazing: Comply with installation requirements in Division 8 Section "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 Surfaces: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

END OF SECTION 08110

**NEW PASSENGER TERMINAL
DULUTH INTERNATIONAL AIRPORT
DULUTH, MINNESOTA**

**SECTION 08210 - FLUSH
WOOD 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:
 - 1. Solid-core doors with wood-veneer faces.
 - 2. Factory finishing flush wood doors.
- B. Related Sections:
 - 1. Section 08110 "Steel Doors and Frames" for door frames.
 - 2. Section 08710 "Finish Hardware" for door hardware.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of door indicated. Include details of core and edge construction and trim for openings. Include factory-finishing specifications.
- B. LEED Submittals:
 - 1. Certificates for Credit MR 7: Chain-of-custody certificates indicating that flush wood doors comply with forest certification requirements. Include statement indicating cost for each certified wood product.
 - 2. Product Data for Credit IEQ 4.4: For adhesives and composite wood products, documentation indicating that product contains no urea formaldehyde.
- C. Shop Drawings: Illustrate door opening criteria elevations, sizes, types, swings, undercuts required, special beveling, special blocking for hardware, identify cutouts for glazing.
- D. Samples: Submit 2 samples of actual door construction including door veneer, 12 x 12 inch in size cut from bottom corner of door size illustrating door core, rail, stile, wood grain, color, and finish.
- E. Manufacturer's Installation Instructions: Indicate special installation instructions.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer specializing in manufacturing the products specified in this section with minimum 3 years documented experience that is certified for chain of custody by an FSC-accredited certification body.
- B. Single Source Responsibility: Obtain doors from single manufacturer to ensure uniformity in quality, appearance and construction.

- C. Perform work in accordance with AWI Quality Standard Section 1300, Custom Grade.
- D. Finish doors in accordance with AWI Quality Standard Section 1500, grades identified in schedule.
- E. Provide only 5 ply architectural doors.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Package, deliver and store doors in accordance with AWI Section 1300. Protect doors with resilient packaging. Do not store in damp or wet areas; or in areas where sunlight might bleach veneer. Seal top and bottom edges if stored more than one week. Break seal on-site to permit ventilation.
- B. Comply with manufacturer's instructions and with requirements of NWWDA pamphlets "Recommended Handling and Finishing Instructions for Wood Fire Doors" and "How to Store, Handle, Finish, Install and Maintain Wood Doors."
- C. Deliver to site after wet construction operations are completed and dry and building has reached average prevailing relative humidity.
- D. Deliver in manufacturer's original unopened protective covering or container, clearly marked with manufacturer's name, brand name and identifying door opening number on covering.
- E. Storage:
 - 1. Store in clean, dry, ventilated area protected from sunlight.
 - 2. Avoid extreme heat, cold, dryness or humidity.
 - 3. Store flat over level surface above floor on wood blocking.
 - 4. Under bottom door and over top of stack, furnish plywood or corrugated cardboard for protection.
- F. Handling: Do not drag doors across one another or across other surfaces.

1.6 FIELD MEASUREMENTS

- A. Verify that field measurements are as indicated on shop drawings.

1.7 COORDINATION

- A. Coordinate the work with door opening construction, door frame and door hardware installation, and keying schedule.

1.8 WARRANTY

- A. Provide warranty to the following term:
 - 1. Life of Installation:
- B. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, telegraphing core construction.

- C. Include hanging, installation of hardware and refinishing which may be required due to repair or replacement of defective doors.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 1. Marshfield Door Company.
 2. Maiman Door Company.
 3. Eggers Industries.
 4. Algoma Hardwoods, Inc.
 5. Chappell Door Co.
 6. Graham Wood Door.
 7. VT Industries, Inc.

2.2 DOOR TYPES

- A. Flush Interior Doors: 1-3/4 inches thick; solid core construction, fire rated as indicated.
- B. Grade: Custom.

2.3 DOOR CONSTRUCTION

- A. Certified Wood: Fabricate doors with not less than 70 percent of wood products produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."
- B. Low-Emitting Materials: Fabricate doors with adhesives and composite wood products that do not contain urea formaldehyde.
- C. WDMA I.S.1-A Performance Grade: Heavy Duty.
- D. Particleboard-Core Doors.
 1. Particleboard: ANSI A208.1, Grade LD-2, made with binder containing no urea-formaldehyde resin.

2.4 FLUSH DOOR FACING

- A. Wood Veneer for transparent finish:
 1. Grade: Custom (Grade A faces).
 2. Species: Cherry..
 3. Cut: Plain or Quarter sliced.
 4. Veneer Match: Book.
 5. Veneer Assembly: Running match.
 6. Pair and Set Match: Provide for doors hung in same opening.
 7. Exposed Vertical and Top Edges: Veneer that matches faces, applied before faces.

8. Core: Particleboard.
9. Construction: Five or seven plies. Stiles and rails are bonded to core, then entire unit abrasive planed before veneering.
10. Facing Adhesive: Type I per WDMA TM-6.

2.5 FABRICATION

- A. Fabricate non-rated doors in accordance with AWI Quality Standards requirements.
- B. Provide lock blocks at lock edge and top of door for closer for hardware reinforcement.
- C. Bond edge banding to cores.
- D. Factory machine doors for finish hardware in accordance with hardware requirements and dimensions. Do not machine for surface hardware.
- E. Factory pre-fit doors for frame opening dimensions identified on shop drawings.

2.6 FACTORY FINISHING

- A. General: Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
 1. Finish faces, all four edges, edges of cutouts, and mortises. Stains and fillers may be omitted on bottom edges, edges of cutouts, and mortises.
- B. Finish doors at factory.
- C. Transparent Finish:
 1. Grade: Custom.
 2. Finish: AWI conversion varnish or catalyzed polyurethane system.
 3. Staining: As selected by Architect from manufacturer's full range.
 4. Sheen: Satin.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine doors and installed door frames before hanging doors.
 1. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
 2. Reject doors with defects.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Installation Instructions: Install doors to comply with manufacturer's written instructions and the referenced quality standard, and as indicated.

- B. Job-Fitted Doors: Align and fit doors in frames with uniform clearances and bevels as indicated below; do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors. Machine doors for hardware. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.
 - 1. Clearances: Provide 1/8 inch at heads, jambs, and between pairs of doors. Provide 1/8 inch from bottom of door to top of decorative floor finish or covering unless otherwise indicated. Where threshold is shown or scheduled, provide 1/4 inch from bottom of door to top of threshold unless otherwise indicated.
- C. Trim door height by cutting bottom edges to a maximum of 3/4 inch. Trim fire door height at bottom edge only, in accordance with fire rating requirements.
- D. Pilot drill screw and bolt holes.
- E. Machine cut for hardware. Core for handsets and cylinders.
- F. Coordinate installation of doors with installation of frames specified in Section 08110 and hardware specified in Section 08710.

3.3 INSTALLATION TOLERANCE

- A. Conform to AWI requirements for fit and clearance tolerances.
- B. Maximum Diagonal Distortion (Warp): 1/8 inch measured with straight edge or taught string, corner to corner, over an imaginary 36 by 84 inch surface area.
- C. Maximum Vertical Distortion (Bow): 1/8 inch measured with straight edge or taught string, top to bottom, over an imaginary 36 by 84 inch surface area.
- D. Maximum Width Distortion (Cup): 1/8 inch measured with straight edge or taught string, edge to edge, over an imaginary 36 by 84 inch surface area.

3.4 ADJUSTING

- A. Operation: Rehang or replace doors that do not swing or operate freely
- B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 08210

**NEW PASSENGER TERMINAL
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DULUTH, MINNESOTA**

**SECTION 08311 – ACCESS 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 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Access doors and frames for walls and ceilings.
- B. Related Sections include the following:
 - 1. Division 3 Section 03300 "Cast-in-Place Concrete" for blocking out openings for access doors and frames in concrete.
 - 2. Division 4 Section 04202 "Interior Unit Masonry" for anchoring and grouting access door frames set in masonry construction.
 - 3. Division 8 Section 08710 "Finish Hardware" for mortise or rim cylinder locks and master keying.
 - 4. Division 15 Sections for heating and air-conditioning duct access doors.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of access door and frame indicated. Include construction details, fire ratings, materials, individual components and profiles, and finishes.
- B. Shop Drawings: Show fabrication and installation details of access doors and frames for each type of substrate. Include plans, elevations, sections, details, and attachments to other work.
- C. Samples: For each door face material, at least 3 by 5 inches in size, in specified finish.
- D. Access Door and Frame Schedule: Provide complete access door and frame schedule, including types, locations, sizes, latching or locking provisions, and other data pertinent to installation.

- E. Ceiling Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted items including access doors and frames, lighting fixtures, diffusers, grilles, speakers, sprinklers, and special trim are shown and coordinated with each other.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of access door and frame through one source from a single manufacturer.
- B. Fire-Rated Access Doors and Frames: Units complying with NFPA 80 that are identical to access door and frame assemblies tested for fire-test-response characteristics per the following test method and that are listed and labeled by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
 - 1. NFPA 252 or UL 10B for vertical access doors and frames.
 - 2. ASTM E 119 or UL 263 for horizontal access doors and frames.
- C. Size Variations: Obtain Architect's acceptance of manufacturer's standard-size units, which may vary slightly from sizes indicated.

1.5 COORDINATION

- A. Verification: Determine specific locations and sizes for access doors needed to gain access to concealed plumbing, mechanical, or other concealed work, and indicate in the schedule specified in "Submittals" Article.

PART 2 - PRODUCTS

2.1 STEEL MATERIALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
 - 1. ASTM A 123/A 123M, for galvanizing steel and iron products.
 - 2. ASTM A 153/A 153M, for galvanizing steel and iron hardware.
- B. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.
 - 1. ASTM A 123/A 123M, for galvanizing steel and iron products
 - 2. ASTM A 153/A 153M, for galvanizing steel and iron hardware.

- C. Steel Sheet: Uncoated or electrolytic zinc-coated, ASTM A 591/A 591M with cold-rolled steel sheet substrate complying with ASTM A 1008/A 1008M, Commercial Steel (CS), exposed.
- D. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS) with A60 zinc-iron-alloy (galvannealed) coating or G60 mill-phosphatized zinc coating; stretcher-leveled standard of flatness; with minimum thickness indicated representing specified thickness according to ASTM A 924/A 924M.
- E. Steel Finishes: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Provide either a baked enamel or powder-coat finish as specified below.
 - 1. Surface Preparation for Steel Sheet: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, or other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or SSPC-SP 8, "Pickling."
 - 2. Surface Preparation for Metallic-Coated Steel Sheet: Clean surfaces with nonpetroleum solvent so surfaces are free of oil and other contaminants. After cleaning, apply a conversion coating suited to the organic coating to be applied over it. Clean welds, mechanical connections, and abraded areas, and apply galvanizing repair paint specified below to comply with ASTM A 780.
 - a. Galvanizing Repair Paint: High-zinc-dust-content paint for reglazing welds in steel, complying with SSPC-Paint 20.
 - 3. Factory-Primed Finish: Apply shop primer immediately after cleaning and pretreating.
 - 4. Baked-Enamel Finish: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-enamel finish consisting of prime coat and thermosetting topcoat. Comply with paint manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils.
 - 5. Powder-Coat Finish: Immediately after cleaning and pretreating, apply manufacturer's standard thermosetting polyester or acrylic urethane powder coating with cured-film thickness not less than 1.5 mils. Prepare, treat, and coat metal to comply with resin manufacturer's written instructions.
- F. Drywall Beads: Edge trim formed from 0.0299-inch zinc-coated steel sheet formed to receive joint compound and in size to suit thickness of gypsum board.

2.2 ACCESS DOORS AND FRAMES FOR WALLS AND CEILINGS

- 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. Acudor Products, Inc.
 - 2. Babcock-Davis; A Cierra Products Co.
 - 3. Elmdor/Stoneman; Div. of Acorn Engineering Co.
 - 4. Jensen Industries.
 - 5. J. L. Industries, Inc.
 - 6. Karp Associates, Inc.
 - 7. Larsen's Manufacturing Company.
 - 8. MIFAB, Inc.
 - 9. Milcor Inc.
 - 10. Nystrom, Inc.
- B. Flush Access Doors and Trimless Frames: Fabricated from metallic-coated steel sheet. Use at locations in GWB and acoustical panel construction.
 - 1. Locations: Wall and ceiling surfaces.
 - 2. Door: Minimum 0.060-inch-thick sheet metal, set flush with surrounding finish surfaces.
 - 3. Frame: Minimum 0.060-inch-thick sheet metal with drywall bead flange.
 - 4. Hinges: Spring-loaded, concealed-pin type or Continuous piano.
 - 5. Latch: Cam latch operated by hex head wrench or flush key with interior release.
 - 6. Lock: Cylinder for access doors requiring secure access to communications and other critical systems..
- C. Maximum-Security, Flush Access Doors and Frames with Exposed Trim: Fabricated from metallic-coated steel sheet and angles.
 - 1. Locations: Wall and ceiling surfaces.
 - 2. Door: Minimum 0.180-inch-thick sheet metal, flush construction.
 - 3. Frame: Minimum 3/16-by-2-by-2-by-3-inch angle welded with joints ground smooth.
 - 4. Hinges: Heavy-duty steel welded to door and frame.
 - 5. Lock: Heavy-duty detention deadbolt.
 - a. Lock Preparation: Prepare door panel to accept cylinder specified in Division 8 Section "Door Hardware."

2.3 FABRICATION

- A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.

- B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.
- C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access panels to types of supports indicated.
 - 1. Exposed Flanges: Nominal 1 inch wide around perimeter of frame.
 - 2. For trimless frames with drywall bead, provide edge trim for gypsum board securely attached to perimeter of frames.
 - 3. Provide mounting holes in frames for attachment of units to metal framing.
 - 4. Provide mounting holes in frame for attachment of masonry anchors. Furnish adjustable metal masonry anchors.
- D. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.
 - 1. For cylinder lock, furnish two keys per lock and key all locks alike.
 - 2. For recessed panel doors, provide access sleeves for each locking device. Furnish plastic grommets and install in holes cut through finish.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with manufacturer's written instructions for installing access doors and frames.
- B. Set frames accurately in position and attach securely to supports with plane of face panels aligned with adjacent finish surfaces.
- C. Install doors flush with adjacent finish surfaces or recessed to receive finish material.

3.2 ADJUSTING AND CLEANING

- A. Adjust doors and hardware after installation for proper operation.
- B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

END OF SECTION 08311

**NEW PASSENGER TERMINAL
DULUTH INTERNATIONAL AIRPORT
DULUTH, MINNESOTA**

**SECTION 08331 - OVERHEAD
COILING 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. This Section includes the following types of electric-motor-operated overhead coiling doors:
 - 1. Exterior insulated service doors.
 - 2. Interior coiling doors.
- B. Related Sections include the following:
 - 1. Division 5 Section 05500 "Metal Fabrications" for miscellaneous steel supports.
 - 2. Division 8 Section 08710 "Finish Hardware" for lock cylinders and keying.
 - 3. Division 9 Section 09900 "Painting" for field applied finish.
 - 4. Division 13 Section 13700 "Computer Controlled Access System" for building security system interface provisions.
 - 5. Division 16 Sections for electrical service and connections for powered operators and accessories.

1.3 DEFINITIONS

- A. Operation Cycle: One cycle of a door is complete when it is moved from the closed position to the fully open position and returned to the closed position.

1.4 PERFORMANCE REQUIREMENTS

- A. Structural Performance, Exterior Doors: Exterior overhead coiling doors shall withstand the wind loads, the effects of gravity loads, and loads and stresses within limits and under conditions indicated according to SEI/ASCE 7. without evidencing permanent deformation of door components:

1. Wind Load: Uniform pressure (velocity pressure) of 20 lbf/sq. ft., acting inward and outward.
- B. Operation-Cycle Requirements: Provide overhead coiling door components and operators capable of operating for not less than 20,000 cycles and for 10 cycles per day.
 1. Include tamperproof cycle counter.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type and size of overhead coiling door and accessory. Include the following:
 1. Construction details, material descriptions, dimensions of individual components, profiles for slats, and finishes.
 2. Rated capacities, operating characteristics, electrical characteristics, and furnished accessories.
 3. Summary of forces and loads on walls and jambs.
- B. Shop Drawings: For each installation and for special components and installations not dimensioned or detailed in manufacturer's product data. Include plans, elevations, sections, details, and attachments to other work.
 1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 2. Show locations of replaceable fusible links.
 3. Wiring Diagrams: For power, signal, and control wiring.
- C. Samples for Initial Selection: Manufacturer's finish charts showing full range of colors and textures available for units with factory-applied finishes.
- D. Samples for Verification: Of each type of exposed finish required, prepared on Samples of size indicated below.
 1. Curtain Slats: 12 inches long.
 2. Bottom Bar: 6 inches long.
 3. Guides: 6 inches long.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.

1.7 CLOSEOUT SUBMITTALS

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

1.8 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for both installation and maintenance of units required for this Project.
- B. Source Limitations: Obtain overhead coiling doors through one source from a single manufacturer.
 - 1. Obtain operators and controls from overhead coiling door manufacturer.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100.
- D. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Protect materials from exposure to moisture. Do not deliver until after wet work is complete and dry.
- C. Store materials in a dry, warm, ventilated weathertight location.

1.10 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.

1.11 COORDINATION

- A. Coordinate Work with other operations and installation of adjacent materials to avoid damage to installed materials.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Atlas Door; Div. of Clopay Building Products Company, Inc.
2. Cookson Company.
3. Cornell Iron Works Inc.
4. Mahon Door Corporation.
5. McKeon Rolling Steel Door Company, Inc.
6. Overhead Door Corp.
7. Raynor.
8. Wayne-Dalton Corp.

2.2 DOOR CURTAIN MATERIALS AND CONSTRUCTION

A. Exterior Service Door Curtains: Fabricate overhead coiling door curtain of interlocking slats, designed to withstand wind loading indicated, in a continuous length for width of door without splices. Unless otherwise indicated, provide slats of thickness and mechanical properties recommended by door manufacturer for performance, size, and type of door indicated, and as follows:

1. Steel Door Curtain Slats: Zinc-coated (galvanized), cold-rolled structural steel (SS) sheet; complying with ASTM A 653/A 653M, G90 (Z275) coating designation.
 - a. Minimum Base-Metal (Uncoated) Thickness: 0.0239 inch.
 - b. Flat profile slats.
2. Vision-Panel Glazing: Manufacturer's standard clear glazing, fabricated from transparent acrylic sheet as required for type of door; set in glazing channel secured to curtain slats.
3. Insulation: Fill slat with manufacturer's standard rigid cellular polystyrene or polyurethane-foam-type thermal insulation complying with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, according to ASTM E 84. Enclose insulation completely within metal slat faces.
4. Inside Curtain Slat Face: To match material of outside metal curtain slat.
5. Gasket Seal: Provide insulated slats with manufacturer's standard interior-to-exterior thermal break or with continuous gaskets between slats.

- B. Interior Door Curtains: Fabricate overhead coiling door curtain of interlocking slats in a continuous length for width of door without splices. Unless otherwise indicated, provide slats of thickness and mechanical properties recommended by door manufacturer for performance, size, and type of door indicated, and as follows:
 - 1. Steel Door Curtain Slats: Zinc-coated (galvanized), cold-rolled structural steel (SS) sheet; complying with ASTM A 653/A 653M, G90 (Z275) coating designation.
 - a. Minimum Base-Metal (Uncoated) Thickness: 0.0478 inch.
 - b. Flat profile slats.
- C. Astragal for Interior Doors: Equip each door bottom bar with a replaceable, adjustable, continuous, compressible gasket of flexible vinyl, rubber, or neoprene as a cushion bumper.
- D. Curtain Jamb Guides: Manufacturer's standard angles or channels and angles of same material and finish as curtain slats unless otherwise indicated, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Slot bolt holes for guide adjustment. Provide removable stops on guides to prevent overtravel of curtain.

2.3 HOODS AND ACCESSORIES

- A. Hood: Form to act as weatherseal and entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Provide closed ends for surface-mounted hoods and provide fascia for any portion of between-jamb mounting projecting beyond wall face. Provide intermediate support brackets as required to prevent sagging.
 - 1. Fabricate hoods for steel doors of minimum 0.028-inch-thick, hot-dip galvanized steel sheet with G90 zinc coating, complying with ASTM A 653/A 653M.
- B. Weatherseals: Provide replaceable, adjustable, continuous, compressible weather-stripping gaskets fitted to bottom and top of exterior doors, unless otherwise indicated. At door head, use 1/8-inch-thick, replaceable, continuous sheet secured to inside of hood.
 - 1. Provide motor-operated doors with combination bottom weatherseal and sensor edge.
 - 2. In addition, provide replaceable, adjustable, continuous, flexible, 1/8-inch-thick seals of flexible vinyl, rubber, or neoprene at door jambs for a weathertight installation.

- C. Fabricate locking device assembly with lock, spring-loaded dead bolt, operating handle, cam plate, and adjustable locking bar to engage through slots in tracks.
 - 1. Locking Bars: Full-disc cremone type, both jamb sides operable from inside only.
 - 2. Lock cylinder is specified in Division 8 Section "Door Hardware."
- D. If door unit is power operated, provide safety interlock switch to disengage power supply when door is locked.
- E. Provide automatic-closing device that is inoperative during normal door operations, with oscillating or viscous-speed governor unit complying with requirements of NFPA 80 and with an easily tested and reset release mechanism, and designed to be activated by the following:
 - 1. Replaceable fusible links with temperature rise and melting point of 165 deg F; interconnected and mounted on both sides of door opening.
 - 2. Manufacturer's standard UL-labeled heat detector and door-holder-release devices.
 - 3. Building fire alarm and detection system and door-holder-release devices.

2.4 COUNTERBALANCING MECHANISM

- A. General: Counterbalance doors by means of adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to door curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.
- B. Counterbalance Barrel: Fabricate spring barrel of hot-formed, structural-quality, welded or seamless carbon-steel pipe, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of slats and to limit barrel deflection to not more than 0.03 in./ft. of span under full load.
- C. Provide spring balance of one or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Provide cast-steel barrel plugs to secure ends of springs to barrel and shaft.
- D. Fabricate torsion rod for counterbalance shaft of cold-rolled steel, sized to hold fixed spring ends and carry torsional load.
- E. Brackets: Provide mounting brackets of manufacturer's standard design, either cast iron or cold-rolled steel plate.

2.5 ELECTRIC DOOR OPERATORS

- A. General: Provide electric door operator assembly of size and capacity recommended and provided by door manufacturer for door and operation-cycle requirements specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, remote-control stations, control devices, integral gearing for locking door, and accessories required for proper operation.
- B. Comply with NFPA 70.
- C. Disconnect Device: Provide hand-operated disconnect or mechanism for automatically engaging chain and sprocket operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Mount disconnect and operator so they are accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.
- D. Design operator so motor may be removed without disturbing limit-switch adjustment and without affecting emergency auxiliary operator.
- E. Provide 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.
- F. Usage Classification: Electric operator and components capable of operating for not less than number of cycles per hour indicated for each door.
- G. Door-Operator Type: Provide wall-, hood-, or bracket-mounted, jackshaft-type door operator unit consisting of electric motor, enclosed gear-head-reduction drive, and chain and sprocket secondary drive.
- H. Electric Motors: Provide high-starting torque, reversible, continuous-duty, Class A insulated, electric motors complying with NEMA MG 1; with overload protection; sized to start, accelerate, and operate door in either direction from any position, at not less than 2/3 fps and not more than 1 fps, without exceeding nameplate ratings or service factor.
 - 1. Type: Polyphase, medium-induction type.
 - 2. Service Factor: According to NEMA MG 1, unless otherwise indicated.
 - 3. Coordinate wiring requirements and electrical characteristics of motors with building electrical system.
 - 4. Provide open dripproof-type motor, and controller with NEMA ICS 6, Type 1 enclosure.
- I. Remote-Control Station: Provide momentary-contact, three-button control station with push-button controls labeled "Open," "Close," and "Stop."

1. Provide interior units, full-guarded, surface-mounted, heavy-duty type, with general-purpose NEMA ICS 6, Type 1 enclosure.
- J. Obstruction Detection Device: Provide each motorized door with indicated external automatic safety sensor capable of protecting full width of door opening. Activation of sensor immediately stops and reverses downward door travel.
1. Photoelectric Sensor: Manufacturer's standard system designed to detect an obstruction in door opening without contact between door and obstruction.
 - a. Self-Monitoring Type: Designed to interface with door operator control circuit to detect damage to or disconnection of sensing device. When self-monitoring feature is activated, door closes only with sustained pressure on close button.
 2. Sensor Edge: Automatic safety sensor edge, located within astragal or weather stripping mounted to bottom bar. Contact with sensor activates device. Connect to control circuit using manufacturer's standard take-up reel or self-coiling cable.
 - a. Self-Monitoring Type: Four-wire configured device designed to interface with door operator control circuit to detect damage to or disconnection of sensor edge.
- K. Limit Switches: Provide adjustable switches, interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.
- L. Emergency Manual Operation: Equip each electrically powered door with capability for emergency manual operation. Design manual mechanism so required force for door operation does not exceed 30 lbf.

2.6 FINISHES, GENERAL

- A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- 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 the 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.

2.7 STEEL AND GALVANIZED STEEL FINISHES

- A. Powder-Coat Finish: Manufacturer's standard powder-coat finish consisting of primer and topcoat according to coating manufacturer's written instructions for cleaning, pretreatment, application, thermosetting, and minimum dry film thickness.
 - 1. Color and Gloss: As selected by Architect from manufacturer's full range.

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. General: Install coiling doors and operating equipment complete with necessary hardware, jamb and head molding strips, anchors, inserts, hangers, and equipment supports.

3.3 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
 - 1. Perform installation and startup checks according to manufacturer's written instructions.
 - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - 3. Test door closing when activated by detector or alarm-connected fire-release system. Reset door-closing mechanism after successful test.

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. Exterior Doors: Adjust seals to provide weathertight fit around entire perimeter.

3.5 DEMONSTRATION

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

END OF SECTION 08331

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**SECTION 08334 - OVERHEAD
COILING GRILLES**

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. Open-curtain overhead coiling grilles.
- B. Related Sections:
 - 1. Division 5 Section "Metal Fabrications" for miscellaneous steel supports.
 - 2. Division 16 Sections for electrical service and connections for powered operators and accessories.

1.3 PERFORMANCE REQUIREMENTS

- A. Operation Cycles: Provide overhead coiling grille components and operators capable of operating for not less than number of cycles indicated for each grille. One operation cycle is complete when a grille is opened from the closed position to the fully open position and returned to the closed position.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type and size of overhead coiling grille and accessory. Include the following:
 - 1. Construction details, material descriptions, dimensions of individual components, profiles for curtain components, and finishes.
 - 2. 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. Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 2. Wiring Diagrams: For power, signal, and control wiring.
 3. Summary of forces and loads on walls and jambs.
- C. Samples for Initial Selection: Manufacturer's finish charts showing full range of colors and textures available for units with factory-applied finishes.
- D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.
1. Open-Curtain Grille: 18-inch-square assembly with full-size components consisting of rods, spacers, and links as required to illustrate each assembly.
 2. Bottom Bar: 6 inches long with sensor edge.
 3. Guides: 6 inches long.
 4. Brackets: 6 inches square.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For overhead coiling grilles to include in maintenance manuals.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for both installation and maintenance of units required for this Project.
- B. Source Limitations: Obtain overhead coiling grilles from single source from single manufacturer.
1. Obtain operators and controls from overhead coiling grille manufacturer.
- C. 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.
- D. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

PART 2 - PRODUCTS

2.1 GRILLE CURTAIN MATERIALS AND CONSTRUCTION

- A. Open-Curtain Grilles: Fabricate metal grille curtain as an open network of horizontal rods, spaced at regular intervals, that are interconnected with vertical links, which are formed and spaced as indicated and are free to rotate on the rods.
 - 1. Aluminum Grille Curtain: ASTM B 221, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.
- B. Endlocks: Continuous end links, chains, or other devices at ends of rods; locking and retaining grille curtain in guides against excessive pressures, maintaining grille curtain alignment, and preventing lateral movement.
- C. Bottom Bar: Manufacturer's standard continuous channel or tubular shape, finished to match grille.
 - 1. Astragal: Equip each grille bottom bar with a replaceable, adjustable, continuous, compressible gasket of flexible vinyl, rubber, or neoprene as a cushion bumper.
 - 2. Provide motor-operated grilles with combination bottom astragal and sensor edge.
- D. Grille Curtain Jamb Guides: Manufacturer's standard shape having curtain groove with return lips or bars to retain curtain. Provide continuous integral wear strips to prevent metal-to-metal contact and to minimize operational noise; with removable stops on guides to prevent overtravel of curtain.

2.2 ACCESSORIES

- A. Mounting Frame: Manufacturer's standard mounting frame designed to support grille; factory fabricated from ASTM A 36/A 36M structural-steel tubes or shapes, hot-dip galvanized per ASTM A 123/A 123M; fastened to floor and structure above grille; to be built into wall construction; and complete with anchors, connections, and fasteners.

2.3 LOCKING DEVICES

- A. Locking Device Assembly: Fabricate with cylinder lock, spring-loaded dead bolt, operating handle, cam plate, and adjustable locking bars to engage through slots in tracks.
 - 1. Lock Cylinders: Provide cylinders standard with manufacturer and keyed to building keying system.

2. Keys: Three for each cylinder.

- B. Safety Interlock Switch: Equip power-operated grilles with safety interlock switch to disengage power supply when grille is locked.

2.4 COUNTERBALANCING MECHANISM

- A. General: Counterbalance grilles by means of manufacturer's standard mechanism with an adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to top of curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.
- B. Counterbalance Barrel: Fabricate spring barrel of manufacturer's standard hot-formed, structural-quality, welded or seamless carbon-steel pipe, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of parts and to limit barrel deflection to not more than 0.03 in./ft. of span under full load.
- C. Spring Balance: One or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Secure ends of springs to barrel and shaft with cast-steel barrel plugs.
- D. Torsion Rod for Counterbalance Shaft: Fabricate of manufacturer's standard cold-rolled steel, sized to hold fixed spring ends and carry torsional load.
- E. Brackets: Manufacturer's standard mounting brackets of either cast iron or cold-rolled steel plate.

2.5 ELECTRIC GRILLE OPERATORS

- A. General: Electric grille operator assembly of size and capacity recommended and provided by grille manufacturer for grille and operation-cycles requirement specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, remote-control stations, control devices, integral gearing for locking grille, and accessories required for proper operation.
1. Comply with NFPA 70.
 2. Provide 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 grille.
- C. Electric Motors: Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements specified in Division 11

Section "Common Motor Requirements for Equipment" unless otherwise indicated.

1. Electrical Characteristics:
 - a. Phase: Single phase.
 - b. Volts: As scheduled.
 - c. Hertz: 60.
 2. Motor Type and Controller: Reversible motor and controller (disconnect switch) for motor exposure indicated.
 3. Motor Size: Minimum size as indicated. If not indicated, large enough to start, accelerate, and operate grille 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.
 4. Operating Controls, Controllers (Disconnect Switches), Wiring Devices, and Wiring: Manufacturer's standard unless otherwise indicated.
 5. Coordinate wiring requirements and electrical characteristics of motors and other electrical devices with building electrical system and each location where installed.
- D. Limit Switches: Equip each motorized grille with adjustable switches interlocked with motor controls and set to automatically stop grille at fully opened and fully closed positions.
- E. Obstruction Detection Device: Equip motorized grille with indicated external automatic safety sensor capable of protecting full width of grille opening. Activation of sensor immediately stops and reverses downward grille travel.
1. Sensor Edge: Automatic safety sensor edge, located within astragal or weather stripping mounted to bottom bar. Contact with sensor activates device. Connect to control circuit using manufacturer's standard take-up reel or self-coiling cable.
 - a. Self-Monitoring Type: Four-wire configured device designed to interface with grille operator control circuit to detect damage to or disconnection of sensing device.
- F. Remote-Control Station: Momentary-contact, three-button control station with push-button controls labeled "Open," "Close," and "Stop."
1. Interior units, full-guarded, surface-mounted, heavy-duty type, with general-purpose NEMA ICS 6, Type 1 enclosure.
 2. Exterior units, full-guarded, standard-duty, surface-mounted, weatherproof type; NEMA ICS 6, Type 4 enclosure, key operated.
- G. Emergency Manual Operation: Equip each electrically powered grille with capability for emergency manual operation. Design manual mechanism so required force for grille operation does not exceed 25 lbf.
- H. 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.

- I. Motor Removal: Design operator so motor may be removed without disturbing limit-switch adjustment and without affecting emergency manual operation.
- J. Audible and Visual Signals: Audible alarm and visual indicator lights in compliance with regulatory requirements for accessibility.
- K. Emergency-Egress Release: Flush, wall-mounted handle mechanism, for ADA-ABA-compliant egress feature, not dependent on electric power. The release allows an unlocked grille to partially open without affecting limit switches to permit passage, and it automatically resets motor drive upon return of handle to original position.

2.6 OPEN-CURTAIN GRILLE ASSEMBLY

- A. Open-Curtain Grille: Overhead coiling grille with a curtain having a network of horizontal rods that interconnect with vertical links.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Cookson Company.
 - b. Cornell Iron Works, Inc.
 - c. Overhead Door Corporation.
 - d. Raynor.
- B. Operation Cycles: Not less than 50,000.
 - 1. Include tamperproof cycle counter.
- C. Grille Curtain Material: Aluminum.
 - 1. Space rods at approximately 2 inches o.c.
 - 2. Space links approximately 9 inches apart in a straight in-line pattern.
 - 3. Glazing Inserts: Manufacturer's standard.
 - 4. Spacers: Metal tubes matching curtain material.
- D. Curtain Jamb Guides: Aluminum with exposed finish matching curtain slats. Provide continuous integral wear strips to prevent metal-to-metal contact and to minimize operational noise.
- E. Locking Devices: Equip grille with locking device assembly.
 - 1. Locking Device Assembly: Cremone type, both jamb sides locking bars, operable from inside and outside with cylinders.

- F. Electric Grille Operator:
 - 1. Usage Classification: Standard duty, up to 60 cycles per hour.
 - 2. Operator Location: As shown on Drawings.
 - 3. Motor Exposure: Interior.
 - 4. Emergency Manual Operation: Push-up type.
 - 5. Obstruction-Detection Device: Automatic, electric sensor edge on bottom bar; self-monitoring type.
 - a. Sensor Edge Bulb Color: As selected by Architect from manufacturer's full range.
 - 6. Remote-Control Station: Where directed or shown on Drawings.
 - 7. Other Equipment: Audible and visual signals.
- G. Grille Finish:
 - 1. Aluminum Finish: Anodized color or clear as selected by Architect from full range of industry colors and color densities.

2.7 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" 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.

2.8 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.
- B. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.

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 overhead coiling grilles and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.
- B. Install overhead coiling grilles, hoods, and operators at the mounting locations indicated for each grille.
- C. Accessibility: Install overhead coiling grilles, switches, and controls along accessible routes in compliance with regulatory requirements for accessibility.

3.3 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
 - 1. Perform installation and startup checks according to manufacturer's written instructions.
 - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - 3. Test grille opening when activated by detector, fire-alarm system, emergency-egress release, or self-opening mechanism as required. Reset grille-opening mechanism after successful test.

3.4 ADJUSTING

- A. Adjust hardware and moving parts to function smoothly so that grilles operate easily, free of warp, twist, or distortion.
- B. Lubricate bearings and sliding parts as recommended by manufacturer.

3.5 DEMONSTRATION

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

END OF SECTION 08334

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**SECTION 08385 - HIGH-SPEED
OVERHEAD DOORS**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. General: Provide all labor, material, equipment, related services and supervision required, including manufacturing, erection and installation for high-speed overhead doors in accordance with the requirements of the Contract Documents.
- B. Extent of high-speed overhead doors is shown on drawings.
- C. Provide complete operating door assemblies including door curtain, guides, counterbalance mechanism, hardware, operating hardware, electric operation, programmable logic controller, safety devices, sensor detection and installation accessories.
- D. Related sections include the following:
 - 1. Division 9, Section 09900 "Painting" for field-applied paint finish on steel channel frames.
 - 2. Division 16 Sections for electrical service and connections for powered operators and accessories.

1.3 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide high-speed overhead doors capable of operating under the following loads and stresses.
 - 1. Wind Load: Uniform pressure (velocity pressure) of 20.6 lbs./sq. ft., acting inward and outward.
- B. Speed: Doors shall have a minimum upward and downward speed of 48 inches per second.

1.4 ACTION SUBMITTALS

- A. **Product Data:** For each type and size of high-speed overhead doors and accessories. Include details of construction relative to materials, dimensions of individual components, profiles, and finishes. Provide roughing-in diagrams, operating instructions, and maintenance information. Include the following:
 - 1. Setting drawings, templates, and installation instructions for built-in or embedded anchor devices.
 - 2. Motors: Show nameplate data and ratings; characteristics; mounting arrangements; size and location of winding termination lugs, conduit entry, and grounding lug; and coatings.
- B. **Shop Drawings:** For special components and installations not dimensioned or detailed in manufacturer's data sheets.
 - 1. Wiring Diagrams: Detail wiring for power, signal, and control systems. Differentiate between manufacturer-installed and field-installed wiring and between components provided by door manufacturer and those provided by others.
- C. **Samples for Verification:** Of each type of exposed finish required, prepared on Samples of size indicated below and of same thickness and material indicated for Work. Where finishes involve normal color and texture variations, include Sample sets showing the full range of variations expected.
 - 1. Door Panel: 12 inch by 12 inch.

1.5 QUALITY ASSURANCE

- A. **Installer Qualifications:** Engage an experienced installer who is an authorized representative of the high-speed overhead door manufacturer for both installation and maintenance of units required for this Project.
- B. **Source Limitations:** Obtain high-speed overhead doors through one source from a single manufacturer. Furnish each door as a complete unit, including hardware, accessories, mounting and installation components.
 - 1. Obtain operators and controls from the high-speed overhead door manufacturer.
- C. **Inserts and Anchorages:** Furnish inserts and anchoring devices that must be set in concrete to install units. Provide setting drawings, templates, instructions and directions to install anchorage devices. Coordinate delivery with other work to avoid delay. Installation of inserts and anchorage devices are covered in Divisions 3 sections.

1.6 WARRANTY:

- A. Manufacturer shall warrant:
 - 1. Balance/Tension springs for a period of five (5) years.
 - 2. Door fabric for a period of five (5) years.
- B. Manufacturer shall warrant mechanical and electrical components against defects in material and workmanship for one (1) year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturer's Basis of Design: The named manufacturer and associated product is the basis of design for the project. Other manufacturer's whose products may be incorporated into the work, subject to compliance with requirements, are also listed. The Contractor is responsible for any modifications to the work resulting from the use of materials other than the basis of design, at no additional cost to the Owner.
 - 1. Albany International, "Rapid Roll Model 670 HD."
- B. Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Rite-Hite.
 - 2. Dynaco USA, Inc.
 - 3. Overhead Door Corporation.
 - 4. Chase Doors.

2.2 MATERIAL AND COMPONENTS

- A. Door Panel:
 - 1. Fabric: Fabricate panel of fabric comprised of a polyester monofilament woven, double layer seamless fabric, impregnated and coated with PVC.
 - a. Thickness: 0.08 inch.
 - b. Impact Strength: Capable of sustaining impacts up to 3,000 lbs. per square inch.
 - c. Tensile Strength: 1,500 lbs. per inch lengthwise and 2,200 lbs. per inch crosswise.

- d. Colors: As selected by Architect from Manufacturer's standard colors.
- B. Door Roll: 5.5 inches diameter, steel tube from 11 gauge galvanized steel complying with ASTM A513. Drum tube deflection shall not exceed 0.01 inch per foot and shall not exceed 0.14 inch over the entire length.
- C. Counterbalance System:
 - 1. Internally mounted counterbalance/curtain tension system shall utilize an extension spring along with a cable and pulley mechanism.
 - 2. Construct pulleys of high-impact injected molded plastic. Pulleys shall contain two permanently sealed and lubricated ball bearings.
 - 3. Provide factory lubricated steel cables with fiber core with Alloy 319 die cast aluminum drums.
- D. Bottom Beam: Beam shall be anodized alloy 6063 extruded aluminum; profile shall be 4.5 inches high and capable of being removed if necessary.
- E. Primary Safety Edge: Through-beam photo cells shall be mounted on retractable steel guides at each end of the bottom beam. Photocell position shall be between door panel guide and 6 inches below bottom edge of door panel during door travel. At closing, photocell shall detect any object and reverse door immediately before bottom edge rubber profile strikes object.
- F. Secondary Safety Edge: EDPM rubber profile shall pneumatically operate a pressure switch. Safety edge cover shall be weatherproof yellow polyester woven PVC impregnated material. On contact with foreign object, door shall reverse to full open position.
- G. Safety Photocell: Provide a safety photocell in proximity to door line.
- H. Side Frames: 14 gauge galvanized steel section including hinged cover together with 12 gauge steel structural C-channel to guide door panel in its upward and downward movement. Provide brush seals to seal against door panel.
 - 1. Finish: Durable, chemical and corrosion resistant-painted coating applied to steel components. Custom color as selected by Architect.
- I. Rapid Reset System or Self Repair System:
 - 1. Provide either Rapid Reset or Self Repair System in accordance with manufacturer's recommendations for door size.
- J. Electrical Operation:

1. High-speed doors shall be electrically operated by a heavy duty drive unit featuring a self-inhibiting worm gear. The motor and gearbox shall be designed for high-cycle operation. Door position shall be controlled by a bi-directional pulse encoder. Basic operation features shall include soft starting and stopping, automatic closing timer, emergency stop, one actuating push button, a safety photocell and a manual disengagement lever to place the door in manual operation. A safety disengagement switch shall be included with the disengagement mechanism.
2. Electrical Motor:
 - a. Provide high-starting torque, reversible intermittent duty, enclosed non-ventilated electric motor, sized to move door in either direction, from any position, at no less than the specified operating speed.
 - b. Motor: Three (3) phase motor rated for 1.25 h.p.
 - c. Door Speed: Up to 100 inches per second.
 - d. Power Supply: Coordinate wiring requirements and current characteristics of door electrical system with building electrical system. Supply shall be rated at 480 volt, three-phase, 60 Hz, 15 amps.
3. Control Panel:
 - a. Panel enclosure shall be NEMA 4.
 - b. Wiring shall be completed by manufacturer and shall be ULC listed.
 - c. Drive shall be controlled by a programmable logic controller.
 - d. Control functions determined by manufacturer's preparation of programmable logic controller.
 - e. Top and bottom limits to be adjustable from the control panel.
 - f. Optional custom designed control system and/or components.
 - g. Control panel shall include an adjustable, automatic closing timer, emergency stop, one actuating push button and a cycle counter.
4. Push button stations and/or pull switches are standard actuation systems.

- a. On side of door's normal direction of traffic, each door shall each have push button station on a pedestal mounted for tug driver access from the driver seat.
 - b. Opposite side of door from normal direction of traffic shall have wall mounted push button stations and metallic activated floor loop receiver reset system for vehicle detection to close door..
 - c. Include photocell featuring an infrared beam that maintains "open" signal when interrupted.
- 5. Door shall be equipped with safety photocell.
- K. Electrical Protection Features:
 - 1. Provide fuses to protect from power line overcurrent and from secondary control voltage overcurrent.
 - 2. Provide complete motor monitoring protection from the programmable operation.
 - 3. Provide thermal protection to protect motor from temperature build-up.
 - 4. Provide switch to electrically disconnect control circuitry during manual operation.
 - 5. Provide running timer to protect drive unit from motor run-on.
 - 6. Provide safety edge system that is continuously monitored and prevents door from closing if a fault is detected.
 - 7. Provide emergency stop feature to instantly stop door in any position.
 - 8. Provide start-up protection to ensure there is no movement of door when system detects a failure.

2.3 ACCESSORIES

- A. Heavier drum tube, acrylic fabric, larger bottom beam, heavy duty motor mounting bracket, larger motor, extra wrap of fabric on top roll for stiffness.
- B. Warning horn and light shall indicate when door is about to close.
- C. Windbar shall provide added protection against pressure differentials.

- D. Impact Release System: Connection between aluminum bottom beam and end bracket shall be a steel clevis and brass tang in a 25 degree angle. Load transmission from balance/tension system through clevis and tang shall be the only mechanism that maintains joint during normal operation.

2.4 FINISHES

- A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- 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 the 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.

2.5 STEEL AND GALVANIZED STEEL FINISHES

- A. Powder-Coat Applied Finish: Apply manufacturer's standard powder-coat applied finish consisting of primer and topcoat(s) according to coating manufacturer's written instructions for cleaning, pretreatment, application, thermosetting and minimum dry film thickness.
 - 1. Color and Gloss: Custom color as selected by Architect.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions under which the work is to be installed and notify Architect and Owner of any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install door and operating equipment complete with necessary hardware, jamb and head mold strips, anchors, inserts, hangers, and equipment supports according to approved shop drawings, manufacturer's written instructions, and as specified.
 - 1. Secure guides to walls, plumb, level and true to line. Anchor guides at spacings indicated on approved shop drawings.
 - 2. Provide additional support as necessary for attachment of guides, brackets and door and operator mechanisms to interfacing surfaces.

3.3 ADJUSTING

- A. After completing installation, including work by other trades, lubricate bearings and sliding parts; adjust doors to operate easily, free from warp, twist, or distortion and fitting weathertight for entire perimeter.
 - 1. Connect and adjust electrical components and operating hardware.

3.4 DEMONSTRATION

- A. Startup Services: Engage a factory-authorized service representative to perform startup services and to train Owner's maintenance personnel as specified below:
 - 1. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment. Test door closing when activated by detector or alarm connected fire-release system. Reset door closing mechanism after successful test.
 - 2. Provide training for the Owner's maintenance personnel on procedures and schedules related to startup and shutdown, troubleshooting, servicing, preventive maintenance, and procedures for testing and resetting release devices.
 - 3. Review data in the maintenance manuals. Refer to Division 1 requirements.
 - 4. Schedule training with Owner with at least 7 days' advance notice.

END OF SECTION 08385

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**SECTION 08710 - FINISH
HARDWARE**

PART 1 - GENERAL

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 the following:
 - a. Swinging doors.
- 2. Cylinders for door hardware specified in other Sections.
- 3. Electrified door hardware.

- B. Related Sections:

- 1. Section 06402 "Interior Architectural Woodwork" for cabinet door hardware provided as part of architectural woodwork.
- 2. Section 08110 "Steel Doors and Frames".
- 3. Section 08211 "Flush Wood Doors"
- 4. Section 08311 "Access Doors and Frames" for access door hardware,
- 5. Section 08322 "Detention Doors and Frames"
- 6. Section 08331 "Overhead Coiling Doors" for door hardware provided as part of overhead door assemblies.
- 7. Section 08334 "Overhead Coiling Grilles" for door hardware provided as part of overhead grille assemblies.
- 8. Section 08411 "Aluminum-Framed Entrances and Storefronts" for installation of entrance door hardware, including cylinders.
- 9. Section 08462 "Sliding Automatic Entrance Doors" for entrance door hardware, except cylinders.
- 10. Section 10265 "Impact-Resistant Wall Protection" for plastic door protection units that match wall protection units.
- 11. Section 13730 "Security Access" for access control devices installed at door openings and provided as part of a security system.

12. Section 13852 "Digital, Addressable Fire-Alarm System" for connections to building fire-alarm system.
 13. Section 13853 "Zoned (DC Loop) Fire-Alarm System" for connections to building fire-alarm system.
- C. Products furnished, but not installed, under this Section include the products listed below. Coordinating and scheduling the purchase and delivery of these products remain requirements of this Section.
1. Lock cylinders to be installed under other Sections.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction and installation details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: Details of electrified door hardware, indicating the following:
1. Wiring Diagrams: For power, signal, and control wiring and including the following:
 - a. Details of interface of electrified door hardware and building safety and security systems.
 - b. Schematic diagram of systems that interface with electrified door hardware.
 - c. Point-to-point wiring.
 - d. Risers.
 - e. Elevations doors controlled by electrified door hardware.
 2. Operation Narrative: Describe the operation of doors controlled by electrified door hardware.
- C. Samples for Verification: For exposed door hardware of each type required, in each finish specified, prepared on Samples of size indicated below. Tag Samples with full description for coordination with the door hardware schedule. Submit Samples before, or concurrent with, submission of door hardware schedule.
1. Sample Size: Complete, full-size units or 6-inch long Samples for other products.
 - a. Complete and full-size Samples will be returned to Contractor. Units that are acceptable and remain undamaged through submittal, review, and field comparison process may, after final check of operation, be incorporated into the Work, within limitations of keying requirements.
- D. Other Action Submittals:

1. Door Hardware Schedule: Prepared by or under the supervision of Installer, detailing fabrication and assembly of door hardware, as well as installation procedures and diagrams. Coordinate final door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
 - a. 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 other work to facilitate the fabrication of other work that is critical in Project construction schedule.
 - b. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule." Double space entries, and number and date each page.
 - c. Content: Include the following information:
 - 1) Identification number, location, hand, fire rating, size, and material of each door and frame.
 - 2) Locations of each door hardware set, cross-referenced to Drawings on floor plans and to door and frame schedule.
 - 3) Complete designations, including name and manufacturer, type, style, function, size, quantity, function, and finish of each door hardware product.
 - 4) Description of electrified door hardware sequences of operation and interfaces with other building control systems.
 - 5) Fastenings and other pertinent information.
 - 6) Explanation of abbreviations, symbols, and codes contained in schedule.
 - 7) Mounting locations for door hardware.
 - 8) List of related door devices specified in other Sections for each door and frame.
2. Keying Schedule: Prepared by or under the supervision of Installer, detailing Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations that are coordinated with the Contract Documents.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Certificates: For electrified door hardware, from the manufacturer.
 1. Certify that door hardware approved for use on types and sizes of labeled fire-rated doors complies with listed fire-rated door assemblies.
- C. Product Test Reports: For compliance with accessibility requirements, based on evaluation of comprehensive tests performed by manufacturer and

witnessed by a qualified testing agency, for door hardware on doors located in accessible routes.

- D. Warranty: Special warranty specified in this Section.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each type of door hardware to include in maintenance manuals. Include final hardware and keying schedule.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Supplier of products and an employer of workers trained and approved by product manufacturers and an Architectural Hardware Consultant who is available during the course of the Work to consult with Contractor, Architect, and Owner about door hardware and keying.
 - 1. Warehousing Facilities: In Project's vicinity.
 - 2. Scheduling Responsibility: Preparation of door hardware and keying schedules.
 - 3. Engineering Responsibility: Preparation of data for electrified door hardware, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.
- B. Source Limitations: Obtain each type of door hardware from a single manufacturer.
 - 1. Provide electrified door hardware from same manufacturer as mechanical door hardware, unless otherwise indicated. Manufacturers that perform electrical modifications and that are listed by a testing and inspecting agency acceptable to authorities having jurisdiction are acceptable.
- C. Fire-Rated Door Assemblies: Where fire-rated door assemblies are indicated, provide door hardware rated for use in assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C, unless otherwise indicated.
- D. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that meet requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.
 - 1. Air Leakage Rate: Maximum air leakage of 0.3 cfm/sq. ft. at the tested pressure differential of 0.3-inch wg of water.

- E. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.
- F. Means of Egress Doors: Latches do not require more than 15 lbf to release the latch. Locks do not require use of a key, tool, or special knowledge for operation.
- G. Accessibility Requirements: For door hardware on doors in an accessible route, comply with the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines, and ICC/ANSI A117.1.
 - 1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf.
 - 2. Comply with the following maximum opening-force requirements:
 - a. Interior, Non-Fire-Rated Hinged Doors: 5 lbf applied perpendicular to door.
 - b. Sliding or Folding Doors: 5 lbf applied parallel to door at latch.
 - c. Fire Doors: Minimum opening force allowable by authorities having jurisdiction.
 - 3. Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 1/2 inch high.
 - 4. Adjust door closer sweep periods so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches from the latch, measured to the leading edge of the door.
- H. Keying Conference: Conduct conference at Project site to comply with requirements in Section 01310 "Project Management and Coordination." In addition to Owner, Construction Manager, Contractor, and Architect. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including, but not limited to, the following:
 - 1. Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
 - 2. Preliminary key system schematic diagram.
 - 3. Requirements for key control system.
 - 4. Requirements for access control.
 - 5. Address for delivery of keys.
- I. 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. Inspect and discuss preparatory work performed by other trades.
 - 3. Inspect and discuss electrical roughing-in for electrified door hardware.
 - 4. Review sequence of operation for each type of electrified door hardware.
 - 5. Review required testing, inspecting, and certifying procedures.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.
- B. Tag each item or package separately with identification coordinated with the final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package.
- C. Deliver keys and permanent cores to Owner by registered mail or overnight package service.

1.8 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 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.
- D. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.
- E. Existing Openings: Where hardware components are scheduled for application to existing construction or where modifications to existing door hardware are required, field verify existing conditions and coordinate installation of door hardware to suit opening conditions and to provide proper door operation.

1.9 WARRANTY

- A. Special 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. Failures include, but are not limited to, the following:
 - a. Structural failures including excessive deflection, cracking, or breakage.
 - b. Faulty operation of doors and door hardware.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.

2. Warranty Period: Three years from date of Substantial Completion, unless otherwise indicated.
 - a. Electromagnetic and Delayed-Egress Locks: Five years from date of Substantial Completion.
 - b. Exit Devices: Two years from date of Substantial Completion.
 - c. Manual Closers: 10 years from date of Substantial Completion.
 - d. Concealed Floor Closers: Five years from date of Substantial Completion.

1.10 MAINTENANCE SERVICE

- A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.
- B. Maintenance Service: Beginning at Substantial Completion, provide six months' full maintenance by skilled employees of door hardware Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door and door hardware operation. Provide parts and supplies that are the same as those used in the manufacture and installation of original products.

PART 2 - PRODUCTS

2.1 FASTENERS

- A. All exposed fasteners shall be Phillips head or as otherwise specified, and shall match the finish of the adjacent hardware. All fasteners exposed to the weather shall be non-ferrous or stainless steel. Furnish correct fasteners to accommodate surrounding conditions.
- B. Where torx tamper resistant fasteners have been specified for a specific hardware group, provide torx head fasteners with center pin on ALL exposed fasteners.
- C. Coordinate required reinforcements for doors and frames. Seek approval of the architect prior to furnishing through-bolts. Furnish through-bolts as required for materials not readily reinforced.

2.2 BUTT HINGES

- A. Acceptable manufacturers and respective catalog numbers:

	<u>Ives</u>	<u>Stanley</u>	<u>Hager</u>	<u>McKinney</u>
1. Standard Weight, Plain Bearing	5PB1	F179	1279	T2714
2. Standard Weight, Ball Bearing	5BB1	BB179	BB1279	TB2714

3.	Standard Weight, Ball Bearing, Non-Ferrous	5BB1	FBB191	BB1191	TB2314
4.	Heavy Weight, Ball Bearing	5BB1HW	FBB168	BB1168	T4B3786
5.	Heavy Weight, Ball Bearing, Non-Ferrous	5BB1HW	FBB199	BB1199	T4B3386

- B. Unless otherwise specified, furnish the following hinge quantities for each door leaf.
1. 3 hinges for doors up to 90 inches.
 2. 1 additional hinge for every 30 inch on doors over 90 inches.
 3. 4 hinges for Dutch door applications.
- C. Unless otherwise specified, top and bottom hinges shall be located as specified in division 8 Section "Hollow Metal Doors and Frames". Intermediate hinges shall be located equidistant from others.
- D. Unless otherwise specified, furnish hinge weight and type as follows:
1. Standard weight: plain bearing hinge 5PB1 for interior openings through 36 inches wide without a door closer.
 2. Standard weight: ball bearing hinge 5BB1 for interior opening over 36 through 40 inches wide without a door closer, and for interior openings through 40 inches wide with a door closer.
 3. Heavyweight: 4 ball bearing hinge 5BB1HW for interior openings over 40 inches wide, and for all vestibule doors.
 4. Heavyweight: 4 ball bearing hinge 5BB1HWss for exterior openings unless otherwise listed in groups.
- E. Unless otherwise specified, furnish hinges for exterior doors, fabricated from brass, bronze, or stainless steel. Unless otherwise specified, hinges for interior doors may be fabricated from steel.
- F. Unless otherwise specified, furnish hinges in the following sizes:
1. 5" x 5" 2-1/4" thick doors
 2. 4-1/2" x 4-1/2" 1-3/4" thick doors
- G. Furnish hinges with sufficient width to accommodate trim and allow for 180-degree swing.
- H. Unless otherwise specified, furnish hinges with flat button tips with non-rising pins at interior doors, non-removable loose pins (NRP) at exterior and out-swinging interior doors.
- I. Unless otherwise specified, furnish all hinges to template standards.

2.3 POWER TRANSFERS

- A. Acceptable manufacturers and respective catalog numbers:
- Von Duprin Securitron ABH

- | | | | | |
|----|--------------------|--------|---------|--------|
| 1. | Concealed Two Wire | EPT-2 | CEPT-10 | PT200 |
| 2. | Concealed Ten Wire | EPT-10 | CEPT-10 | PT1000 |

- B. Door cords shall be armored cable with screw on caps.
- C. Concealed power transfers shall be concealed in the door and frame when the door is closed.
- D. Concealed power transfers shall have a steel tube to protect wires from being cut.
- E. Concealed power transfers with spring tubes shall be rejected.
- F. Concealed power transfers shall be supplied with a mud box to house all terminations.

2.4 FLUSH BOLTS AND DUST PROOF STRIKES

- A. Acceptable manufacturers and respective catalog numbers:

	<u>Ives</u>	<u>Door Controls</u>	<u>Hager</u>
1. Dust Proof Strike	DP2	80	280X
2. Auto Flush Bolt (Metal Door)	FB31P	842	292D
3. Auto Flush Bolt (Wood Door)	FB41P	942	291D
4. Manual Flush Bolt	FB458	780	282D

- B. Unless otherwise specified, provide 12" rods for manual flush bolts for door 7'6" or less, 24" top rods for doors over 7'6" to 8'6".
- C. Unless otherwise specified, provide doors over 8'6" with automatic top bolts.
- D. Provide automatic flush bolts where required to maintain fire door listing and or egress requirements on pairs of doors.
- E. All flush-bolt applications shall be UL listed to be installed with top flush-bolt only. Provide auxiliary fire bolt as required for fire rated openings where less bottom bolt has been specified.
- F. Provide all bottom flush bolts with non-locking dust proof strikes.

2.5 EXIT DEVICES

- A. Acceptable manufacturers and respective catalog numbers:

	<u>Von Duprin</u>	<u>Precision</u>	<u>Sargent</u>
1. Wide Stile, Push Pad	99 Series	2000 Series	43-80 Series
2. Narrow Stile, Push Pad	33 Series	20 Series	43-80 Series
3. Lever Trim	996 Series	3900 Series	740 ET

4. Pull Trim 990 Series 1700A Series 800 MAL

- B. Obtain exit devices from a single manufacturer, although several may be indicated as offering products complying with requirements.
- C. On full glass doors there shall be no exposed fasteners on the back of the mechanism visible through the glass.
- D. All exit devices shall be provided with flush end caps to reduce potential damage from impact.
- E. All exit devices shall be provided with dead-locking latch bolts to insure security.
- F. All exit devices shall be U.L. listed for accident hazard. Exit device for use on fire doors shall also be U.L. listed for fire exit hardware.
- G. Provide optional strikes, special length rods, and adapter plates to accommodate door and frame conditions. Provide narrow style series devices in lieu of wide stile series devices where optional strikes will not accommodate door and frame conditions.
- H. Coordinate with related trades to insure adequate clearance and reinforcement is provided in doors and frames. Provide thru bolts as required.
- I. Refer to hardware groups for exit device applications utilizing the option of: "less bottom rod and floor strike" (LBR)
- J. All exit devices shall be provided with optional trim designs to match other lever and pull designs used on the project.
- K. Provide interchangeable core cylinders when used in conjunction with exit devices. Cylinder keyway shall match locksets furnished on this project.
- L. Provide cylinder keyed dogging (interchangeable core) for all non-fire rated exit devices.
- M. Provide glass bead kits as required to accommodate door conditions. Screws shall not be visible through full glass doors.
- N. Where specified, provide compatible keyed mullions with cylinder for pairs of doors.
- O. Provide reinforced crossbars for all traditional style exit devices applied to doors over 36" wide.

2.6 LOCKS AND LATCHES

- A. Acceptable manufacturers and respective catalog numbers:
- | | <u>Schlage</u> | <u>Best</u> | <u>Sargent</u> |
|--------------------|----------------|----------------|----------------|
| 1. Grade 1 Mortise | L Series 17A | 45H Series 14H | 8200 LNP |
- B. Unless otherwise specified, all locks and latches to have:
1. 2-3/4" Backset
 2. 1/2" minimum throw latchbolt
 3. 1" throw deadbolt
 4. 6 pin cylinders
 5. ANSI A115.2 strikes
- C. Provide guarded latch bolts for all locksets, and latch bolts with sufficient throw to maintain fire rating of both single and paired door assemblies.
- D. Length of strike lip shall be sufficient to clear surrounding trim.
- E. Provide wrought boxes for strikes at inactive doors, wood frames, and metal frames without integral mortar covers.

2.7 PULLS, PUSH BARS, PUSH/PULL PLATES

- A. Acceptable manufacturers and respective catalog numbers:
- | | <u>Burns</u> | <u>Hager</u> | <u>Ives</u> |
|---|--------------|--------------|-------------------|
| 1. Straight Pull (1" dia., 10" ctc) | 26C | 4J | 8103EZ-0 |
| 2. Straight Pull (3/4" dia., 8" ctc) | 25B | 3G | 8102-8 |
| 3. Offset Door Pull (1" dia., 10" ctc) | 39C | 12J | 8190-0 |
| 4. Pull / Push-Bar (1" dia., 10" ctc Pull) | 422 x 26C | 153 | 9103EZ-0 |
| 6. Push Plate (.050 4"X 16") | 54 | 30S 4 x 16 | 8200 4 x 16 |
| 7. Push Plate (.050 6"X 16") | 56 | 30S 6 x 16 | 8200 6" X 16" |
| 8. Pull Plate (1" dia., 10" ctc - .050" X 4" X 16") | 5426C | 34J 4 x 16 | 8303EZ-0 4" X 16" |
- B. Adjust dimensions of protection plates to accommodate stile and rail dimensions, lite and louver cutouts, and adjacent hardware. Where required by adjacent hardware, protection plates shall be factory drilled for cylinders or other mortised hardware. All push plates shall be beveled 4 sides and counter sunk.
- C. Where specified, provide surface mounted door edges. Edges shall butt to protective plates. Provide edges with cutouts as required adjacent hardware.
- D. Where possible, provide back-to-back, and concealed mounting for pulls and push bars. Push bar length shall be 3" less door width, or center of stile to center of stile for stile & rail or full glass doors.

2.8 COORDINATORS

- A. Acceptable manufacturers and respective catalog numbers:
- | | <u>Ives</u> | <u>Door Controls</u> | <u>Hager</u> |
|---------------------|-------------|----------------------|--------------|
| 1. Bar Coordinator | COR x FL | 600 x Filler | 297D x 297F |
| 2. Mounting Bracket | MB Series | AB, C Series | 297 Series |
- B. Provide coordinators at all pairs of doors having automatic flush bolts and closers on the inactive leaf, and for pairs of doors having vertical rod/mortise exit device combinations with overlapping astragals.
- C. Provide appropriate filler bars, closer mounting brackets, carry bars, and special top latch preparations as required by adjacent hardware.

2.9 CLOSERS

- A. Acceptable manufacturers and respective catalog numbers:
- | | <u>LCN</u> | <u>Sargent</u> | <u>Corbin</u> |
|-------------------|--------------|-----------------------|---------------|
| 1. 4011 /4111 EDA | 281 / 281P10 | DC8000 A10 /DC8000 A3 | |
- B. Obtain door closers from a single manufacturer, although several may be indicated as offering products complying with requirements.
- C. Provide extra heavy duty arm (EDA / HD) when closer is to be installed using parallel arm mounting.
- D. Closers shall use high strength cast iron cylinders, forged main arms, and 1 piece forged steel pistons.
- E. Closers shall utilize a stable fluid withstanding temperature range of +120deg F to -30deg F without seasonal adjustment of closer speed to properly close the door. Closers for fire-rated doors shall be provided with temperature stabilizing fluid that complies with standards UL10C.
- F. Unless otherwise specified, all door closers shall have full covers and separate adjusting valves for sweeps, latch, and backcheck.
- G. Provide closers for all labeled doors. Provide closer series and type consistent with other closers for similar doors specified elsewhere on the project.
- H. Provide closers with adjustable spring power. Size closers to insure exterior and fire rated doors will consistently close and latch doors under existing conditions. Size all other door closers to allow for reduced opening force not to exceed 5 lbs.
- I. Install closers on the room side of corridor doors, stair side of stairways and interior side of exterior doors.

- J. Closers shall be furnished complete with all mounting brackets and cover plates as required by door and frame conditions, and by adjacent hardware.
- K. Pressure Relief Valve, PRV, shall not be acceptable.

2.10 KICK PLATES AND MOP PLATES

- A. Furnish protective plates as specified in hardware groups.
- B. Where specified, provide 10" kick plates, 36" armor plates, and 4" mop plates. Unless otherwise specified, metal protective plates shall be .050" thick; plastic plates shall be 1/8" thick.
- C. Protective plates shall be 2" less door width, or 1" less door width at pairs. All protective plates shall be beveled 4 sides and counter sunk. Protection plates over 16" shall not be provided for labeled doors unless specifically approved by door manufacturers listing.
- D. Where required by adjacent hardware, protection plates shall be factory drilled for cylinders or other mortised hardware.

2.11 OVERHEAD STOPS

- A. Acceptable manufacturers and respective catalog numbers:

	<u>Glynn-Johnson</u>	<u>Rixson</u>	<u>Sargent</u>
1. Heavy Duty Surface Mount	GJ900 Series	9 Series	590
2. Heavy Duty Concealed Mount	GJ100 Series	1 Series	690
3. Medium Duty Surface Mount	GJ450 Series	10 Series	1540
- B. Overhead stops (including slide block and end caps) shall be fabricated from metal.
- C. Unless otherwise specified, furnish GJ900 series overhead stop for doors equipped with regular arm surface type closers that swing more than 140 degrees before striking a wall, for doors that open against equipment, casework, sidelights, or other objects that would make wall bumpers inappropriate, and as specified in hardware groups.
- D. Furnish sex bolt attachments for wood and mineral core doors unless doors are supplied with proper reinforcing blocks.
- E. Provide special stop only ("SE" suffix) overhead stops when used in conjunction with electronic hold open closers.
- F. Do not provide holder function for labeled doors.

2.12 WALL STOPS AND HOLDERS

- A. Acceptable manufacturers and respective catalog numbers:

	<u>Ives</u>	<u>Hager</u>	<u>Burns</u>
1. Wrought Convex Wall Bumper	WS406CVX	232W	570
2. Wrought Concave Wall Bumper	WS406CCV	236W	575
3. Extended Wall Stop	WS11/WS11X	255W	530
4. Extended Wall Stop	WS33/WS33X	****	****
5. Automatic Wall Holder	WS40	254W	533

- B. Furnish a stop or holder for all doors. Furnish floor stops only where specifically specified.
- C. Where wall stops are not applicable, furnish overhead stops.
- D. Do not provide holder function for labeled doors.

2.13 MAGNETIC HOLD OPENS

- A. Acceptable manufacturers and respective catalog numbers:

	<u>LCN</u>	<u>ABH</u>	<u>Edwards</u>
1. Wall Holder	SEM 7800	2000	1500

- B. Magnetic holder's housing and armature shall be constructed of a die cast zinc material.
- C. Provide types as listed in groups.
- D. Where wall conditions do not permit the armature to reach the magnet, provide extensions.
- E. Provide proper voltage and power consumption as required by Division 16.
- F. Coordinate electrical requirements and mounting locations with other trades.

2.14 WEATHERSTRIP, GASKETING

- A. Acceptable manufacturers and respective catalog numbers:

	<u>Zero</u>	<u>Pemko</u>	<u>NGP</u>	<u>Reese</u>
1. Weatherstrip	429	2891_PK	700NA	755
2. Adhesive Gasket	188	S88	5050	797
3. Mullion Seal/Silencer	8780	5110	5100N	
4. Meeting Edge Seals	8193	18041	9605	959
5. Adhesive Edge Seal	****	S77	5060	****
6. Automatic Door Bottom (Surface Mtd.)	321	4131	222	320
7. Sweeps	8192	18061_NB	B606	964
8. Sweep w/ drip	8198	345_N	C627	354
9. Drip Cap	142	346	16	R201

- B. Where specified in the hardware groups, furnish the above products unless otherwise detailed in groups.
- C. Provide weatherstripping all exterior doors and where specified.
- D. Provide intumescent and other required edge sealing systems as required by individual fire door listings to comply with positive pressure standards UL 10C.
- E. Provide Zero 188 smoke gaskets at all fire rated doors and smoke and draft control assemblies.
- F. Provide gasketing for all meeting edges on pairs of fire doors. Gasketing shall be compatible with astragal design provided by door supplier as required for specific fire door listings.

2.15 THRESHOLDS

- A. Acceptable manufacturers and respective catalog numbers:

	<u>Zero</u>	<u>Pemko</u>	<u>NGP</u>	<u>Reese</u>
1. Saddle Thresholds	8655	171	425	S205
2. Half Saddle Thresholds	1674	227	324	S239
3. Interlocking Threshold	74A	114	442-5	T550
- B. Hardware supplier shall verify all finish floor conditions and coordinate proper threshold as required to insure a smooth transition between threshold and interior floor finish.
- C. Threshold Types:
 - 1. Unless otherwise specified, provide saddle threshold similar to Zero 8655 for all exterior openings with an interior floor finish less than or equal to 1/4" in height.
 - 2. Unless otherwise specified, provide half saddle threshold similar to Reese S239 for all exterior openings with an interior floor finish greater than 1/4" in height. Threshold height shall match thickness of interior floor finish.

2.16 ELECTRIC STRIKES

- A. Acceptable manufacturers and respective catalog numbers:

	<u>Von Duprin</u>	<u>Folger Adams</u>	<u>HES</u>
1. Type 1	6000 Series	300 Series	1000 Series
- B. Provide electric strikes designed for use with the type of locks shown at each opening where specified.
- C. Electric strikes shall be UL listed as Burglary-Resistant Electric Door Strikes and where required shall be UL listed as Electric Strike for Fire Doors.

- D. Provide transformers and rectifiers for each strike as required. Verify voltage with electrical contractor.

2.17 MAGNETIC LOCKS

- A. Acceptable manufacturers and respective catalog numbers:
- | | | |
|----------------|----------------------------|-------------------|
| | <u>Schlage Electronics</u> | <u>Securitron</u> |
| 1. Direct Hold | 490 Series | 82SC |
- B. Provide magnetic locks as specified, complete with mounting brackets and fasteners appropriate to the application. Direct Hold magnetic locks shall have a minimum of 1800 lbs holding force. Shear Locks shall have a minimum of 2700 lbs holding force.
- C. Provide magnetic locks with integral magnetic bond sensor, time delay (1-90 Seconds) for re-locking, and LED status indicator as noted in hardware groups.
- D. Provide regulated and filtered power supplies for magnetic locks by the same manufacturer.

2.18 FINISHES AND BASE MATERIALS

- A. Unless otherwise indicated in the hardware groups or herein, hardware finishes shall be applied over base metals as specified in the following finish schedule:

		<u>BHMA FINISH AND BASE</u>
	<u>HARDWARE ITEM</u>	<u>MATERIAL</u>
1.	Butt Hinges: Exterior, or Non-Ferrous	630 (US32D - Satin Stainless Steel)
2.	Butt Hinges: Interior	652 (US26D - Satin Chromium)
3.	Flush Bolts	626 (US26D - Satin Chromium)
4.	Exit Devices	626 (US26D - Satin Chromium)
5.	Locks and Latches	626 (US26D - Satin Chromium)
6.	Pulls and Push Plates/Bars	630 (US32D - Satin Stainless Steel)
7.	Coordinators	600 (Prime painted or mill alum.)
8.	Closers	689 (Powder Coat Aluminum)
9.	Protective Plates	630 (US32D - Satin Stainless Steel)
10.	Overhead Stops	630 (US32D - Satin Stainless Steel)
11.	Wall Stops and Holders	630 (US32D - Satin Stainless Steel)
12.	Thresholds	628 (Mill Aluminum)
13.	Weather-strip, Sweeps Drip Caps (wood and hollow metal doors)	Aluminum Anodized
14.	Weather-strip, Sweeps Drip Caps (aluminum doors)	Match finish of aluminum doors.
15.	Magnetic Holders	Sprayed Aluminum
16.	Magnetic Locks	628 (US28)
17.	Miscellaneous	626 (US26D - Satin Chromium)

2.19 KEYING

- A. Acceptable manufacturers and respective catalog numbers:

<u>Schlage</u>	<u>Sargent</u>	<u>Best</u>
1. Everest Primus	Signature	Peaks
- B. Provide all locks and cylinders utilizing a patented keyway to prevent manufacturing and distribution of aftermarket key blanks by anyone other than factory authorized dealers.
- C. All locks under this section shall be keyed as directed by the owner to a new Restricted Patented Grand Master Key System.
- D. Keying shall be by lock manufacturer where permanent records shall be kept.
- E. Furnish a total of 2 keys per cylinder. Actual cut keys to be determined by owner.
- F. Master keys and control keys to be delivered by registered mail to the owner. Construction keys shall be delivered to the contractor.

2.20 KEY CABINETS

- A. Acceptable manufacturers and respective catalog numbers:

<u>Lund</u>	<u>Key Control</u>	<u>Telkee</u>
1. 1200-1205 AA	M228-2480	RWC-AWC
- B. Furnish 1 each model 1200 or 1205 AA key cabinet with a capacity 1.5 times the number of key sets.
- C. Provide one key cabinet with at least one hook for each key set, plus additional hooks for 50% expansion.
- D. Furnish key cabinet complete with cam lock, permanent key tags, and change key cards.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. 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. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Steel Doors and Frames: For surface applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.
- B. Wood Doors: Comply with DHI WDHS.5 "Recommended Hardware Reinforcement Locations for Mineral Core Wood Flush Doors."

3.3 INSTALLATION

- A. Mounting Heights: 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. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
- B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing. Do not install surface-mounted items until finishes have been completed on substrates involved.
 - 1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
 - 2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
- C. Lock Cylinders: Install construction cores to secure building and areas during construction period.
 - 1. Replace construction cores with permanent cores as directed by Owner.
- D. Boxed Power Supplies: Locate power supplies as indicated. Verify location with Architect.
- E. Thresholds: Set thresholds for exterior doors and other doors indicated in full bed of sealant complying with requirements specified in Section 07920 "Joint Sealants."

- F. 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 will impede traffic.
- G. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
- H. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.
- I. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

3.4 FIELD QUALITY CONTROL

- A. Independent Architectural Hardware Consultant: Contractor will engage a qualified independent Architectural Hardware Consultant to perform inspections and to prepare inspection reports.
 - 1. Independent Architectural Hardware Consultant 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.

3.5 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. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.
 - 2. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.
- B. Occupancy Adjustment: Approximately six months after date of Substantial Completion, Installer's Architectural Hardware Consultant shall examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors, door hardware, and electrified door hardware.

3.6 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 that door hardware is without damage or deterioration at time of Substantial Completion.

3.7 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain door hardware and door hardware finishes. Refer to Section 01820 "Demonstration and Training."

3.8 DOOR HARDWARE SCHEDULE

HW SET: 01

			HINGES AS REQUIRED
1	EA	EU STOREROOM LOCK	L9080EU-RX (FAIL SECURE)
1	EA	SURFACE CLOSER	4011/4111 EDA
1	EA	KICK PLATE	8400 10" X 2" LDW B4E
1	EA	STOP	
1	EA	POWER SUPPLY	PS902K
1	EA	POWER TRANSFER	EPT10

ACCESS CONTROL BY OTHER SECTION
 PROVIDE GASKETING AT FIRE RATED OPENINGS

HW SET: 02

			HINGES AS REQUIRED
1	EA	EU STOREROOM LOCK	L9080EU-RX (FAIL SECURE)
1	EA	SURFACE CLOSER	4011
1	EA	OVERHEAD STOP	900S
1	EA	KICK PLATE	8400 10" X 2" LDW B4E
1	EA	POWER SUPPLY	PS902K
1	EA	POWER TRANSFER	EPT10

ACCESS CONTROL BY OTHER SECTION
 PROVIDE GASKETING AT FIRE RATED OPENINGS

HW SET: 03

			HINGES AS REQUIRED
1	EA	EU STOREROOM LOCK	L9080EU-RX (FAIL SECURE)
1	EA	SURFACE CLOSER	4111 SCUSH
1	A	KICK PLATE	8400 10" X 2" LDW B4E
1	EA	POWER SUPPLY	PS902K
1	EA	POWER TRANSFER	EPT10

ACCESS CONTROL BY OTHER SECTION
 PROVIDE GASKETING AT FIRE RATED OPENINGS

HW SET: 04

			HINGES AS REQUIRED	
1	EA	EU INSTITUTION LOCK	L9082EU (FAIL SECURE)	SCH
1	EA	SURFACE CLOSER	4011/4111 EDA	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B4E	IVE
1	EA	STOP		
1	EA	POWER SUPPLY	PS902K	SCE
1	EA	POWER TRANSFER	EPT10	VON

ACCESS CONTROL BOTH SIDES BY OTHER SECTION

HW SET: 05

			HINGES AS REQUIRED	
1	EA	PANIC HARDWARE	QEL-RX-99L-NL	
1	EA	CYLINDER	INTERCHANGEABLE CORE	
1	EA	SURFACE CLOSER	4111 EDA	
1	EA	KICK PLATE	8400 10" X 2" LDW B4E	
1	EA	STOP		
1	EA	POWER SUPPLY	PS902-2Q K	
1	EA	POWER TRANSFER	EPT10	

ACCESS CONTROL BY OTHER SECTION

HW SET: 06

			HINGES AS REQUIRED	
1	EA	PANIC HARDWARE	QEL-RX-99L-NL-F	VON
1	EA	CYLINDER	INTERCHANGEABLE CORE	
1	EA	SURFACE CLOSER	4111 EDA	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B4E	IVE
1	EA	STOP		
1	SET	GASKETING	188S	ZER
1	EA	POWER SUPPLY	PS902-2Q K	SCE
1	EA	POWER TRANSFER	EPT10	VON

ACCESS CONTROL BY OTHER SECTION

HW SET: 07

			HINGES AS REQUIRED	
1	EA	PANIC HARDWARE	QEL-RX-99L-NL-F	VON
1	EA	CYLINDER	INTERCHANGEABLE CORE	

1	EA	SURFACE CLOSER	4111 SCUSH	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B4E	IVE
1	SET	GASKETING	188S	ZER
1	EA	POWER SUPPLY	PS902-2Q K	SCE
1	EA	POWER TRANSFER	EPT10	VON

ACCESS CONTROL BY OTHER SECTION

HW SET: 08

			HINGES AS REQUIRED	
1	EA	CLASSROOM LOCK	L9070	SCH
1	EA	STOP		

HW SET: 09

			HINGES AS REQUIRED	
1	EA	CLASSROOM LOCK	L9070	SCH
1	EA	SURFACE CLOSER	4011/4111 EDA	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B4E	IVE
1	EA	STOP		

PROVIDE GASKETING AT FIRE RATED OPENINGS

HW SET: 10

			HINGES AS REQUIRED	
1	EA	CLASSROOM LOCK	L9070	SCH
1	EA	OVERHEAD STOP	900S	GLY

HW SET: 11

			HINGES AS REQUIRED	
1	EA	STOREROOM LOCK	L9080	SCH
1	EA	STOP		

HW SET: 12

			HINGES AS REQUIRED	
1	EA	STOREROOM LOCK	L9080	SCH
1	EA	SURFACE CLOSER	4011	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B4E	IVE
1	EA	STOP		

HW SET: 13

			HINGES AS REQUIRED	
1	EA	STOREROOM LOCK	L9080	SCH
1	EA	OVERHEAD STOP	900S	GLY

HW SET: 14

			HINGES AS REQUIRED	
1	EA	PRIVACY SET	L9040	SCH
1	EA	SURFACE CLOSER	4011	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B4E	IVE
1	EA	STOP		

HW SET: 15

			HINGES AS REQUIRED	
1	EA	PRIVACY SET	L9040	SCH
1	EA	STOP		

HW SET: 16

			HINGES AS REQUIRED	
1	EA	PASSAGE SET	L9010	SCH
1	EA	STOP		

HW SET: 17

			HINGES AS REQUIRED	
1	EA	MORTISE DEADBOLT	L463	SCH
1	EA	DOOR PULL	8102-8	IVE
1	EA	PUSH PLATE	8200 8" X 16"	IVE
1	EA	SURFACE CLOSER	4011	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B4E	IVE
1	EA	STOP		

HW SET: 18

			HINGES AS REQUIRED	
1	EA	DOOR PULL	8102-8	IVE
1	EA	PUSH PLATE	8200 8" X 16"	IVE
1	EA	SURFACE CLOSER	4011	LN
1	EA	OVERHEAD STOP	900H	GLY
1	EA	KICK PLATE	8400 10" X 2" LDW B4E	IVE

HW SET: 19

			HINGES AS REQUIRED	
1	EA	ENTRANCE LOCK	L9453	SCH
1	EA	STOP		

HW SET: 20

			HINGES AS REQUIRED	
1	EA	UTILITY LOCK	L9466	SCH
1	EA	SURFACE CLOSER	4111 EDA	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B4E	IVE
1	EA	STOP		
1	SET	GASKETING	188S	ZER

HW SET: 21

			HINGES AS REQUIRED	
1	EA	STOREROOM LOCK	L9480	SCH
1	EA	SURFACE CLOSER	4011	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B4E	IVE
1	EA	STOP		

HW SET: 22

			HINGES AS REQUIRED	
1	EA	PANIC HARDWARE	99L-BE-F	VON
1	EA	SURFACE CLOSER	4111 SCUSH	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B4E	IVE
1	SET	GASKETING	188S	ZER

HW SET: 23

			HINGES AS REQUIRED	
1	EA	PANIC HARDWARE	LD99EO	VON
1	EA	SURFACE CLOSER	4111 EDA	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B4E	IVE
1	EA	STOP		

HW SET: 24

			HINGES AS REQUIRED	
1	EA	PANIC HARDWARE	CD99L	VON
2	EA	CYLINDER	INTERCHANGEABLE CORE	
1	EA	SURFACE CLOSER	4111 HEDA	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B4E	IVE
1	EA	STOP		

HW SET: 25

HINGES AS REQUIRED				
1	SET	CONST LATCHING BOLT	FB51P	IVE
1	EA	DUST PROOF STRIKE	DP2	IVE
1	EA	PANIC HARDWARE	99L-BE-F	VON
1	EA	COORDINATOR	COR X FL	IVE
2	EA	SURFACE CLOSER	4111 SCUSH	LCN
2	EA	KICK PLATE	8400 10" X 2" LDW B4E	IVE
1	SET	GASKETING	188S	ZER
1	SET	EDGE SEAL	S77D	PEM

HW SET: 26

HINGES AS REQUIRED				
1	SET	CONST LATCHING BOLT	FB51P	IVE
1	EA	DUST PROOF STRIKE	DP2	IVE
1	EA	PANIC HARDWARE	QEL-RX-99L-NL-F	VON
1	EA	CYLINDER	INTERCHANGEABLE CORE	
1	EA	ELECTROMAGNETIC LOCK	M490	SCE
1	EA	ELECTROMAGNETIC LOCK	M490 (INACTIVE LEAF)	SCE
1	EA	COORDINATOR	COR X FL	IVE
2	EA	SURFACE CLOSER	4111 EDA	LCN
2	EA	KICK PLATE	8400 10" X 2" LDW B4E	IVE
2	EA	STOP		
1	SET	GASKETING	188S	ZER
1	SET	EDGE SEAL	S77D	PEM
1	EA	POWER SUPPLY	PS902-2Q K	SE
1	EA	POWER TRANSFER	EPT10	VON

ACCESS CONTROL BY OTHER SECTION

HW SET: 27

HINGES AS REQUIRED				
1	EA	PANIC HARDWARE	QEL9927L-DT LBR	VON
1	EA	PANIC HARDWARE	QEL9927L-NL LBR	VON
1	EA	CYLINDER	INTERCHANGEABLE CORE	
2	EA	SURFACE CLOSER	4111 SHCUSH	LCN
2	EA	KICK PLATE	8400 10" X 2" LDW B4E	IVE
1	EA	POWER SUPPLY	PS902-2Q K	SCE
2	EA	POWER TRANSFER	EPT10	VON

ACCESS CONTROL BY OTHER SECTION

HW SET: 28

			HINGES AS REQUIRED	
1	EA	ALARM PANIC DEVICE	99L-BE ALK EI	VON
1	EA	CYLINDER	INTERCHANGEABLE CORE	
1	EA	SURFACE CLOSER	4111 EDA	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B4E	IVE
1	EA	STOP		
1	EA	POWER SUPPLY	PS9 K	VON
1	EA	POWER TRANSFER	EPT10	VON

ACCESS CONTROL TO SHUNT ALARM BY OTHER SECTION

HW SET: 29

			HINGES AS REQUIRED	
2	EA	SGL DUMMY TRIM	L0170	SCH
2	EA	ROLLER LATCH	RL32 (TOP MOUNT)	IVE
2	EA	OVERHEAD STOP	900S	GLY

HW SET: 30

			HINGES AS REQUIRED	
2	EA	MANUAL FLUSH BOLT	FB458 (BOTTOM OF BOTH LEAFS)	IVE
1	EA	MANUAL FLUSH BOLT	FB458 (TOP INACTIVE)	IVE
3	EA	DUST PROOF STRIKE	DP2	IVE
1	EA	EU INSTITUTION LOCK	L9082EU (FAIL SECURE)	SCH
2	EA	ELECTROMAGNETIC LOCK	M490	SCE
1	EA	POWER SUPPLY	PS902K	SCE
1	EA	POWER TRANSFER	EPT10	VON

BOTTOM FLUSH BOLTS AND EXTRA DUST PROOF STRIKES TO BE HOLD OPENS AT 90 DEGREES
ACCESS CONTROL BOTH SIDES BY OTHER SECTION

HW SET: 31

			HINGES AS REQUIRED	
1	SET	CONST LATCHING BOLT	FB51P	IVE
1	EA	DUST PROOF STRIKE	DP2	IVE
1	EA	EU STOREROOM LOCK	L9080EU-RX (FAIL SECURE)	SCH
1	EA	ELECTROMAGNETIC LOCK	M490 (INACTIVE LEAF)	SCE
1	EA	COORDINATOR	COR X FL	IVE
2	EA	SURFACE CLOSER	4111 EDA	LCN
2	EA	KICK PLATE	8400 10" X 2" LDW B4E	IVE
2	EA	STOP		
1	SET	GASKETING	188S	ZER
1	SET	EDGE SEAL	S77D	PEM

1	POWER SUPPLY	PS902K	SCE
1	POWER TRANSFER	EPT10	VON

ACCESS CONTROL BY OTHER SECTION

HW SET: 32

		HINGES AS REQUIRED - TORX	
1	EA	UL437 DEADBOLT	B863 TORX SCH
1	EA	EU STOREROOM LOCK	L9080EU-RX (FAIL SECURE) TORX SCH
1	EA	SURFACE CLOSER	4111 EDA LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B4E IVE
1	EA	STOP	
1	EA	POWER SUPPLY	PS902K SCE
1	EA	POWER TRANSFER	EPT10 TORX VON

ACCESS CONTROL BY OTHER SECTION

HW SET: 33

		HINGES AS REQUIRED - TORX	
1	EA	UL437 DEADBOLT	B863 TORX SCH
1	EA	STOREROOM LOCK	L9080 TORX SCH
1	EA	STOP	

HW SET: 34

		HINGES AS REQUIRED - TORX	
1	EA	UL437 DEADBOLT	B862 TORX SCH
1	EA	FLUSH PULL	15C TORX HAG
1	EA	PUSH PLATE	8200 8" X 16" TORX IVE
1	EA	STOP	

HW SET: 35

		HINGES AS REQUIRED	
2	EA	MANUAL FLUSH BOLT	FB458 IVE
1	EA	DUST PROOF STRIKE	DP2 IVE
1	EA	PASSAGE SET	L9010 SCH
1	EA	SURFACE CLOSER	4111 SHCUSH X ST LCN
1	EA	OVERHEAD STOP	900H GLY
2	EA	KICK PLATE	8400 10" X 2" LDW B4E IVE
1	SET	WEATHERSTRIP	429 ZER
1	SET	ASTRAGAL SEAL	188S ZER
1	EA	RAIN DRIP	142 ZER
2	EA	DOOR SWEEP	8192 ZER
1	EA	THRESHOLD	8655A ZER

OVERLAPPLING ASTRAGAL BY DOOR MFG. MOUNT ASTRAGAL SEAL ON OVERLAPPLING ASTRAGAL
MOUNT WEATHERSTRIP BEFORE CLOSER, PROVIDE CLOSER WITH SPECIAL TEMPLATE

HW SET: 36

			HINGES AS REQUIRED	
1	EA	PASSAGE SET	L9010	SCH
1	EA	SURFACE CLOSER	4111 SHCUSH X ST	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B4E	IVE
1	SET	WEATHERSTRIP	429	ZER
1	EA	RAIN DRIP	142	ZER
1	EA	DOOR SWEEP	8192	ZER
1	EA	THRESHOLD	8655A	ZER

OVERLAPPLING ASTRAGAL BY DOOR MFG. MOUNT ASTRAGAL SEAL ON OVERLAPPLING ASTRAGAL
MOUNT WEATHERSTRIP BEFORE CLOSER, PROVIDE CLOSER WITH SPECIAL TEMPLATE

HW SET: 37

			HINGES AS REQUIRED	
1	EA	MANUAL FLUSH BOLT	FB458 (BOTTOM)	IVE
1	EA	CONST LATCHING BOLT	FB51T	IVE
1	EA	DUST PROOF STRIKE	DP2	IVE
1	EA	STOREROOM LOCK	L9480	SCH
1	EA	SURFACE CLOSER	4111 SHCUSH X ST	LCN
1	EA	OVERHEAD STOP	900H	GLY
2	EA	KICK PLATE	8400 10" X 2" LDW B4E	IVE
1	SET	WEATHERSTRIP	429	ZER
1	SET	ASTRAGAL SEAL	188S	ZER
1	EA	RAIN DRIP	142	ZER
2	EA	DOOR SWEEP	8192	ZER
1	EA	THRESHOLD	8655A	ZER

OVERLAPPLING ASTRAGAL BY DOOR MFG. MOUNT ASTRAGAL SEAL ON OVERLAPPLING ASTRAGAL
MOUNT WEATHERSTRIP BEFORE CLOSER, PROVIDE CLOSER WITH SPECIAL TEMPLATE

HW SET: 38

			HINGES AS REQUIRED	
1	EA	STOREROOM LOCK	L9480	SCH
1	EA	SURFACE CLOSER	4111 SCUSH X ST	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B4E	IVE
1	SET	WEATHERSTRIP	429	ZER
1	EA	RAIN DRIP	142	ZER
1	EA	DOOR SWEEP	8192	ZER
1	EA	THRESHOLD	8655A	ZER

MOUNT WEATHERSTRIP BEFORE CLOSER, PROVIDE CLOSER WITH SPECIAL TEMPLATE

HW SET: 39

			HINGES AS REQUIRED	
1	EA	PANIC HARDWARE	LD99EO	VON
1	EA	SURFACE CLOSER	4111 SCUSH X ST	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B4E	IVE
1	SET	WEATHERSTRIP	429	ZER
1	EA	RAIN DRIP	142	ZER
1	EA	DOOR SWEEP	8192	ZER
1	EA	THRESHOLD	8655A	ZER

MOUNT WEATHERSTRIP BEFORE CLOSER, PROVIDE CLOSER WITH SPECIAL TEMPLATE

HW SET: 40

			HINGES AS REQUIRED	
1	EA	PANIC HARDWARE	QEL-RX-99NL	VON
1	EA	CYLINDER	INTERCHANGEABLE CORE	
1	EA	SURFACE CLOSER	4111 SCUSH X ST	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B4E	IVE
1	SET	WEATHERSTRIP	429	ZER
1	EA	RAIN DRIP	142	ZER
1	EA	DOOR SWEEP	8192	ZER
1	EA	THRESHOLD	8655A	ZER
1	EA	POWER SUPPLY	PS902-2Q K	SCE
1	EA	POWER TRANSFER	EPT10	VON

ACCESS CONTROL BY OTHER SECTION

MOUNT WEATHERSTRIP BEFORE CLOSER, PROVIDE CLOSER WITH SPECIAL TEMPLATE

HW SET: 41

			HINGES AS REQUIRED	
1	EA	PANIC HARDWARE	LD99L-BE	VON
1	EA	SURFACE CLOSER	4111 SCUSH X ST	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B4E	IVE
1	SET	WEATHERSTRIP	429	ZER
1	EA	RAIN DRIP	142	ZER
1	EA	DOOR SWEEP	8192	ZER
1	EA	THRESHOLD	8655A	ZER

MOUNT WEATHERSTRIP BEFORE CLOSER, PROVIDE CLOSER WITH SPECIAL TEMPLATE

HW SET: 42

			HINGES AS REQUIRED	
1	EA	PANIC HARDWARE	LD99L-BE	VON

1	EA	SURFACE CLOSER	4111 EDA	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B4E	IVE
1	EA	STOP		

HW SET: 43

			HINGES AS REQUIRED	
1	EA	DELAYED EGRESS	CX99NL	VON
2	EA	CYLINDER	INTERCHANGEABLE CORE	
1	EA	ELECTRIC STRIKE	6111 FSE	VON
1	EA	SURFACE CLOSER	4111 SCUSH X ST	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B4E	IVE
1	SET	WEATHERSTRIP	429	ZER
1	EA	RAIN DRIP	142	ZER
1	EA	DOOR SWEEP	8192	ZER
1	EA	THRESHOLD	8655A	ZER
1	EA	WIRING DIAGRAM	BY HARDWARE SUPPLIER	
1	EA	POWER SUPPLY	PS904K	SCE
1	EA	POWER TRANSFER	EPT10	VON

ACCESS CONTROL ON BOTH SIDES BY OTHER SECTION

MOUNT WEATHERSTRIP BEFORE CLOSER, PROVIDE CLOSER WITH SPECIAL TEMPLATE

HW SET: 44

			HINGES AS REQUIRED	
1	EA	DELAYED EGRESS	CX99EO	VON
1	EA	CYLINDER	INTERCHANGEABLE CORE	
1	EA	SURFACE CLOSER	4111 SCUSH	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B4E	IVE
1	EA	WIRING DIAGRAM	BY HARDWARE SUPPLIER	
1	EA	POWER SUPPLY	PS902K	SCE
1	EA	POWER TRANSFER	EPT10	VON

ACCESS CONTROL BY OTHER SECTION

HW SET: 45

			HINGES AS REQUIRED	
1	EA	DELAYED EGRESS	CX9975L-BE RX996L-BE	VON
1	EA	CYLINDER	INTERCHANGEABLE CORE	
1	EA	SURFACE CLOSER	4111 SCUSH	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B4E	IVE
1	EA	WIRING DIAGRAM	BY HARDWARE SUPPLIER	
1	EA	POWER SUPPLY	PS902K	SCE
1	EA	POWER TRANSFER	EPT10	VON

ACCESS CONTROL BY OTHER SECTION

HW SET: 46

			HINGES AS REQUIRED	
1	EA	DELAYED EGRESS	CX9947EO-F	VON
1	EA	DELAYED EGRESS	CX9947L-BE-F RX996L-BE	VON
2	EA	CYLINDER	INTERCHANGEABLE CORE	
2	EA	SURFACE CLOSER	4111 SCUSH	LCN
2	EA	KICK PLATE	8400 10" X 2" LDW B4E	IVE
1	EA	WIRING DIAGRAM	BY HARDWARE SUPPLIER	
1	EA	POWER SUPPLY	PS904K	SCE
2	EA	POWER TRANSFER	EPT10	VON

ACCESS CONTROL BY OTHER SECTION

HW SET: 47

1	EA	CYLINDER	INTERCHANGEABLE CORE	
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BALANCE OF HARDWARE BY DOOR SUPPLIER

HW SET: 48

			HINGES AS REQUIRED	
1	EA	ALARM PANIC DEVICE	99L-NL LX ALK EI	VON
2	EA	CYLINDER	INTERCHANGEABLE CORE	
1	EA	ELECTRIC STRIKE	6111 FSE	VON
1	EA	SURFACE CLOSER	4111 EDA	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B4E	IVE
1	EA	STOP		
1	EA	WIRING DIAGRAM	BY HARDWARE SUPPLIER	
1	EA	POWER SUPPLY	PS9 K	VON
1	EA	POWER SUPPLY	PS902K	SCE
1	EA	POWER TRANSFER	EPT10	VON

ACCESS CONTROL BOTH SIDES BY OTHER SECTION

HW SET: 49

			HINGES AS REQUIRED	
1	EA	ALARM PANIC DEVICE	99L E996L LX ALK EI	VON
2	EA	CYLINDER	INTERCHANGEABLE CORE	
1	EA	SURFACE CLOSER	4111 CUSH	LCN
1	EA	ELEC TRACK HOLDER	4040SEH	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B4E	IVE
1	SET	WEATHERSTRIP	429	ZER
1	EA	DOOR SWEEP	8192	ZER
1	EA	THRESHOLD	8655A	ZER
1	EA	WIRING DIAGRAM	BY HARDWARE SUPPLIER	

1	EA	POWER SUPPLY	PS9 K	VON
1	EA	POWER SUPPLY	PS902K	SCE
1	EA	POWER TRANSFER	EPT10	VON

ACCESS CONTROL BOTH SIDES BY OTHER SECTION

HW SET: 50

			HINGES AS REQUIRED	
1	EA	DELAYED EGRESS	CX99L	VON
2	EA	CYLINDER	INTERCHANGEABLE CORE	
1	EA	SETRONIC CLOSER	4040SE (PUSH SIDE)	LCN
1	EA	OVERHEAD STOP	100SE	GLY
1	EA	KICK PLATE	8400 10" X 2" LDW B4E	IVE
1	SET	WEATHERSTRIP	429	ZER
1	EA	RAIN DRIP	142	ZER
1	EA	DOOR SWEEP	8192	ZER
1	EA	THRESHOLD	8655A	ZER
1	EA	WIRING DIAGRAM	BY HARDWARE SUPPLIER	
1	EA	POWER SUPPLY	PS902K	SCE
1	EA	POWER TRANSFER	EPT10	VON

ACCESS CONTROL ON BOTH SIDES BY OTHER SECTION

MOUNT WEATHERSTRIP BEFORE CLOSER, PROVIDE CLOSER WITH SPECIAL TEMPLATE

HW SET: 51

			HINGES AS REQUIRED	
1	EA	DELAYED EGRESS	CX99L	VON
2	EA	CYLINDER	INTERCHANGEABLE CORE	
1	EA	ELECTRIC STRIKE	6111 FSE	VON
1	EA	AUTO. OPERATOR	9542	LCN
1	EA	OVERHEAD STOP	900S	GLY
1	EA	KICK PLATE	8400 10" X 2" LDW B4E	IVE
1	SET	WEATHERSTRIP	429	ZER
1	EA	RAIN DRIP	142	ZER
1	EA	DOOR SWEEP	8192	ZER
1	EA	THRESHOLD	8655A	ZER
1	EA	WIRING DIAGRAM	BY HARDWARE SUPPLIER	
1	EA	POWER SUPPLY	PS904K	SCE
1	EA	POWER TRANSFER	EPT10	VON

ACCESS CONTROL ON BOTH SIDES BY OTHER SECTION

HW SET: 52

			HINGES AS REQUIRED	
1	EA	PULL/PUSHBAR	9103EZ-0	IVE
1	EA	AUTO. OPERATOR	9542	LCN

1	EA	OVERHEAD STOP	900S	GLY
1	EA	KICK PLATE	8400 10" X 2" LDW B4E	IVE

HW SET: 54

			HINGES AS REQUIRED	
1	EA	DELAYED EGRESS	CX9975L-BE-F RX996L-BE	VON
1	EA	CYLINDER	INTERCHANGEABLE CORE	
1	EA	SURFACE CLOSER	4111 SCUSH	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B4E	IVE
1	SET	GASKETING	188S	ZER
1	EA	WIRING DIAGRAM	BY HARDWARE SUPPLIER	
1	EA	POWER SUPPLY	PS902K	SCE
1	EA	POWER TRANSFER	EPT10	VON

ACCESS CONTROL BY OTHER SECTION

HW SET: 55

			HINGES AS REQUIRED	
1	EA	PASSAGE SET	L9010	SCH
1	EA	SURFACE CLOSER	4111 SCUSH X ST	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B4E	IVE
1	SET	WEATHERSTRIP	429	ZER
1	EA	RAIN DRIP	142	ZER
1	EA	DOOR SWEEP	8192	ZER
1	EA	THRESHOLD	8655A	ZER

MOUNT WEATHERSTRIP BEFORE CLOSER, PROVIDE CLOSER WITH SPECIAL TEMPLATE

HW SET: 56

			HINGES AS REQUIRED	
1	EA	ALARM PANIC DEVICE	99L E996L LX ALK EI	VON
1	EA	SURFACE CLOSER	4111 EDA	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B4E	IVE
1	EA	MAGNETIC HOLD-OPEN	SEM 7850	LCN
1	EA	WIRING DIAGRAM	BY HARDWARE SUPPLIER	
1	EA	POWER SUPPLY	PS9 K	VON
1	EA	POWER SUPPLY	PS902K	SCE
1	EA	POWER TRANSFER	EPT10	VON

ACCESS CONTROL BOTH SIDES BY OTHER SECTION

HW SET: 57

			HINGES AS REQUIRED	
1	EA	DELAYED EGRESS	CX99L	VON

2	EA	CYLINDER	INTERCHANGEABLE CORE	
1	EA	SURFACE CLOSER	4111 SHCUSH	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B4E	IVE
1	EA	WIRING DIAGRAM	BY HARDWARE SUPPLIER	
1	EA	POWER SUPPLY	PS904K	SCE
1	EA	POWER TRANSFER	EPT10	VON

ACCESS CONTROL ON BOTH SIDES BY OTHER SECTION

END OF SECTION 08710

**NEW PASSENGER TERMINAL
DULUTH INTERNATIONAL AIRPORT
DULUTH, MINNESOTA**

**SECTION 09111 – NON-STRUCTURAL
STEEL FRAMING**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes non-load-bearing steel framing members for the following applications:
 - 1. Interior framing systems e.g., supports for partition walls, framed soffits, furring and support for other interior finishes requiring framing.
 - 2. Interior suspension systems supports for ceilings and suspended soffits.
 - 3. Metal strapping as backing for support of wall cabinets, closet shelving and bracketed counter and work surfaces not supported by base cabinets.
- B. Related Sections include the following:
 - 1. Division 5 Section 05400 "Cold-Formed Metal Framing" for exterior and interior load-bearing and exterior non-load-bearing framing.
 - 2. Division 9 Section 09250 "Gypsum Board" for gypsum panels and other components of wall assemblies.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. LEED Submittals:
 - 1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.

1.4 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.
- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- B. Framing Members, General: Comply with ASTM C 754 for conditions indicated.
 - 1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal, unless otherwise indicated.
 - 2. Protective Coating: ASTM A 653/A 653M, G40 hot-dip galvanized, unless otherwise indicated.

2.2 SUSPENSION SYSTEM COMPONENTS

- A. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.0625-inch-diameter wire, or double strand of 0.0475-inch-diameter wire.
- B. Hanger Attachments to Concrete:
 - 1. Anchors: Fabricated from corrosion-resistant materials with holes or loops for attaching wire hangers and capable of sustaining, without failure, a load equal to 5 times that imposed by construction as determined by testing according to ASTM E 488 by an independent testing agency.
 - a. Type: Postinstalled, chemical anchor or postinstalled, expansion anchor.
 - 2. Powder-Actuated Fasteners: Suitable for application indicated, fabricated from corrosion-resistant materials with clips or other devices for attaching hangers of type indicated, and capable of sustaining, without failure, a load equal to 10 times that imposed

by construction as determined by testing according to ASTM E 1190 by an independent testing agency.

- C. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.162-inch diameter.
- D. Carrying Channels: Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.0538 inch and minimum 1/2-inch-wide flanges.
 - 1. Depth: As indicated on Drawings.
- E. Furring Channels (Furring Members):
 - 1. Steel Studs: ASTM C 645.
 - a. Minimum Base-Metal Thickness: 0.0179 inch.
 - b. Depth: As indicated on Drawings.
 - 2. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8 inch deep.
 - a. Minimum Base Metal Thickness: 0.0179 inch.
- F. Grid Suspension System for Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Armstrong World Industries, Inc.; Drywall Grid Systems.
 - b. Chicago Metallic Corporation; Drywall Furring System.
 - c. USG Corporation; Drywall Suspension System.
 - d. Approved equivalent.

2.3 STEEL FRAMING FOR FRAMED ASSEMBLIES

- A. Steel Studs and Runners: ASTM C 645.
 - 1. Minimum Base-Metal Thickness: 0.0312 inch.
 - 2. Depth: As indicated on Drawings.
- B. Slip-Type Head Joints: Where indicated, provide one of the following:
 - 1. Single Long-Leg Runner System: ASTM C 645 top runner with 2-inch-deep flanges in thickness not less than indicated for studs, installed with studs friction fit into top runner and with continuous bridging located within 12 inches of the top of studs to provide lateral bracing.
 - 2. Double-Runner System: ASTM C 645 top runners, inside runner with 2-inch-deep flanges in thickness not less than indicated for

- studs and fastened to studs, and outer runner sized to friction fit inside runner.
3. Deflection Track: Steel sheet top runner 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.
 - a. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) Steel Network Inc. (The); VertiTrack VTD Series.
 - 2) Superior Metal Trim; Superior Flex Track System (SFT).
 - 3) Approved equivalent.
 - C. Firestop Tracks: Top runner manufactured to allow partition heads to expand and contract with movement of the structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.
 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Fire Trak Corp.; Fire Trak attached to studs with Fire Trak Slip Clip.
 - b. Metal-Lite, Inc.; The System.
 - c. Approved equivalent.
 - D. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
 1. Minimum Base-Metal Thickness: 0.0312 inch.
 - E. Cold-Rolled Channel Bridging: 0.0538-inch bare-steel thickness, with minimum 1/2-inch-wide flanges.
 1. Depth: 1-1/2 inches minimum.
 2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 0.068-inch-thick, galvanized steel.
 - F. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
 1. Minimum Base Metal Thickness: 0.0179 inch.
 2. Depth: 7/8 inch.
 - G. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches wall attachment flange of 7/8 inch minimum bare-metal thickness of 0.0179 inch and depth required to fit insulation thickness indicated.

2.4 SHAFT-WALL FRAMING

- A. Studs: Manufacturer's standard profile for repetitive members, corner and end members, and fire-resistance-rated assembly indicated.
 - 1. Depth: As indicated.
 - 2. Minimum Base-Metal Thickness: 0.18 inch.
- B. Runner Tracks: Manufacturer's standard J-profile track with manufacturer's standard long-leg length, but at least 2 inches long and matching studs in depth.
- C. Firestop Tracks: Provide firestop track at head of shaft wall on each floor level.

2.5 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards.
 - 1. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.
- B. Isolation Strip at Exterior Walls: Provide one of the following:
 - 1. Asphalt-Saturated Organic Felt: ASTM D 226, Type I (No. 15 asphalt felt), nonperforated.
 - 2. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch thick, in width to suit steel stud size.

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

3.2 INSTALLATION, GENERAL

- A. Installation Standard: ASTM C 754, except comply with framing sizes and spacing indicated.

1. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.
- B. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
- C. Install bracing at terminations in assemblies.
- D. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.3 INSTALLING SUSPENSION SYSTEMS

- A. Install suspension system components in sizes and spacings indicated on Drawings, but not less than those required by referenced installation standards for assembly types and other assembly components indicated.
- B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.
- C. Suspend hangers from building structure as follows:
 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.
 - a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
 - a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.
 3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
 4. Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure and

- hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
- 5. Do not attach hangers to steel roof deck.
- 6. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
- 7. Do not connect or suspend steel framing from ducts, pipes, or conduit.
- D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.
- E. Seismic Bracing: Sway-brace suspension systems with hangers used for support.
- F. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.
- G. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

3.4 INSTALLING FRAMED ASSEMBLIES

- A. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
- B. Install studs so flanges within framing system point in same direction.
 - 1. Space studs as follows:
 - a. Single-Layer Application: 16 inches o.c., unless otherwise indicated.
 - b. Multilayer Application: 16 inches o.c., unless otherwise indicated.
 - c. Tile backing panels: 16 inches o.c., unless otherwise indicated.
- C. Install tracks (runners) 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 penetrating 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.

2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
 - a. Install two studs at each jamb, unless otherwise indicated.
 - b. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
 3. Other Framed Openings: Frame openings other than door openings the same as required for door openings, unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
 4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
 - a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.
 5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
 6. Curved Partitions:
 - a. Bend track to uniform curve and locate straight lengths so they are tangent to arcs.
 - b. Begin and end each arc with a stud, and space intermediate studs equally along arcs. On straight lengths of not less than 2 studs at ends of arcs, place studs 6 inches o.c.
- D. Direct Furring:
1. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
- E. Z-Furring Members:
1. Erect insulation (specified in Division 7 Section "Building Insulation") vertically and hold in place with Z-furring members spaced 24 inches o.c.
 2. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
 3. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel. At interior corners, space second member no more than 12 inches from corner and cut insulation to fit.

- F. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

END OF SECTION 09111

**NEW PASSENGER TERMINAL
DULUTH INTERNATIONAL AIRPORT
DULUTH, MINNESOTA**

**SECTION 09250
GYPSUM BOARD**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Interior gypsum board and other components of gypsum board wall assemblies.
 - 2. Gypsum board shaft wall assemblies.
 - 3. Tile backing panels.
- B. Related Sections include the following:
 - 1. Division 5 Section 05400 "Cold-Formed Metal Framing" for load-bearing steel framing that supports gypsum board.
 - 2. Division 7 Section 07841 "Through-Penetration Firestop Systems" for head-of-wall assemblies that incorporate gypsum board.
 - 3. Division 9 Section 09111 "Non-Structural Steel Framing" for non-structural framing and suspension systems that support gypsum board.
 - 4. Division 9 Section 09900 "Painting" for primers applied to gypsum board surfaces.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. LEED Submittals:
 - 1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.
 - 2. Product Certificates for Credit MR 5: For products and materials required to comply with requirements for regional materials, certificates indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include

- statement indicating distance to Project, cost for each regional material, and fraction by weight that is considered regional.
3. Product Data for Credit IEQ 4.1: For adhesives used to laminate gypsum board panels to substrates, documentation including printed statement of VOC content.

1.4 QUALITY ASSURANCE

- A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.
- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

1.5 STORAGE AND HANDLING

- A. Store materials inside under cover and keep them dry and protected against damage from weather, condensation, direct sunlight, construction traffic, and other causes. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.
- B. Do not install interior products until installation areas are enclosed and conditioned.
- C. Do not install panels that are wet, those that are moisture damaged, and those that are 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 PANELS, GENERAL

- A. Size: Provide in 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. General: Complying with ASTM C 36/C 36M or ASTM C 1396/C 1396M, as applicable to type of gypsum board indicated and whichever is more stringent.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. American Gypsum Co.
 - b. G-P Gypsum.
 - c. Lafarge North America Inc.
 - d. National Gypsum Company.
 - e. USG Corporation.
- B. Type X:
 - 1. Thickness: 5/8 inch unless otherwise indicated.
 - 2. Long Edges: Tapered.
- C. Type C: ASTM C 1396
 - 1. Thickness: As required by fire-resistance-rated assembly indicated on Drawings.
 - 2. Long Edges: Tapered.
- D. Flexible Type: Manufactured to bend to fit radii and to be more flexible than standard regular-type gypsum board of same thickness.
 - 1. Thickness: 1/4 inch.
 - 2. Long Edges: Tapered.
- E. Ceiling Type: Manufactured to have more sag resistance than regular-type gypsum board.
 - 1. Thickness: 1/2 inch unless otherwise indicated.
 - 2. Long Edges: Tapered.
- F. Abuse-Resistant Type: Manufactured to produce greater resistance to surface indentation, through-penetration (impact resistance), and abrasion than standard, regular-type and Type X gypsum board.

1. Core: As indicated on Drawings.
 2. Long Edges: Tapered.
- G. Moisture- and Mold-Resistant Type: With moisture- and mold-resistant core and surfaces.
1. Core: 5/8 inch, Type X.
 2. Long Edges: Tapered.
- H. Gypsum Shaftliner Board, Type X: ASTM C 1396/C 1396M; manufacturer's proprietary fire-resistive liner panels with paper faces.
1. Panel Size: Provide in maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.
 2. Thickness: 1 inch.
 3. Long Edges: Double bevel

2.3 TILE BACKING PANELS

- A. Water-Resistant Gypsum Backing Board: ASTM C 630/C 630M or ASTM C 1396/C 1396M.
1. Manufacturers: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. American Gypsum Co.
 - b. G-P Gypsum.
 - c. Lafarge North America Inc.
 - d. National Gypsum Company.
 - e. USG Corporation.
 2. Core: As indicated on Drawings.
- B. Glass-Mat, Water-Resistant Backing Board:
1. Complying with ASTM C 1178/C 1178M.
 - a. Product: Subject to compliance with requirements, provide "DensShield Tile Guard" by G-P Gypsum.
 2. Complying with ASTM C1177/C 1177M.
 - a. Product: Subject to compliance with requirements, provide "DensArmor Plus Interior Guard" by G-P Gypsum.
 3. Core: As indicated on Drawings.
- C. Cementitious Backer Units: ANSI A118.9.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Custom Building Products; Wonderboard.
 - b. FinPan, Inc.; Util-A-Crete Concrete Backer Board.
 - c. USG Corporation; DUROCK Cement Board.
3. Thickness: As indicated on Drawings.

2.4 TRIM ACCESSORIES

- A. Interior Trim: ASTM C 1047.
 1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc.
 2. Shapes:
 - a. Cornerbead.
 - b. LC-Bead: J-shaped; exposed long flange receives joint compound.
 - c. L-Bead: L-shaped; exposed long flange receives joint compound.
 - d. Expansion (control) joint.
 - e. Curved-Edge Cornerbead: With notched or flexible flanges.
- B. Aluminum Trim: Extruded accessories of profiles and dimensions indicated.
 1. 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:
 - a. Fry Reglet Corp.
 - b. Gordon, Inc.
 - c. Pittcon Industries.
 2. Aluminum: Alloy and temper with not less than the strength and durability properties of **ASTM B 221**, Alloy 6063-T5.
 3. Finish: Corrosion-resistant primer compatible with joint compound and finish materials specified.

2.5 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C 475/C 475M.
- B. Joint Tape:
 - 1. Interior Gypsum Wallboard: Paper.
 - 2. Exterior Gypsum Soffit Board: Paper.
 - 3. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.
 - 4. Tile Backing Panels: As recommended by panel manufacturer.
- C. Joint Compound for Interior Gypsum Wallboard: 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 compound.
 - a. Use setting-type compound for installing paper-faced metal trim accessories.
 - 3. Fill Coat: For second coat, use setting-type, sandable topping compound.
 - 4. Finish Coat: For third coat, use setting-type, sandable topping compound.
 - 5. Skim Coat: For final coat of Level 5 finish, use setting-type, sandable topping compound.
- D. Joint Compound for Tile Backing Panels:
 - 1. Water-Resistant Gypsum Backing Board: Use setting-type taping compound and setting-type, sandable topping compound.
 - 2. Glass-Mat, Water-Resistant Backing Panel: As recommended by backing panel manufacturer.
 - 3. Cementitious Backer Units: As recommended by backer unit manufacturer.

2.6 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.
- B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.

- C. 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.
 - 2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.
- D. Diamond Mesh: Flattened 9 ga. expanded steel sheet with 1½" x 2" maximum diamond.
- E. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
 - 1. Thickness: as indicated.
 - 2. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
- F. Acoustical Sealant: As specified in Division 7 Section "Joint Sealants."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames and framing, for compliance with requirements and other conditions affecting performance.
- B. Examine panels before installation. Reject panels that are wet, moisture damaged, and 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, except floors. 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.
- 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. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.

3.3 APPLYING INTERIOR GYPSUM BOARD

- A. Install interior gypsum board in the following locations:
 - 1. Type X: As indicated on Drawings.
 - 2. Type C: As indicated on Drawings.
 - 3. Flexible Type: Apply in double layer at curved assemblies.
 - 4. Ceiling Type: As indicated on Drawings.
 - 5. Abuse-Resistant Type: As indicated on Drawings.
 - 6. Moisture- and Mold-Resistant Type: 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), 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.
 - b. At stairwells and other high walls, install panels horizontally, unless otherwise indicated or required by fire-resistance-rated assembly.
3. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

C. Multilayer Application:

1. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
2. Fastening Methods: Fasten base layers and face layers separately to supports with screws.

D. Curved Surfaces:

1. Install panels horizontally (perpendicular to supports) and unbroken, to extent possible, across curved surface plus 12-inch-long straight sections at ends of curves and tangent to them.
2. For double-layer construction, fasten base layer to studs with screws 16 inches o.c. Center gypsum board face layer over joints in base layer, and fasten to studs with screws spaced 12 inches o.c.

3.4 APPLYING TILE BACKING PANELS

- A. Water-Resistant Gypsum Backing Board: Install at showers, tubs, and where indicated. Install with 1/4-inch gap where panels abut other construction or penetrations.
- B. Glass-Mat, Water-Resistant Backing Panel: Comply with manufacturer's written installation instructions and install where indicated. Install with 1/4-inch gap where panels abut other construction or penetrations.

- C. Cementitious Backer Units: ANSI A108.11, at locations indicated to receive tile.
- D. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.5 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, unless otherwise indicated.
 - 2. LC-Bead: Use at exposed panel edges.
 - 3. L-Bead: Use where indicated.
 - 4. Curved-Edge Cornerbead: Use at curved openings.
- D. Exterior Trim: Install in the following locations:
 - 1. Cornerbead: Use at outside corners.
 - 2. LC-Bead: Use at exposed panel edges.
- E. Aluminum Trim: Install in locations indicated on Drawings.

3.6 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 those with trim having flanges not intended for tape.
- 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 2: Panels that are substrate for tile.
 - 3. Level 4: At panel surfaces that will be exposed to view, unless otherwise indicated.

- a. Primer and its application to surfaces are specified in other Division 9 Sections.
- 4. Level 5: Where indicated on Drawings.
 - a. Primer and its application to surfaces are specified in other Division 9 Sections.
- E. Glass-Mat Gypsum Sheathing Board: Finish according to manufacturer's written instructions for use as exposed soffit board.
- F. Glass-Mat, Water-Resistant Backing Panels: Finish according to manufacturer's written instructions.
- G. Cementitious Backer Units: Finish according to manufacturer's written instructions.

3.7 PROTECTION

- A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- B. 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 09250

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**SECTION 09960 – HIGH-PERFORMANCE
COATINGS**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes surface preparation and application of high-performance coating systems on the following substrates:
 - 1. Exterior Substrates:
 - a. Concrete masonry units (CMU).
 - b. Steel.
 - 2. Interior Substrates:
 - a. Steel.
- B. Related Requirements:
 - 1. Division 5 Sections for shop priming of metal substrates with primers specified in this Section.

1.3 DEFINITIONS

- A. Gloss Level 1: Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.
- B. Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- C. 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. Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.
- E. Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.
- F. 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 indicated. Include preparation requirements and application instructions. Include certifications and test results necessary to show compliance with the Contract Documents.
- B. LEED Submittals:
 - 1. Product Data for Credit EQ 4.2: For interior coatings, documentation including printed statement of VOC content.
- C. Samples for Initial Selection: For each type of topcoat product indicated in the form of manufacturer's color charts.
- D. Samples for Verification: For each type of coating system and in each color and gloss of topcoat indicated.
 - 1. Submit (3) three Samples on representative samples of the actual substrate:
 - a. For steel, on 16 ga. Sheet metal, 4 inch x 12 inch.
 - 2. Step coats on Samples to show each coat required for system.
 - 3. Label each coat of each Sample.
 - 4. Label each Sample for location and application area.
- E. Product List: For each product indicated, include the following:
 - 1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
 - 2. Printout of current "MPI Approved Products List" for each product category specified in Part 2, with the proposed product highlighted.
 - 3. VOC content.

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. Coatings: 5 percent, but not less than 1 gal. of each material and color applied.

1.6 QUALITY ASSURANCE

- A. Mockups: Apply mockups of each coating system indicated to verify preliminary selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Architect will select one surface to represent surfaces and conditions for application of each coating system.
 - a. Wall Surfaces: Provide sample of at least 100 sq. ft.
 - b. Other Items: Architect will designate items or areas required.

2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- B. Applicator Qualifications: Installation of high performance coatings shall be performed only by a qualified Applicator. The term qualified means experienced in performing the Work required by this section. The Applicator shall have experience on Projects similar in size and scope to this Project. The Applicator shall submit evidence of such qualifications upon request.
- C. Before starting the work, arrange a pre-construction meeting in accordance with General Conditions. Items for discussion shall include construction procedures and scheduling, surface readiness, application requirements, material storage, and protection.
- D. Material compatibility: provide fillers, primers, finish coat materials, and related materials that are compatible with one another and the indicated substrates under conditions of service and application, as demonstrated by the manufacturer based on testing and field experience.

1.7 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.

1.8 FIELD CONDITIONS

- A. Apply coatings only when temperature of surfaces to be coated and surrounding air temperatures are between 50 and 95 deg F unless otherwise allowed by the manufacturer's written guidelines for application.
- B. Do not apply coatings when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.
- C. Do not apply exterior coatings in snow, rain, fog, or mist.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

HIGH-PERFORMANCE COATINGS
 Bid Package 2A – Issue for Bids
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1. Benjamin Moore & Co.
2. Columbia Paint & Coatings.
3. DuPont de Nemours & Co.
4. ICI Paints.
5. PPG Architectural Finishes, Inc.
6. Sherwin-Williams Company (The).
7. Tnemec Company, Inc.

- B. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, products listed in other Part 2 articles for the paint category indicated.

2.2 HIGH-PERFORMANCE COATINGS, GENERAL

- A. Material Compatibility:
1. Provide materials for use within each coating system that are 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 coating system, provide products recommended in writing by manufacturers of topcoat for use in coating system and on substrate indicated.
 3. Provide products of same manufacturer for each coat in a coating system.
- B. VOC Content:
1. Products shall comply with VOC limits of authorities having jurisdiction.
 2. For interior coatings applied at project site, the following VOC limits, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - a. Nonflat Paints and Coatings: 150 g/L.
 - b. Primers, Sealers, and Undercoaters: 200 g/L.
 - c. Anti-Corrosive and Anti-Rust Paints Applied to Ferrous Metals: 250 g/L.
 - d. Zinc-Rich Primers: 340 g/L.
- C. Colors: As selected by Architect from manufacturer's full range.

2.3 METAL PRIMERS

- A. Primer, Zinc-Rich, Epoxy:
1. "Amercoat 68" (PPG Architectural Finishes, Inc.)
 2. "90/97 Tneme-Zinc" (Tnemec Company, Inc.)

2.4 EPOXY COATINGS

- A. Epoxy, High-Build, Low Gloss:
1. "Amercoat 385" (PPG Architectural Finishes, Inc.)
 2. "Series 66 High Build Epoxoline" (Tnemec Company, Inc.).

2.5 POLYURETHANE COATINGS

- A. Polyurethane, Two-Component, Pigmented, Gloss (Gloss Level 5):
 - 1. "Amercoat 450 S MIO" (PPG Architectural Finishes, Inc.).
 - 2. "Enduralume 1077" (Tnemec Company, Inc.)

2.6 SHOP FINISHING REQUIREMENTS:

- A. Shop paint exposed structural steel surfaces as indicated, except the following:
 - 1. Surfaces to receive stud shear connectors.
 - 2. Contact surfaces of welded or high strength bolted connections.
- B. Prepare exposed structural steel surfaces in accordance with SSPC SP1 and SSPC SP6.
- C. Apply high performance coatings in accordance with high performance coating manufacturer's written instructions.
- D. Surfaces within 2" of any field weld location shall be free of materials that would prevent proper welding or produce objectionable fumes while welding is being done.
 - 1. If shop painted, surfaces to be welded shall be wire brushed in the field before welding, to reduce paint film to a minimum.
 - 2. After welding all abrasions shall be touched up.
- E. Apply shop primer before rust bloom occurs (maximum 4 hours after blast cleaning).
- F. Shop prime and intermediate coat new architecturally exposed structural steel surfaces for a total dry film thickness of not less than 8.5 mils.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for conditions affecting performance of the Work.
- B. Proceed with coating application only after unsatisfactory conditions have been corrected.
 - 1. Beginning coating application constitutes Contractor's acceptance of substrates and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates indicated.

- B. Clean substrates of substances that could impair bond of coatings, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
 - 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce coating systems indicated.
- C. Steel Substrates: Remove rust, loose mill scale, and incompatible shop primer if any. Clean using methods recommended in writing by paint manufacturer.
 - 1. SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
- D. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

3.3 APPLICATION

- A. Apply high-performance coatings according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."
 - 1. Use applicators and techniques suited for coating and substrate indicated.
 - 2. Items to receive HPC-1 shall receive a finish coat for a total dry film thickness of not less than 11.5 mils.
- B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of the same material are to be applied. Tint undercoats to match color of finish coat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.
- C. If undercoats or other conditions show through final coat, apply additional coats until cured film has a uniform coating finish, color, and appearance.
- D. Apply coatings to produce surface films without cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections. Produce sharp glass lines and color breaks.

3.4 FIELD QUALITY CONTROL

- A. Dry Film Thickness Testing: Owner will engage the services of a qualified testing and inspecting agency to inspect and test coatings for dry film thickness.
 - 1. Contractor shall touch up and restore coated surfaces damaged by testing.
 - 2. If test results show that dry film thickness of applied coating does not comply with coating manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with coating 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 coating application, clean spattered surfaces. Remove spattered coatings by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from coating operation. Correct damage by cleaning, repairing, replacing, and recoating, 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 coated surfaces.

3.6 EXTERIOR HIGH-PERFORMANCE COATING SCHEDULE

A. CMU Substrates:

- 1. Epoxy System:
 - a. Block Filler: Block filler, epoxy, (MPI #116 or equal).
 - b. Topcoat: Epoxy, Gloss Level 4, (MPI #77 or equal).

B. Steel Substrates:

- 1. Pigmented Polyurethane over Epoxy Zinc-Rich Primer and High-Build Epoxy System:
 - a. Prime Coat: Primer, zinc-rich, epoxy, (MPI #20 or equal) at minimum dry film thickness of 2.5 to 3.5 mils.
 - b. Intermediate Coat: Epoxy, high-build, low gloss, (MPI #108 or equal) at a minimum dry film thickness of 5.0 to 6.0 mils.
 - c. Topcoat: Polyurethane, two-component, pigmented, gloss (Gloss Level 5), at a minimum dry film thickness of 2.5 to 3.5 mils.

END OF SECTION 09960

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**SECTION 10200 - LOUVERS
AND VENTS**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This section includes fixed, extruded-aluminum louvers.
- B. Related sections include the following:
 - 1. Division 7 Section "Joint Sealants" for sealants installed in perimeter joints between louver frames and adjoining construction.
 - 2. Division 15 Sections for louvers that are a part of mechanical equipment.

1.3 DEFINITIONS

- A. Louver Terminology: Definitions of terms for metal louvers contained in AMCA 501 apply to this Section unless otherwise defined in this Section or in referenced standards.
- B. Horizontal Louver: Louver with horizontal blades; i.e., the axes of the blades are horizontal.
- C. Drainable-Blade Louver: Louver with blades having gutters that collect water and drain it to channels in jambs and mullions, which carry it to bottom of unit and away from opening.
- D. Storm-Resistant Louver: Louver that provides specified wind-driven rain performance, as determined by testing according to AMCA 500-L.

1.4 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Louvers shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of louver components, noise or metal fatigue caused by louver blade rattle or flutter, or permanent damage to fasteners and anchors. Wind pressures shall be considered to act normal to the face of the building.
 - 1. Wind Loads: Determine loads based on a uniform pressure of 20 lbf/sq. ft., acting inward or outward.
- B. Thermal Movements: Provide louvers that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by

preventing buckling, opening of joints, overstressing of components, and other detrimental effects:

1. Temperature Change (Range): 120 degrees F, ambient; 180 degrees F, material surfaces.
- C. Louver Performance Ratings: Provide louvers complying with requirements specified, as demonstrated by testing manufacturer's stock units identical to those provided, except for length and width according to AMCA 500-L.

1.5 SUBMITTALS

- A. Product Data: For each type of product specified.
- B. Shop Drawings: For louvers and accessories. Include plans, elevations, sections, details, and attachments to other work. Show frame profiles and blade profiles, angles, and spacing.
1. Show weep paths, gaskets, flashing, sealant, and other means of preventing water intrusion.
 2. Show mullion profiles and locations.
 3. Wiring Diagrams: For power, signal, and control wiring for motorized adjustable louvers.
- C. Samples for Verification: For each type of metal finish required.
- D. Product Certificates: Signed by manufacturers of louvers certifying that the products furnished comply with requirements and are licensed to bear the AMCA seal based on tests made according to AMCA 500 and complying with AMCA's Certified Ratings Program.

1.6 QUALITY ASSURANCE

- A. Source Limitations: Obtain louvers and vents through one source from a single manufacturer where alike in one or more respects regarding type, design, or factory-applied finish.
- B. Welding Standards: As follows:
1. Comply with AWS D1.2, "Structural Welding Code - Aluminum."
 2. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.
- C. SMACNA Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" recommendations for fabrication, construction details, and installation procedures.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Aluminum Extrusions: ASTM B221, alloy 6063-T5 or T-52.
- B. Aluminum Sheet: ASTM B209, alloy 3003 or 5005 with temper as required for forming, or as otherwise recommended by metal producer for required finish.

- C. Aluminum Castings: ASTM B26, alloy 319.
- D. Fasteners: Of same basic metal and alloy as fastened metal or 300 series stainless steel, unless otherwise indicated. Do not use metals that are incompatible with joined materials.
 - 1. Use types and sizes to suit unit installation conditions.
 - 2. Use Phillips flat-head screws for exposed fasteners, unless otherwise indicated.
- E. Anchors and Inserts: Of type, size, and material required for loading and installation indicated. Use nonferrous metal or hot-dip galvanized anchors and inserts for exterior installations and elsewhere as needed for corrosion resistance. Use toothed steel or expansion bolt devices for drilled-in-place anchors.
- F. Bituminous Paint: Cold-applied asphalt mastic complying with SSPC-Paint 12 but containing no asbestos fibers, or cold-applied asphalt emulsion complying with ASTM D1187.

2.2 FABRICATION, GENERAL

- A. Assemble louvers in factory to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
- B. Maintain equal louver blade spacing to produce uniform appearance.
- C. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining materials' tolerances, and perimeter sealant joints.
- D. Include supports, anchorages, and accessories required for complete assembly.
- E. Provide vertical mullions of type and at spacings indicated, but not more than recommended by manufacturer, or 72 inches o.c., whichever is less. At horizontal joints between louver units, provide horizontal mullions, unless continuous vertical assemblies are indicated.
- F. Provide sill extensions and loose sills made of same material as louvers where indicated or required for drainage to exterior and to prevent water penetrating to interior.
- G. Join frame members to one another and to fixed louver blades with fillet welds, threaded fasteners, or both, as standard with louver manufacturer, concealed from view; unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

2.3 FIXED, EXTRUDED-ALUMINUM LOUVERS

- A. Louver Construction: Provide fixed-blade louvers with extruded-aluminum frames and blades.
- B. Horizontal, Drainable-Blade Louvers: As follows:
 - 1. Louver Depth: 4 inches, unless otherwise indicated.
 - 2. Frame Thickness: 0.081 inch.

3. Blade Thickness: 0.081 inch.
4. Blade Angle and Spacing: 45 degrees and 4 inches o.c. for 4-inch-deep louvers.
5. Maintain a minimum 50% free area.

2.4 LOUVER SCREENS

- A. General: Provide each exterior louver with louver screens complying with the following requirements:
 1. Screen Location for Fixed Louvers: Interior face.
 2. Screening Type: Insect screening, unless otherwise indicated.
- B. Secure screens to louver frames with stainless-steel machine screws, spaced a maximum of 6 inches from each corner and at 12 inches o.c.
- C. Louver Screen Frames: Fabricate screen frames with mitered corners to louver sizes indicated and to comply with the following requirements:
 1. Metal: Same kind and form of metal as indicated for louver to which screens are attached.
 - a. Reinforce extruded-aluminum screen frames at corners with clips.
 2. Finish: Same finish as louver frames to which louver screens are attached.
 3. Type: Rewirable frames with a driven spline or insert for securing screen mesh.
- D. Louver Screening for Aluminum Louvers:
 1. Insect Screening: Aluminum, 18-by-16 (1.4-by-1.6-mm) mesh, 0.012-inch (0.30-mm) wire.

2.5 BLANK-OFF PANELS

- A. Insulated, Blank-Off Panels: Laminated panels consisting of insulating core surfaced on back and front with metal sheets and attached to back of louver.
 1. Thickness: 2 inches.
 2. Metal Facing Sheets: Aluminum sheet, not less than 0.032-inch (0.81-mm) nominal thickness, or Galvanized-steel sheet, not less than 0.028-inch (0.71-mm) nominal thickness.
 3. Insulating Core: Rigid, glass-fiber-board insulation or extruded-polystyrene foam.
 4. Edge Treatment: Trim perimeter edges of blank-off panels with louver manufacturer's standard channel frames, with corners mitered and with same finish as panels.
 5. Seal perimeter joints between panel faces and louver frames with gaskets or sealant.
 6. Panel Finish: Same type of finish applied to louvers, but black color.

2.6 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish louvers after assembly.

2.7 ALUMINUM FINISHES

- A. Finish designations prefixed by AA comply with system established by the Aluminum Association for designating aluminum finishes.
- B. High-Performance Organic Finish: 2-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 1. Color and Gloss: Match Architect's sample.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and openings, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

3.3 INSTALLATION

- A. Locate and place louvers and vents level, plumb, and at indicated alignment with adjacent work.
- B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.
- C. Form closely fitted joints with exposed connections accurately located and secured.
- D. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.
- E. Repair finishes damaged by cutting, welding, soldering, and grinding. Restore finishes so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory, make required alterations, and refinish entire unit or provide new units.
- F. Protect unpainted galvanized and nonferrous-metal surfaces that will be in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint or by separating surfaces with waterproof gaskets or nonmetallic flashing.

- G. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required. Comply with Division 7 Section "Joint Sealants" for sealants applied during louver installation.

3.4 ADJUSTING AND CLEANING

- A. Test operation of adjustable louvers and adjust as needed to produce fully functioning units that comply with requirements.
- B. Clean exposed surfaces of louvers and vents that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate during construction period.
- C. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.
- D. Restore louvers and vents damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.
 - 1. Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

END OF SECTION 10200

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DULUTH, MINNESOTA**

**SECTION 10651 - OPERABLE
PANEL PARTITIONS**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

- 1. Manually operated partitions.
- 2. Electrically operated, folding partitions.

B. Related Sections:

- 1. Section 05500 "Metal Fabrications" for supports that attach supporting tracks to overhead structural system.
- 2. Section 08710 "Finish Hardware" for hardware to the extent not specified in this Section.
- 3. Section 13700 "Computer Controlled Access System" for building security system interface provisions.
- 4. Division 16 Sections for electrical requirements including safety feature wiring.

1.3 DEFINITIONS

- A. NIC: Noise Isolation Class.
- B. NRC: Noise Reduction Coefficient.
- C. SAA: Sound Absorption Average.
- D. STC: Sound Transmission Class.

1.4 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design operable panel partitions, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Acoustical Performance: Provide operable panel partitions tested by a qualified testing agency for the following acoustical properties according to test methods indicated:
 - 1. Sound-Transmission Requirements: Operable panel partition assembly tested in a laboratory for sound transmission loss performance according to ASTM E 90,

calculated according to ASTM E 413, and rated for not less than the STC value indicated.

2. Noise Reduction Requirements: Operable panel partition assembly, identical to partition tested for STC, tested for sound-absorption performance according to ASTM C 423, and rated for not less than the NRC value indicated.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. LEED Submittals:
 1. Product Data for Credit IEQ 4.4: For composite wood and agrifiber products used in operable panel partitions, documentation indicating that products contain no urea formaldehyde.
- C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 1. Indicate storage and operating clearances. Indicate location and installation requirements for hardware and track, blocking, and direction of travel.
 2. Wiring Diagrams: For power, signal, and control wiring.
- D. Samples for Verification: For each type of exposed material, facing material, and finish indicated, prepared on Samples of size indicated below:
 1. Textile: Full width by not less than 36-inch-long section of fabric from dye lot to be used for the Work, with specified treatments applied. Show complete pattern repeat.
 2. Facing Material: Manufacturer's standard-size unit, not less than 12 inches square.
 3. Edge Material: Not less than full width by 3 inches long.
 4. Hardware: Manufacturer's standard exposed door-operating device.

1.6 INFORMATIONAL SUBMITTALS

- A. Setting Drawings: For cutouts required in other work, including support-beam, mounting-hole template.
- B. Qualification Data: For manufacturer and Installer.
- C. Product Certificates: For each type of operable panel partition, from manufacturer.
- D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each operable panel partition.
- E. Warranty: Sample of special warranty.

1.7 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For operable panel partitions to include in maintenance manuals. In addition to items specified in Section 01782 "Operation and Maintenance Data," include the following:
 - 1. Facing materials and finishes for exposed trim and accessories. Include precautions for cleaning materials and methods that could be detrimental to finishes and performance.
 - 2. Seals, hardware, track, carriers, and other operating components.
 - 3. Electric operator.

1.8 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body.
- B. Installer Qualifications: An employer of workers trained and approved by manufacturer.
- C. Fire-Test-Response Characteristics: Provide partitions with finishes meeting the following as determined by testing identical products by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
 - 1. Surface-Burning Characteristics: As determined by testing per ASTM E 84.
 - a. Flame-Spread Index: 25 or less.
 - b. Smoke-Developed Index: 450 or less.
 - 2. Fire Growth Contribution: Meeting acceptance criteria of local code and authorities having jurisdiction when tested according to NFPA 265 or NFPA 286.
- D. 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.

1.9 PROJECT CONDITIONS

- A. Field Measurements: Verify actual dimensions of operable panel partition openings by field measurements before fabrication.

1.10 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of operable panel partitions that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Faulty operation of operable panel partitions.

- b. Deterioration of metals, metal finishes, and other materials beyond normal wear.
- 2. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 OPERABLE PANEL PARTITIONS 117B AND 219C

- A. Operable panel Partition: Operable panel frame with continuously hinged sections designed for horizontal extension and retraction, covered with decorative facing material, reinforced for hardware attachment, supported by overhead suspension system.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Hufcor, Inc.
 - b. Modernfold, Inc.; a DORMA Group company.
- B. Partition Type: Product to be top supported, electrically operated, continuously hinged panels:
 - 1. Panels shall be nominally 3" thick.
 - 2. Frames shall be of 16 gauge painted steel with integral factory applied aluminum vertical edge and face protection.
 - 3. Vertical sound seals shall be of tongue and groove configuration, ensure panel-to-panel alignment and prevent sound leaks between panels.
 - 4. All standard panels shall have bottom retractable seals which provide a minimum of 2" floor clearance during movement of the partition, including all panels adjacent to pass door(s). Retractable bottom floor seal to exert downward seal force when activated. Floating or rigid seals that maintain contact with the floor during partition movement will not be acceptable.
 - 5. Motor shall automatically extend/retract the bottom seals. No floor mounted seal activators are allowed.
 - 6. Panels must provide wall-to-wall contact for security purposes. Operable wall systems that do not extend to the back of storage pocket are not acceptable.
- C. Suspension system:
 - 1. Track shall be of architectural grade extruded aluminum alloy 6063-T6 or 1/4" formed steel, as required. Track design shall provide precise alignment at the trolley running surfaces. Guide rails and/or track sweep seals shall not be required. Track shall be connected to the structural support by pairs of minimum 3/8" dia. threaded steel hanger rods.
 - a. Each panel shall be supported by one 4-wheeled carrier in the track and one internal 4-wheeled carrier. Wheels to be of hardened steel ball bearings encased with molded polymer tires.
 - 2. Factory assembled power unit shall be UL listed and include motor, torque limiter and brake, two key control stations wired in series,

emergency release, and all necessary equipment for electric operation. Roller chain drive shall attach to carrier of lead panel. Limit switches shall be provided to prevent over-travel.

D. Finishes:

1. Face finish shall be high pressure laminate (factory installed) selected by Architect from manufacturer's full range.

E. Dimensions:

1. Stack Width (Stored): Maximum 50 inches.
2. Total Stack Depth (Stored):
 - a. 117B: Maximum 72 inches.
 - b. 219C: Maximum 54 inches.

F. Electric Controls: Remote-control station and emergency release mechanism.

1. Controls integrated with computer controlled access system.

G. Safety Features:

1. Pressure-sensitive leading edge on first panel.
 - a. System shall stop the forward motion of the partition during deployment when a force of 9 lbs. is applied.
 - b. Finish faces of assembly with same material as operable partition surfaces.
2. Pressure –sensitive mats located on both sides of track in the stack area.
 - a. System shall stop stacking motion of partition when a force of 5 lb./sq. in. is applied,
 - b. Mats to recessed into floor with mat edges covered and secured by metal trim.

2.2 OPERABLE PANEL PARTITIONS 320B AND 322B

A. Operable panel Partition: Operable panel frame with continuously hinged sections designed for horizontal extension and retraction, covered with decorative facing material, reinforced for hardware attachment, supported by overhead suspension system.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Hufcor, Inc.
 - b. Modernfold, Inc.; a DORMA Group company.
 - c. Panelfold Inc.

B. Partition Type: Product to be top supported, individual, omni-directional panels:

1. Panels shall be nominally 4" thick.
2. Panel faces shall be laminated to appropriate substrate to meet the STC requirements.

3. Frames shall be of 16 gauge painted steel with integral factory applied aluminum vertical edge and face protection.
4. Vertical sound seals shall be of tongue and groove configuration, ensure panel-to-panel alignment and prevent sound leaks between panels.
5. Horizontal top seals shall be fixed continuous contact dual 4-finger vinyl.
6. Horizontal bottom seals shall be retractable, provide up to 2" [50] nominal operating clearance, and exert downward force when extended.

C. Suspension system:

1. Track shall be of architectural grade extruded aluminum alloy 6063-T6 or 1/4" formed steel, as required. Track design shall provide precise alignment at the trolley running surfaces. Guide rails and/or track sweep seals shall not be required. Track shall be connected to the structural support by pairs of minimum 3/8" dia. threaded steel hanger rods.
 - a. Each panel shall be supported by one carrier in the track.

D. Finishes:

1. Face finish shall be factory-applied stain resistant polyolefin fabric selected by Architect from manufacturer's full range.

E. Dimensions:

1. Stack Width (Stored): Maximum 50 inches.
2. Total Stack Depth (Stored): Maximum 45 inches.

F. Operation:

1. Panels are manually moved from the storage area, positioned in the opening, and seals set.
2. Retractable seals shall be activated by a removable quick-set operating handle located approximately 42" from the floor in the panel edge. Seal activation requires approximately 15 lbs. of force per panel and approximately a 190 degree turn of the removable handle.
3. Final partition closure to be by lever closure panel with expanding jamb which compensates for minor wall irregularities and provides a minimum of 250 lbs. seal force against the adjacent wall for optimum sound control. The jamb activator shall be located approximately 45" from the floor in the panel face and be accessed from either side of the panel. The jamb is equipped with a mechanical rack and pinion gear drive mechanism and shall extend 4"-6" by turning the removable operating handle.

G. Acoustical Performance:

1. Fully deployed partition shall have an NIC rating of 42.

2.3 COMPONENTS

- A. Hardware: Manufacturer's standard manually operated pulls, latches, locks, and bolts as required to operate operable panel partitions; with decorative, protective finish.
- B. Trim: Manufacturer's standard with decorative, protective finish.

2.4 SUSPENSION SYSTEMS

- A. Suspension Tracks: Steel or aluminum with adjustable steel hanger rods for overhead support, designed for type of operation, size, and weight of operable panel partition indicated. Size track to support partition operation and storage without damage to suspension system, operable panel partitions, or adjacent construction. Limit track deflection to no more than 0.10 inch between bracket supports. Provide a continuous system of track sections and accessories to accommodate configuration and layout indicated for partition operation and storage.
- B. Carriers: Trolley system as required for size and weight of partition and for easy, quiet operation; with manufacturer's standard ball-bearing carriers at lead post and manufacturer's standard ball-bearing carriers at intermediate panel supports.
- C. Track Switches and Accessories: Manufacturer's standard switches as required for type of operation, storage, track configuration, and layout indicated.
- D. Aluminum Finish: Mill finish or manufacturer's standard, factory-applied, decorative finish unless otherwise indicated.
- E. Steel Finish: Factory-applied, corrosion-resistant, protective coating unless otherwise indicated.

2.5 ELECTRIC OPERATORS

- A. General: Factory-assembled electric operation system of size and capacity recommended and provided by operable panel partition manufacturer for partition specified; with electric motor and factory-prewired motor controls, speed reducer, chain drive, remote-control stations, control devices, and accessories required for proper operation. Include wiring from motor control to motor. Coordinate operator wiring requirements and electrical characteristics with building electrical system.
- B. Comply with NFPA 70.
- C. Motor Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, within installed environment, with indicated operating sequence, and without exceeding nameplate rating or considering service factor; complying with NEMA MG 1.
- D. Control Equipment: Complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6.
 - 1. Remote-Control Station: For partitions indicated, provide constant-pressure, three-position control station labeled "Open," "Close," and "Stop." Stations shall be connected to building security system card readers for activation.
 - 2. Obstruction-Detection Device: For partitions indicated, provide automatic safety sensor indicated, that causes operator to immediately stop operator.
 - a. Sensor Edge: Contact-pressure-sensitive safety edge along partition's leading edge.
 - 3. Sensor Mat: For partitions indicated, provide electrically-operated, weight sensitive mat located in storage pocket that causes operator to stop.

4. Limit Switches: Provide each partition with adjustable switches, interlocked with motor controls and set to automatically stop operable panel partition at fully extended and fully stacked positions.
5. Safety Interlocks: Provide each partition with safety interlocks to prevent operation of operable panel partition under the following conditions:
 - a. On partition, to prevent operation when partition is extended and locked.
 - b. On storage pocket door, to prevent partition operation if door is not in fully open position.
 - c. On partition, at location of convergence by another partition, to prevent operation if crossing partitions are in place.
6. Emergency Release Mechanism: For partitions indicated, provide quick disconnect-release of electric-motor drive system, permitting manual operation in event of operating failure.

2.6 WOOD MATERIALS, GENERAL

- A. Composite Wood and Agrifiber Products: Fabricate products with composite wood and agrifiber products that do not contain urea formaldehyde.

2.7 FACING MATERIALS

- A. General: Provide facing materials with appropriate backing that comply with indicated fire-test-response characteristics, and that are factory attached to operable panel partitions with concealed fasteners.
 1. Factory-apply facing material free of air bubbles, wrinkles, blisters, and other defects; and with no gaps or overlaps. Tightly secure and conceal raw and selvage edges of facing material for finished appearance. Horizontal butted edges or seams are not permitted.
 2. Where facing material with directional or repeating pattern, directional weave, or matching grain is indicated, mark facing-material top and attach facing material in same direction.
- B. Woven Fabric: Manufacturer's standard woven polyolefin fabric treated to resist stains.
- C. Plastic Laminate: High-pressure decorative laminate; NEMA LD 3, Grade HGS.
- D. Paint: Manufacturer's standard baked enamel.

2.8 STORAGE POCKET DOORS

- A. Storage Pocket Door 117B and 219C: Full height at end of partition runs to conceal stacked partition of same materials, finish, construction, thickness, and acoustical qualities as partition, complete with operating hardware. Hinges in finish to match other exposed hardware.
 1. Rim Lock: Prep door to receive key-operated lock cylinder provided by hardware supplier, to secure storage pocket door in closed position.

- B. Electric Interlock: Provide each pocket door for an electrically operated, operable panel partition with electric interlocks to prevent operation of operable panel partition if pocket door is not in fully open position and tie into computer controlled access system.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine flooring, structural support, and opening, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of operable panel partitions.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Comply with ASTM E 557 except as otherwise required by operable panel partition manufacturer's written installation instructions. Install operable panel partitions level and plumb, with tight joints and uniform appearance, and free of deformation and surface and finish irregularities.
- B. Install operable panel partitions and accessories after other finishing operations, including painting, have been completed.

3.3 ADJUSTING

- A. Adjust operable panel partitions to operate smoothly, without warping or binding. Lubricate hardware and other moving parts.
- B. Adjust storage pocket doors to operate smoothly and easily, without binding or warping. Check and readjust operating hardware. Confirm that latches and locks engage accurately and securely without forcing or binding.
- C. Adjust electric interlocks to properly control operation of electrically operated, operable panel partitions.

3.4 CLEANING

- A. Clean soiled surfaces of operable panel partitions, to remove dust, loose fibers, fingerprints, adhesives, and other foreign materials according to manufacturer's written instructions.

3.5 DEMONSTRATION

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

END OF SECTION 10651

OPERABLE PANEL PARTITIONS
Bid Package 2A – Issue for Bid
10651 - 9

**NEW PASSENGER TERMINAL
DULUTH INTERNATIONAL AIRPORT
DULUTH, MINNESOTA**

**SECTION 13050 - FIRE PROTECTION
GENERAL REQUIREMENTS**

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Work Included:

1. The system shall include all fire department connections, roof manifolds, hose stations, fire department outlets, fire, jockey pumps & controllers valves, wet sprinklers, dry sprinklers, etc. sprinkler heads, piping drain risers, cabinets, alarms as required for a complete system. Building or area will be fully sprinkled (exception only as per local code).
2. All areas will be supplied from a combination standpipe sprinkler riser system.
3. Areas exposed to freezing will have a dry type sprinkler system.
4. Before any work is commenced, shop drawings shall be carefully prepared and submitted for approval. It is required that the sprinkler systems be sized hydraulically in accordance with NFPA standards. Submit hydraulic calcdelivery, and balanced supply and demand for the appropriate hazard class as defined in NFPA 13, latest edition accepted by local authority having jurisdiction. Such drawings and calculations must be reviewed and approved by all governing authorities, Fire Department, Owners Insurance Underwriters, Factory Mutual and/or Industrial Risk Insurers before any work is commenced at the jobsite.

1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.**
- B. Related Work**
1. Division 2, Section 02200, EARTHWORK
 2. Division 2, Section 03300, CAST-IN PLACE CONCRETE.
 3. Division 5, Section 05500, METAL FABRICATIONS.
 4. Division 7, Section 07841, FIRESTOPPING.
 5. Division 7, Section 07920, SEALANTS AND CAULKING.
 6. Division 9, Section 09900, PAINTING.
 7. This section is part of each Division 13000 - "Fire Protection" Section
 8. Division 16, ELECTRICAL
 9. Other Sections where applicable.

1.3 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. Exposed: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Concealed: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.
- D. Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions.
- E. Interior Installations: Protected from weather conditions and not subject to outdoor ambient temperatures.
- F. Piping: Pipe, fittings, flanges, valves, controls, hangers, drains, insulation, and items customarily required in connection with the transfer of gaseous and fluid mediums.
- G. By Other Trades: By persons or parties responsible for work at the project other than the party or parties who have been duly awarded the contract for the work of this Trade. In the event that this document is used to acquire work as part of a general construction contract the words "by other trades" shall mean by persons or parties who are not anticipated to be the sub-contractor for this trade working together with the general contractor. In this context the words "by other trades" shall not be interpreted to mean not included in the overall contract.

1.4 SUBMITTALS

- A. In accordance with Division 1, Section 01330, SUBMITTAL PROCEDURES, prior to purchasing any equipment or materials and prior to assembling or installing the work, the following shall be submitted for approval:
 - 1. Scale drawings indicating insert and sleeve locations if required by Architect or Structural Engineer.
 - 2. Scale drawings showing all piping and duct runs with sizes, elevations and appropriate indication of coordination with other trades. This submission to us shall consist of one (1) original and six (6) prints.
 - 3. Catalog information, factory assembly drawings and field installation drawings as required for a complete explanation and description of all items of equipment. List all manufacturers and certifications. Submit min. six (6) copies.

B. Documents will not be accepted for review unless:

1. They include complete information in accordance with local code and with the applicable sections of NFPA including 10, 13, 14, 20 and 415 pertaining to appurtenances and accessories.
2. They are submitted as a package where they pertain to related items.
3. They are properly marked with service or function, project name, where they consist of catalog sheets displaying other items which are not applicable.
4. They indicate the project name and address along with the Contractor's name, address and phone number.
5. They are properly marked with external connection identification as related to the project where they consist of standard factory assembly or field installation drawings.

C. Shop Drawing Review

1. The purpose of the review of shop drawings is to maintain integrity of the design. Unless the contractor clearly points out changes, substitutions, deletions or any other differences between the submission and the Contract Documents in writing on the Contractor's letterhead, approval by the Engineer or Architect does not constitute acceptance. It is not to be assumed that the engineer has read the text nor reviewed the technical data of a manufactured item and its components except where the Vendor has pointed out differences between his product and the specified model.
2. It is the responsibility of the contractor to confirm all dimensions, quantities, and the coordination of materials and products supplied by him with other trades. Approval of shop drawings containing errors does not relieve the contractor from making corrections at his expense.
3. Substitutions of equipment, systems, materials, must be coordinated by the Contractor with his own or other trades which may be involved with the item, such as, but not limited to, equipment substitutions which change electrical requirements, or hanging or support weights or dimensions.
4. Any extra charges or credits which may be generated by other trades due to substitutions will not be accepted unless the Contractor has an agreement in writing with the Owner.
5. Substitutions of equipment, systems, etc. requiring approval of local authorities must comply with such regulations and be filed at the expense of the Contractor (should filing be necessary). Substitutions are subject to approval or disapproval by the Engineer. The Contractor in offering substitutions shall hold the Owner and Engineer harmless if the substituted item is an infringement of patent held by the specified item.

6. Shop drawings shall show all data required by NFPA and Authorities having Jurisdiction.

D. Explanation of Shop Drawing Stamp

1. Approval indicates that we have not found any reason why this item should not be acceptable within the intent of the documents.
2. Approved As Noted indicates that we have found questionable components which if corrected or otherwise explained make the product acceptable.
3. Resubmit indicates that this item should be resubmitted for approval before further processing.
 - a. If both "Approved As Noted" and "Resubmit" are checked, the resubmittal is for record purposes only.
4. Disapproved indicates that the item will not meet the intent of the Contract
5. No shop drawing stamp or note shall constitute an order to fabricate or ship. Such notification can only be performed by the Project Manager for Construction, the Contractor scheduling his own work, or the Owner.

E. Maintenance Data and Operating Instructions:

1. Maintenance and operating manuals in accordance with Division 1, Section 01400, QUALITY REQUIREMENTS, Paragraph, INSTRUCTIONS, for systems and equipment.
2. After all final tests and adjustments have been completed, fully instruct the proper Owner's Representative in all details of operation for equipment installed. Supply qualified personnel to operate equipment for sufficient length of time to assure that Owner's Representative is properly qualified to take over operation and maintenance procedures. Supply qualified personnel to operate equipment for sufficient length of time as required to meet all governing authorities in operation and performance tests.
3. Furnish required number of manuals, in bound form containing data covering capacities, maintenance of operation of all equipment and apparatus. Operating instruction shall cover all phases of control and include the following:
 - a. Performance Curves: For pumps, and similar equipment at the operating conditions.
 - b. Lubrication Schedule: Indicating type and frequency of lubrication required.
 - c. List of Spares: Recommended for normal service requirements.

- d. Parts List: Identifying the various parts of the equipment for repair and replacement purposes.
 - e. Instruction Books may be standard booklets but shall be clearly marked to indicate applicable equipment.
 - f. Wiring Diagrams: Generalized diagrams are not acceptable, submittal shall be specifically prepared for this Project.
 - g. Automatic Controls: Diagrams and functional descriptions.
- 4. Where applicable, one set of operating and maintenance instructions shall be neatly hung adjacent to the equipment concerned.
- F. Product Data: For the following:
 - 1. Transition fittings.
 - 2. Dielectric fittings.
 - 3. Mechanical sleeve seals.
 - 4. Escutcheons.
- G. Welding certificates.

1.5 QUALITY ASSURANCE

- A. Applicator: Company specializing in piping installation with seven years minimum experience.
- B. Systems, installation, equipment and materials shall conform to requirements of the local Building Code, Owners Insurance Underwriters, Factory Mutual, Industrial Risk Insurers, local Fire Department, N.F.P.A., ANSI/ASME B31.9 "Building Service Piping" and all authorities having jurisdiction. Equipment and materials Underwriters listed, labeled and approved as required.
- C. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."
- D. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
 - 1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
 - 2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.
- E. Products Criteria
 - 1. All equipment and materials shall be new and without blemish or defect.

2. New equipment and materials shall be Underwriters Laboratories, Inc. (U.L.) labeled and/or listed where specifically called for or where normally subject to such U.L. labeling and/or listing services.
3. Asbestos
 - a. All equipment and materials shall be free of asbestos.
4. Electrical equipment and materials shall be products which will meet with the acceptance of the agency inspecting the electrical work. Where such acceptance is contingent upon having the products examined, tested and certified by Underwriters or other recognized testing laboratory, the product shall be examined, tested and certified. Where no specific indication as to the type or quality of materials or equipment is indicated, a first class standard article shall be furnished.
5. Electrical Characteristics for Mechanical Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.
6. It is the intent of these specifications that wherever a manufacturer of a product is specified, and the terms "other approved" or "or approved equal" or "equal" are used, the substituted item must conform in all respects to the specified item. Consideration will not be given to claims that the substituted item meets the performance requirements with lesser construction. Performance as delineated in schedules and in the specifications shall be interpreted as minimum performance. In many cases equipment is oversized to allow for pick-up loads which cannot be delineated under the minimum performance.
7. All equipment of one type shall be the products of one manufacturer.
8. Substituted equipment or optional equipment where permitted and approved, must conform to space requirements. Any substituted equipment that cannot meet space requirements, whether approved or not, shall be replaced at the Contractor's expense. Any modifications of related systems as a result of substitutions shall be made at the Contractor's expense.
9. Note that the approval of shop drawings, or other information submitted in accordance with the requirements hereinbefore specified, does not assure that the Engineer, Architect, or any other Owner's Representative, attests to the dimensional accuracy or dimensional suitability of the material or equipment involved or the ability of the material or equipment involved or the mechanical performance of equipment. Approval of Shop Drawings does not invalidate the plans and specifications if in conflict, unless a letter requesting such change is submitted and approved on the Engineer's letterhead.

10. Substitutions of equipment for that shown on the schedules or designated by model number in the specifications will not be considered if the item is not a regular cataloged item shown in the current catalog of the manufacturer.

1.6 DELIVERY, STORAGE, HANDLING AND PROTECTION

- A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
- B. Store plastic materials in a location protected from direct sunlight or extreme heat. Support to prevent sagging and bending.
- C. This trade shall be responsible for its work and equipment until finally inspected, tested and accepted. Carefully store materials and equipment which are not immediately installed after delivery to site. Close open ends of work with temporary covers or plugs during construction to prevent entry of obstructing material.
- D. This trade shall protect work and material of other trades from damage that might be caused by its work or workmen and make good damage thus caused.

1.7 COORDINATION

- A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for mechanical installations.
- B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
- C. Coordinate requirements for access panels and doors for mechanical items requiring access that are concealed behind finished surfaces.
- D. Provide all designating signs for shutoff valves, control vales, alarms, and the like, as required by the agencies having jurisdiction.

1.8 COORDINATION DRAWINGS

- A. Prepare coordination drawings in accordance with Division 1 Section "PROJECT COORDINATION," to a scale of 3/8"=1'-0" or larger; detailing major elements, components, and systems of mechanical equipment and materials in relationship with other systems, installations, and building components. Indicate locations where space is limited for installation and access and where sequencing and coordination of installations are of importance to the efficient flow of the Work, including (but not necessarily limited to) the following:
 1. Indicate the proposed locations of piping, equipment, and materials. Include the following:
 - a. Planned piping layout, including valve and specialty locations and valve stem movement.

- b. Clearances for servicing and maintaining equipment, including space for equipment disassembly required for periodic maintenance.
 - c. Equipment connections and support details.
 - d. Exterior wall and foundation penetrations.
 - e. Fire-rated wall and floor penetrations.
 - f. Sizes and location of required concrete pads and bases.
 - g. Clearances as required by Electric Code.
- 2. Indicate scheduling, sequencing, movement, and positioning of large equipment into the building during construction.
 - 3. Prepare reflected ceiling plans to coordinate and integrate sprinkler installations, air outlets and inlets, light fixtures, communication systems components and other ceiling-mounted items.

B. Fire Protection Coordination Drawings

- 1. This trade shall add to Coordination Drawings prepared by the HVAC Contractor showing all of the fire protection work (equipment, piping, conduit, etc.) to be installed as part of the work of this section of the specifications.
- 2. This Trade after showing all of the fire protection work shall forward the reproducible Coordination Drawings to the Electrical Contractor.
- 3. The sequence of coordination drawings shall be HVAC-PLBG- C-FP-ELEC-CM.
- 4. The Fire Protection Contractor shall attend a series of meetings arranged by the General Contractor/Construction Manage to resolve any real or apparent interferences or conflicts with the work of the other Contractors.
- 5. The Fire Protection Contractor shall then make adjustments to his work on the Coordination Drawings to resolve any real or apparent interferences or conflicts.
- 6. After any real or apparent interferences and conflicts have been incorporated into the Coordination Drawings, the Fire Protection Contractor shall "sign-off" the final Coordination Drawings.
- 7. The Fire Protection Contractor shall not install any of his work prior to "sign-off" of final Coordination Drawings. If the fire protection work proceeds prior to sign-off of Coordination Drawings, any change to the fire protection work to correct the interferences and conflicts which result will be made by the Fire Protection Contractor at no additional cost to the project.
- 8. Coordination Drawings are for the Contractor's and Architects use during construction and shall not be construed as replacing any shop "as-built", or Record Drawings required elsewhere in these Contract Documents.

9. Architect's review of Coordination Drawings shall not relieve Contractor from his overall responsibility for coordination of all work performed pursuant to the Contract or from any other requirements of the Contract.

C. Record Drawings

1. As part of the required fire protection work, a complete set of "as-built" or record drawings shall be made up and delivered to the architect.
2. The drawings shall show:-
 - a. All work installed exactly in accordance with the original design.
 - b. All installed as a modification or addition to the original design.
 - c. The dimensional information necessary to delineate the exact location of all piping runs which are so concealed as to be untraceable by inspection through the regular means of access established for inspection and maintenance.
3. Where shop drawings have been prepared and approved, the "as-built" drawings shall be cross referenced to the respective shop drawing.
4. As-built record drawings shall include the updating of all equipment schedule sheets.
5. The record drawings shall be of legible reproducible and durable type.
6. The Contractor shall make arrangements with the Engineer to obtain design drawings on DVD or compact diskettes in AutoCad 2005 format for use as a basis for the "as-built" drawings. These documents remain the property of Cosentini Associates and shall be used for no other purpose without expressed, written consent. The contractor shall assume all liabilities resulting from unauthorized use or modifications to the drawings.
7. Prior to developing any "as-built" drawings, the contractor shall coordinate with the Owner and the Architect Engineer the drawing layers, colors, etc., of the CAD drawings.
8. "As-built" information shall be submitted as follows:
 - a. CAD drawing files on DVD or compact diskettes in AutoCad 2005 format.
 - b. One (1) set of reproducible drawings.
9. The quantity of design drawings which are made available shall in no way be interpreted as setting a limit to the number of drawings necessary to show the required "as-built" information.
10. Progress prints of record drawings shall be submitted monthly during the construction period for Architect's approval.
11. This trade shall submit the "as-built" set for approval by the Engineer in a form acceptable to the Engineer.

12. Final acceptance of the fire protection systems by the authority having jurisdiction will not be implemented until "as-built" drawings are on site.

1.9 INTERPRETATION OF THE DRAWINGS AND SPECIFICATIONS

- A. As used in the drawings and specifications, certain non technical words shall be understood to have specific meanings as follows:
 1. "Furnish"-----Purchase and deliver to the project site complete with every necessary appurtenance and support.
 2. "Install"-----Unload at the delivery point at the site and perform every operation necessary to establish secure mounting and correct operation at the proper location in the project.
 3. "Provide"-----"Furnish" and "Install".
- B. Except where modified by a specific notation to the contrary, it shall be understood that the indication and/or description of any item, in the drawings or specifications or both, carries with it the instruction to furnish and install the item, regardless of whether or not this instruction is explicitly stated as part of the indication or description.
- C. It shall be understood that the specifications and drawings are complementary and are to be taken together for a complete interpretation of the work. Where there are conflicts between the drawings and specifications or within the specifications or drawings themselves, the items of higher standard shall govern.
- D. No exclusions from, or limitations, in the language used in the drawings or specifications shall be interpreted as meaning that the appurtenances or accessories necessary to complete any required system or item of equipment are to be omitted.
- E. The drawings of necessity utilize symbols and schematic diagrams to indicate various items of work. Neither of these have any dimensional significance nor do they delineate every item required for the intended installations. The work shall be installed, in accordance with the diagrammatic intent expressed on the drawings, and in conformity with the dimensions indicated on final architectural and structural working drawings and on equipment shop drawings.
- F. No interpretation shall be made from the limitations of symbols and diagrams that any elements necessary for complete work are excluded.
- G. Certain details appear on the drawings which are specific with regard to the dimensioning and positioning of the work. These details are intended only for the purpose of establishing general feasibility. They do not obviate field co-ordination for the indicated work.

- H. Information as to the general construction shall be derived from structural and architectural drawings and specifications only.
- I. The use of words in the singular shall not be considered as limiting where other indications denote that more than one item is referred to.
- J. In the event that extra work is authorized, and performed by this trade, work shown on drawings depicting such work, and/or described by Bulletin is subject to the base building specifications in all respects.

1.10 SEPARATION OF WORK BETWEEN TRADES

- A. The Specifications for the overall construction delineate various items of work under separate trade headings. The list below sets forth this delineation to the extent that it affects the Fire Protection Work.
- B. In the absence of more detailed information, this list shall be taken as a specific instruction to the Fire Protection trade to include the work assigned to it.
- C. Indications that the Fire Protection trade is to perform an item of work mean that it is to perform the work for its own accommodation only, except as specifically noted otherwise.
- D.

Oth	=	Other than electrical or mechanical
Plb	=	Plumbing
FP	=	Fire Protection
Htg	=	Heating, Ventilating & Air Conditioning
Elec	=	Electrical
F	=	Furnished
I	=	Installed
P	=	Provided (furnished and installed)

Item	Oth	Plb	FP	Htg	Elec	Notes
Motor for plumbing equipment			p			
Motor controls for fire protection equipment.			f		i	Specifications and drawings delineate detailed exceptions.
Wiring for plumbing equipment motors and motor controls.					p	Specifications and drawings delineate detailed exceptions.
Temporary heat	p					
Temporary water	p					

Item	Oth	Plb	FP	Htg	Elec	Notes
Temporary light and power.	p					
Temporary toilets.	P					
Temporary fire protection.	p					Specification and drawings delineate detailed exceptions.
Hoisting	p					
Rigging	p					
Bracing of building for safe rigging.			p			
Cutting, chasing and patching	p					Cost where due to late installation, or improper coordination of work is the responsibility of the delinquent trade.
Framed slots and openings in walls decks and slabs.			p			
Sleeves through slabs, decks and walls.			p			
Sleeves through membraned and waterproofed slabs, decks and walls.			p			
Waterproof sealing of pipes passing through sleeves.			p			
Waterproof sealing of sleeves through membraned through membraned and water proofed slabs.			p			
Fireproof sealing of excess openings in slabs, decks and fire rated walls.			p			
Standpipe, Sprinkler piping and heads, and valves.			p			

Item	Oth	Plb	FP	Htg	Elec	Notes
Excavation and backfill inside buildings.	p					
Excavation and backfill outside buildings.	p					
Keeping site and excavations free from water during construction.	p					To accommodate the overall project.
Fastenings			p			
Supports			p			
Concrete encasement of underground runs.	p					
Base flashing for roof drains and all piping penetrating roof.	p					
Cap flashing for all piping penetrating roof.			p			
Concrete foundations, pads and bases.	p					Furnishing of anchors and vibration mounts included in the Fire Protection Trade..
Concrete (masonry) pits.	p					Fire Protection Contractor to furnish sizes and locations.
Pit frames and covers.	p					Fire Protection Trade to furnish sizes and locations.
Trenches in building foundation.	p					
Field touch up painting of damaged shop coats.			p			
Prime coating hangers and supports.			p			
Rustproofing field cut and assembled iron supporting frames and racks.			p			
Finished painting	p					

Item	Oth	Plb	FP	Htg	Elec	Notes
Finished wall and ceiling access doors, panels and supporting frames.			p			Supplying list locating all required access doors (none to be less than 16" x 16") Included in Fire Protection Contractor.
Cat walks to mechanical equipment.	P					Fire Protection Contractor to supply list of locations.
Ladders to mechanical equipment and fire protection valves.	p					Fire Protection contractor to supply list of locations.
Fire hose cabinets and hose.			p			
Fire pump, jockey pump and controller.			p			
Fire extinguishers.	p					
Fire extinguisher cabinets.	p					
Rubbish removal.			p			Where one trade furnishes and another installs, the installing trade removes the shipping and packing materials which accumulate.
Special tools for equipment maintenance.			p			
Fire service from street main, including curb valve and box, double check valve and OS&Y valve connection inside building.			p			
Electric heating cables for pipe tracing.					p	

- A. The Fire Protection Trade is required to supply all necessary supervision and coordination information to any other trades who are to supply work to accommodate the Standpipe and Sprinkler installation.
- B. Where the Fire Protection Trade is required to install items which it does not purchase, it shall include for such items:

1. The co-ordination of their delivery.
2. Their unloading from delivery trucks driven in to any designated point on the property line at grade level.
3. Their safe handling and field storage up to the time of permanent placement in the project.
4. The correction of any damage, defacement or corrosion to which they may have been subjected.
5. Their field assembly and internal connection as may be necessary for their proper operation.
6. Their mounting in place including the purchase and installation of all dunnage supporting members and fastenings necessary to adapt them to architectural and structural conditions.
7. Their connection to building systems including the purchase and installation of all terminating fittings necessary to adapt and connect them to the building systems.

1.2 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

Reference	Definition
ASTM	American Society for Testing Materials
NFPA	National Fire Protection Association
UL	Underwriters Laboratories, Inc.
NEMA	National Electrical Manufacturers Assn.
FM	Factory Mutual
USAS	United States of America Standards Institute
ANSI	American National Standards Institute
AWWA	American Water Works Association
F.S.	Federal Specifications, U.S. Government
I.S.O.	Insurance Services Organization

1.3 CERTIFICATION OF EQUIPMENT AND PIPING SUPPORTS

- A. Provide details for support, restraint and bracing of equipment and piping. Such details shall be of complete detailed shop drawings based on the contractor's installation techniques, equipment arrangement and the specific routing of the work. The submission of shop drawings shall include all necessary calculations and manufacturer's certifications as required to demonstrate the suitability of the proposed installation. Calculations shall be performed by an approved licensed structural engineer with experience in the field of equipment support and seismic design, who shall be retained by the contractor for this purpose.

- B. See Section 13060 "Fire Protection Hanger and Supports" for additional information and requirements.

1.4 UNIT PRICES

- A. Include unit prices (ADD AND DEDUCT) that are to apply for each type of sprinkler head. Unit prices shall include complete installation, receiving, handling, distributing, storing, hoisting, protection, overhead, profit, taxes, etc., and piping, fittings, hangers, escutcheons, heads and all accessories. Provide unit prices for each type of sprinkler head, each type and size of valve, each type and size of piping.

1.5 CODES, PERMITS AND INSPECTIONS

- A. All work shall meet or exceed the latest requirements of all national, state, county, municipal and other authorities exercising jurisdiction over construction work at the project.
- B. All required permits, approval and inspection certificates shall be obtained, paid for, and made available at the completion of the work, by the Fire Protection Contractor.
- C. Any portion of the work which is not subject to the approval of an authority having jurisdiction, shall be governed by the applicable sections of the overall National Fire Code, as published by the National Fire Protection Association (NFPA).
- D. Installation procedures, methods, and conditions shall comply with the latest requirements of The Federal Occupational Safety and Health Act (OSHA)..
- E. Prepare and submit to the building owner a set of "as-built" record drawings for approval, in a form acceptable to the building owner.
- F. The Fire Protection Contractor shall be responsible for the installation and filing until the installation has been approved by the authorities having such jurisdiction and accepted by the building owner.

1.6 GUARANTEES AND CERTIFICATIONS

- A. All work shall be guaranteed to be free from leaks or defects. Any defective materials or workmanship as well as damage to the work of all trades resulting from same shall be replaced or repaired as directed for the duration of stipulated guaranteed periods.
- B. The duration of guarantee periods following the date of beneficial use of the system shall be one year. Beneficial use is defined as operation of the system to obtain its intended use.
- C. The date of acceptance shall be the date of the final payment for the work or the date of a formal notice of acceptance, whichever is earlier.

- D. Certification shall be submitted attesting to the fact that specified performance criteria are met by all items of Fire Protection equipment.

1.7 EXAMINATION OF SITE AND CONTRACT DOCUMENTS

- A. Before submitting prices or beginning work, thoroughly examine the site and the Contract Documents.
- B. No claim for extra compensation will be recognized if difficulties are encountered which examination of site conditions and Contract Documents prior to executing Contract would have revealed.

1.8 WORKMANSHIP

- A. The entire work provided in this Specification shall be constructed and finished in every respect in a workmanlike and substantial manner.
- B. It is not intended that the drawings shall show every pipe, fitting and appliance. Fire Protection Contractor shall furnish and install all such parts as may be necessary to complete the systems in accordance with the best trade practice.
- C. Keep other trades fully informed as to shape, size and position of all openings required for apparatus and give full information to the General Contractor and other trades in a timely manner so that all openings may be built in advance.
- D. In case of failure on the part of the Fire Protection Contractor to give proper and timely information as required above, he shall do his own cutting and patching or have some done by the General Contractor, but in any case, without extra expense to the Owner.
- E. Obtain detailed information from the manufacturers of apparatus as to the proper method of installing and connecting same. Obtain all information from the General Contractor and other trades which may be necessary to facilitate work and completion of the whole project.

1.9 CONTINUITY OF SERVICES

- A. Do not interrupt existing services without Owner's Representative approval.
- B. Schedule interruptions in advance, according to Owner's Representative instructions. Submit, in writing, with request for interruption, methods proposed to minimize impact on Owner's operations. Interruptions shall also be coordinated with the local Fire Department.
- C. Interruptions shall be scheduled at such times of day and work to minimize impact on Owner's operations.

1.10 FIRE FLOW TEST

- A. The Fire Protection Contractor shall perform up-to-date fire flow tests indicating the static and residual pressures in the water mains used for fire service with certified flow volumes at time of test. Tests must be conducted at or near peak demand times of day.
- B. This data must be used in conjunction with Contractor's hydraulic calculations to submit any revised Fire Pump Specifications listing new GPM flow required, head generated, horsepower requirements, etc., for approval by the Engineer.

1.11 UTILITY SERVICES:

- A. This contractor will install sprinkler services to a point 5'-0" beyond the building wall and connect to all services provided by the site utility contractor. Coordinate adaptable materials with Site Contractor.
- B. Services shall be installed in accordance with the provisions of the local authorities having jurisdiction and the Sprinkler Trade shall obtain all necessary approvals.
- C. It is intended that directly or indirectly, all required metered water, services shall be installed ready for operation without additional cost to the Owner.

1.12 SUPERVISORY ALARMS AND ALARM PANEL:

- A. A fire and sprinkler alarm panel will be provided by another trade. The following devices and equipment will be wired to this panel by the Electrical Trade:-
 - 1. Tamper switches - on all fire standpipe and sprinkler control valves.
 - 2. Fire pumps - pump running alarm (each pump) fire pumps power available (each pump), low suction pressure, pump failure to start, pump in off position, phase reversal, phase failure.
 - 3. Waterflow indicators.
 - 4. Alarm check valve flow switch.
 - 5. Dry pipe valve water flow switches.
 - 6. Air compressor power failure switch.
 - 7. Air compressor low air pressure switches.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified. Substitutions will not be permitted unless approved by the Engineer.

2.2 TOOLS AND LUBRICANTS:

- A. Furnish special tools not readily available commercially, that are required for disassembly or adjustment of equipment and machinery furnished.
- B. Lubricants: A minimum of one quart of oil, and one pound of grease, of equipment manufacturer's recommended grade and type, in unopened containers and properly identified as to use for each different application.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Coordinate location of piping, sleeves, inserts, hangers, ductwork and equipment. Locate piping, sleeves, inserts, hangers, and equipment clear of windows, doors, openings, light outlets, and other services and utilities. Follow manufacturer's published recommendations for installation methods not otherwise specified.
- B. All threads on valves, fire department connections, and other equipment to which local fire department could attach hose shall be provided with hose thread to suit local fire department.
- C. All equipment and materials suitable and rated for system water working pressure.
- D. Color finish of valve handles, fire department caps and plugs, etc., as required by local fire department.
- E. The drawings and information included in this specification are given as a guide only, and they therefore do not relieve this Contractor from providing all work and equipment necessary to complete the installation according to the requirements of Local Building Code, Owners Underwriters, N.F.P.A. and all other governing authorities.
- F. The arrangement, positions and connections of pipes, drains, valves, etc., shown on the drawings shall be taken as a close approximation and while they shall be followed as closely as possible, the right is reserved by the Architect and/or Design Engineer to change the locations, to accommodate any conditions which may arise during the progress of the work without additional compensation to this contractor for such changes, provided that the changes are requested prior to the installation of this Contractor's work. The responsibility for accurately laying out the work rests with this Contractor. Should it be found out that any of his work is so laid out that interferences will occur, he shall also report that to the Architect before installation.
- G. The Architect and/or Design Engineer reserves the right to reject any and all work not in accordance with the approved shop drawing.

- H. Whether or not the system shown on the Contract Drawings meets the requirements of the National Fire Protection Association, these specifications require the furnishing and installation of fire protection systems complete in all details and in accordance with local code and the standards of the National Fire Protection Association.

3.2 PROTECTION AND CLEANING:

A. Cleaning of Piping System (General)

- 1. During construction, properly cap, plug and cover all openings in pipe, lines and equipment nozzles so as to prevent the entrance of sand, dirt, and foreign matter. Each system of piping shall be flushed (for the purpose of removing grit, dirt, sand, and foreign matter from the piping), in accordance with NFPA requirements for as long a time as is required to thoroughly clean the systems.

B. Adjusting (General)

- 1. After the entire installation has been completed, make all required adjustments to automatic controls, pressure reducing valves, etc., until all performance requirements are met.

C. All bearings of all equipment shall be oiled or greased as recommended by the manufacturer, after installation.

D. The alignment of each centrifugal pump shall be checked and each pump shall be properly aligned after the pumps are placed in service. Mechanical seals and shaft sleeves shall be replaced by this Contractor without charge in the event that unusual wear or faulty operation occurs during the guarantee period.

E. Cleaning (General)

- 1. Upon completion of the work, all equipment shall be thoroughly cleaned, polished and left in first class condition for final acceptance.

3.3 EXCAVATION AND BACKFILL

- A. The excavation and backfill will be done by the General Contractor. The fire protection trade shall be responsible for the coordination of trench routing, slop and elevation.

3.4 ARCHITECTURAL COORDINATION AND SAMPLES

- A. All devices and appurtenances which are to be installed in all finished areas must be coordinated with the Architect for final approval as it relates to location, finish, materials, color, texture, etc.

- B. Submit samples of all materials requested by the Architect.
- C. Samples shall be prepared and submitted with all postage and transportation costs paid by the Contractor submitting same. Label each sample with identifying numbers and titles.
- D. Submit samples of:-
 - 1. All exposed to view items such as sprinkler heads, etc.

3.5 TESTS

- A. Provide all designating signs for shutoff valves, control valves, alarms, and the like, as required by the agencies having jurisdiction.
- B. Testing of Systems
 - 1. Perform all required tests in the manner prescribed by and to the satisfaction of the local building department and local fire department, NFPA, Owners Insurance Underwriters, and all authorities having jurisdiction. Owners and Architects representatives shall be present to witness tests. Obtain all required certificates of approval and pay any fees or costs in conjunction therewith.
 - 2. Provide and pay for all devices, materials, supplies, labor and power required in connection with all tests. All tests shall be made in the presence and to the satisfaction of the Architect and inspectors having jurisdiction.
 - 3. Defects disclosed by the tests shall be repaired, or if required by the Architect, defective work shall be replaced with new work without extra charge to the Owner. Tests shall be repeated as directed, until all work is proven satisfactory.
 - 4. This Contractor shall also be responsible for the work of other trades that may be damaged or disturbed by the tests, or the repair or replacement of his own work, and he shall, without extra charge to the Owner, restore to its original condition, work of the trades so damaged and disturbed, engaging the original Contractors to do the work of restoration.

3.6 TESTING OF FIRE SAFETY SYSTEMS

- A. Include in the base bid price sufficient man hours to conduct tests of fire safety systems. The trades shall jointly assign personnel to test the following
 - 1. Electric
 - 2. HVAC Fans and Dampers
 - 3. Automatic Controls and Signals
 - 4. Fire Suppression System (Sprinkler, Standpipe, Pre-action, etc.)
 - 5. Fire Protective Alarm System

- B. This trade shall coordinate with other trades and jointly test all systems. When all systems are working properly, inform Owner in writing so that Owner's representative can witness.

3.7 TEMPORARY FIRE PROTECTION DURING CONSTRUCTION - UTILIZATION OF FIRE STANDPIPE SYSTEM

- A. The permanent fire standpipe system shall be utilized for temporary fire protection all in accordance with the Fire Department and Building Department standards.
- B. Portions of fire standpipe system supplemented with temporary piping, (booster pumps when required by Authority having jurisdiction,) etc., as required; including siamese connections, hose valves, etc., shall be kept in active working order and such temporary fire protection means shall be continually installed and extended as closely following the installation of the general construction as practical.
- C. Inform the local Fire Department and the Architect of the extent of temporary fire standpipe system available for Fire Department use (location of temporary and permanent siamese connections, hose stations, etc.). Submit periodically scheduled reports to the local Fire Department indicating the extent of the temporary and permanent fire standpipe facilities available for fire fighting used.

END OF SECTION 13050

**NEW PASSENGER TERMINAL
DULUTH INTERNATIONAL AIRPORT
DULUTH, MINNESOTA**

**SECTION 13053 - FIRE PROTECTION
GENERAL MATERIALS AND METHODS**

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. This Section includes the following:

1. Piping materials and installation instructions common to most piping systems.
2. Transition fittings.
3. Dielectric fittings.
4. Mechanical sleeve seals.
5. Sleeves.
6. Escutcheons.
7. Grout.
8. Access doors.
9. Equipment installation requirements common to equipment sections.
10. Painting.
11. Concrete bases.
12. Supports and anchorages.

1.2 RELATED DOCUMENTS

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

B. Related Work

1. Division 2, Section 02200, EARTHWORK
2. Division 2, Section 03300, CAST-IN PLACE CONCRETE.
3. Division 5, Section 05500, METAL FABRICATIONS.
4. Division 7, Section 07841, FIRESTOPPING.
5. Division 7, Section 07920, SEALANTS AND CAULKING.
6. Division 9, Section 09900, PAINTING.
7. Division 13, Section 13050 - BASIC FIRE PROTECTION REQUIREMENTS.
8. Division 16, ELECTRICAL
9. Other Sections where applicable.

1.3 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.
- F. Piping: Pipe, fittings, flanges, valves, controls, hangers, drains, insulation, and items customarily required in connection with the transfer of fluids.
- G. By Other Trades: By persons or parties responsible for work at the project other than the party or parties who have been duly awarded the contract for the work of this Trade. In the event that this document is used to acquire work as part of a general construction contract the words "by other trades" shall mean by persons or parties who are not anticipated to be the sub-contractor for this trade working together with the general contractor. In this context the words "by other trades" shall not be interpreted to mean not included in the overall contract.

1.4 SUBMITTALS:

- A. See Section 13050, "Basic Fire Protection Requirements" for requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified. Substitutions will not be permitted unless approved by the Engineer.

2.2 PIPE, TUBE, AND FITTINGS

- A. Refer to individual Division 13 Sections 13915 "Fire Suppression Piping" for pipe, tube, and fitting materials and joining methods.

2.3 JOINING MATERIALS

- A. Refer to individual Division 13 piping Sections 13915 "Fire Suppression Piping" for joining methods and materials.

2.4 DIELECTRIC FITTINGS

- A. Refer to individual Division 13 Section 13915 "Fire Suppression Piping" for dielectric fittings.

2.5 MECHANICAL SLEEVE SEALS

- A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
 - 1. Manufacturers:
 - a. Advance Products & Systems, Inc.
 - b. Calpico, Inc.
 - c. Metraflex Co.
 - d. Pipeline Seal and Insulator, Inc.
 - 2. Sealing Elements: NBR interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 - 3. Pressure Plates: Stainless steel. Include two for each sealing element.
 - 4. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.6 SLEEVES

- A. General:
 - 1. Provide sleeves for each pipe passing through walls, partitions, floors, and roofs. Penetrations in fire/smoke rated components shall be by UL listed assembly.
- B. Galvanized-Steel Sheet: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.
- C. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.
- D. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- E. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
 - 1. Underdeck Clamp: Clamping ring with set screws.

F. Molded PVC: Permanent designed to be embedded in concrete, with nailing flange for attaching to wooden forms.

G. Sleeve Materials

Type Designation

1	Galvanized steel sheet.
2	Standard weight galvanized steel pipe.
3	Standard weight galvanized steel pipe 1/4" steel plate extending from outside of sleeve a minimum of 2" all around, similar to F&S Mfg. Corp. Fig. 204.
4	Cast iron pipe sleeve with center flange, similar to James B. Clow & Sons No. F-1430 and F-1435.
5	Standard weight galvanized steel pipe with flashing clamp device welded to pipe sleeve or watertight sleeves, similar to Zurn 195-10 with oakum and lead caulking as required.
6	Metal deck and wall sleeves. Similar to Adjust-to-Crete Manuf., Co.

H. Sleeve Sizes

1. Floors and required fire rated partitions - 1/2" maximum clearance between outside of pipe (or insulation on insulated pipes) and inside of sleeve.
2. Partitions not fire rated - 1-1/2" maximum clearance between outside of pipe (or insulation on insulated pipes) and inside of sleeve.

I. Sleeve Lengths

Location	Sleeve Length
Floors	Equal to depth of floor construction including finish. In waterproof floor construction sleeves to extend minimum of 2" above finished floor level.
Roofs	Equal to depth of roof construction including insulation.
Walls & Partitions	Equal to depth of construction and terminated flush with finished surfaces.

J. Sleeve Caulking & Packing

Type Designation	Caulking & Packing Requirements
A	Space between pipe and sleeve packed with oakum or hemp and caulked watertight with lead.
B	Space between pipe or pipe covering and sleeve shall be caulked with an incombustible permanently plastic, waterproof non-staining smooth appearance or pack with mineral wool or other equally approved fire resistive material to within ½" of both wall faces and provide caulking compound as per above.

K. Sleeve Application

Sleeve Type Thru Required Fire Rated Construction	Sleeve Type Thru Non-Fire Rated Construction	Location	Sleeve Caulking & Packing Type Designation	Sleeve Caulking & Packing Type Thru Fire Rated Construction
5	5	Membrane waterproof floor, roof & wall construction.	B	B
5	5	Non-membrane waterproof floor, roof & wall construction where flashing is required.	A or B	B
2	1, 2	Interior walls, partitions & floors.	B	B
3 or 4	3 or 4	Exterior walls.	A	A
2	6	Cellular metal deck floors.	B	B

Sleeve Type Thru Required Fire Rated Construction	Sleeve Type Thru Non-Fire Rated Construction	Location	Sleeve Caulking & Packing Type Designation	Sleeve Caulking & Packing Type Thru Fire Rated Construction
1	1	Precast concrete floor with poured con- crete topp- ing. Note: Sleeves to have flat flanges and/ or guides which rest on top of precast slab.	B	B

2.7 ESCUTCHEONS

- A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
- B. One-Piece, Stamped-Steel Type: With set screw or spring clips and chrome-plated finish.
- C. Split-Plate, Stamped-Steel Type: With concealed or exposed-rivet hinge, set screw or spring clips, and chrome-plated finish.

2.8 GROUT

- A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
 - 1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
 - 2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
 - 3. Packaging: Premixed and factory packaged.

2.9 FIRESTOPPING

- A. In addition to fire protection means specified elsewhere in this specification, this trade shall comply with the following:

1. All pipe penetrations requiring Fire Stopping shall be "UL" approved thru-wall fire stop assemblies.
2. Contractor shall provide assembly for each type of pipe material thru fire-rated wall thickness.
3. Fire Stopping assemblies shall be installed as approved by local authority having jurisdiction.
4. Fire stop assemblies shall be Rectorseal, 3M, Hilti, Tremco, or approved equal.

2.10 PIPE AND EQUIPMENT SUPPORTS AND RESTRAINTS

- A. See Division 13, Section 13060 "Fire Suppression Supports and Hangers".

2.11 TOOLS AND LUBRICANTS

- A. Furnish special tools not readily available commercially, that are required for disassembly or adjustment of equipment and machinery furnished.
- B. Lubricants: A minimum of one quart of oil, and one pound of grease, of equipment manufacturer's recommended grade and type, in unopened containers and properly identified as to use for each different application.

2.12 ACCESS DOORS IN FINISHED CONSTRUCTION

- A. Access Doors
 1. Access doors as required for operation and maintenance of concealed equipment, valves, controls, etc. will be provided by another trade.
 2. This Trade is responsible for access door location, size and its accessibility to the valves or equipment being served.
 3. Coordinate and prepare a location, size, and function schedule of access doors required and deliver to a representative of the installing trade.
 4. Access doors shall be of ample size, minimum of 16" x 16"..

2.13 FOUNDATIONS

- A. General
 1. All equipment, piping, etc., mounted on/or suspended from approved foundations and supports, as shown on the drawings and as specified in Section 13060, "Fire Protection Supports and Hangers".

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Coordinate location of piping, sleeves, inserts, hangers, ductwork and equipment. Locate piping, sleeves, inserts, hangers, and equipment clear of windows, doors, openings, light outlets, and other services and utilities. Follow manufacturer's published recommendations for installation methods not otherwise specified.

3.2 PROTECTION AND CLEANING:

- A. See Section 13050 - "Fire Protection Basic Requirements" for requirements.

3.3 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. Install piping according to the following requirements and Division 13 Sections specifying piping systems.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping to permit valve servicing.
- G. Install piping at indicated slopes.
- H. Install piping free of sags and bends.
- I. Install fittings for changes in direction and branch connections.
- J. Install piping to allow application of insulation as required.
- K. Select system components with pressure rating equal to or greater than system operating pressure.
- L. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:
 - 1. One-piece, stamped-steel type with spring clips.

- M. Sleeves are not required for core-drilled holes or for holes formed by removable PE sleeves.
- N. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.
 - 1. Cut sleeves to length for mounting flush with both surfaces.
 - (a) Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas **2 inches (50 mm)** above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
 - 2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
 - 3. Install sleeves that are large enough to provide **1/4-inch (6.4-mm)** annular clear space between sleeve and pipe or pipe insulation. Use the sleeve materials as specified in paragraph 2 of this section:
 - (a) Steel Pipe Sleeves: For pipes smaller than **NPS 6 (DN 150)**.
 - (b) Steel Sheet Sleeves: For pipes **NPS 6 (DN 150)** and larger, penetrating gypsum-board partitions.
 - 4. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing: Secure flashing between clamping flanges. Install sleeve to extend sleeve to **2 inches (50 mm)** above finished floor level. Refer to Division 7 Section "Sheet Metal Flashing and Trim" for flashing.
 - 5. Seal space outside of sleeve fittings with grout.
 - 6. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 7 Section "Joint Sealants" for materials and installation.
 - 7. For exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for **1-inch (25-mm)** annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- O. Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- P. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to paragraph 2 of this section and Division 7 Section "Through-Penetration Firestop Systems" for materials.

- Q. Verify final equipment locations for roughing-in prior to installing sleeves.
- R. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.4 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 13 Sections specifying piping systems - Section 13915, "Fire Suppression Piping".

3.5 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.
- B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- C. Install mechanical equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
- D. Install equipment to allow right of way for piping installed at required slope.

3.6 CONCRETE BASES

- A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to Division 13 Section 13060 "Fire Protection Supports and Hangers".

3.7 ERECTION OF WOOD METAL SUPPORTS AND ANCHORAGES

- A. Refer to Division 5 Section 05500 "Metal Fabrications" for structural steel.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.
- C. Refer to Division 13 Section 13060 "Fire Protection Supports and Hangers" for additional requirements.
- D. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor mechanical materials and equipment.

3.8 GROUTING

- A. Mix and install grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors.
- B. Clean surfaces that will come into contact with grout.

- C. Provide forms as required for placement of grout.
- D. Avoid air entrapment during placement of grout.
- E. Place grout, completely filling equipment bases.
- F. Place grout on concrete bases and provide smooth bearing surface for equipment.
- G. Place grout around anchors.
- H. Cure placed grout.

3.9 PAINTING

- A. Painting of mechanical systems, equipment, and components is specified in Division 9 Section.
- B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.
- C. All electrical motors, pump casings, and other apparatus shall be provided with factory applied protective coating and after installation shall be carefully cleaned, rubbed down and oiled.
- D. For protective coatings of other equipment such as hangers, etc., refer to that section of the specification wherein construction data is described.
- E. Provide prime coat painting for the following:-
 - 1. Miscellaneous steel and iron provided by this trade.
 - 2. Hangers and supports.

3.10 DRIP PANS

- A. Examine the drawings and in cooperation with the Electrical Trade confirm the final location of all electrical equipment to be installed in the vicinity of piping. Plan and arrange all overhead piping no closer than two feet from a vertical line to electric motors and controllers, switchboards, panelboards, or similar equipment. Piping is not permitted in Electric Equipment, Transformer, Switch Gear, Telephone Rooms. Except as required by the authority having jurisdiction to provide fire suppression.
- B. Where the installation of piping does not comply with the requirements of foregoing paragraph, the piping shall be relocated.
- C. Furnish gutters as follows:
 - 1. Provide and erect a gutter of 16 ounce cold rolled copper or 18 gauge galvanized steel, under every pipe which is within 2'-0" from a vertical line to any motor, electrical controllers, switchboards, panelboards, or the like.

2. Each gutter shall be reinforced, rimmed, soldered and made watertight, properly suspended and carefully pitched to a convenient point for draining. Provide a 3/4" drain, with valve as directed, to nearest floor drain or slop sink, as approved.
3. In lieu of such separate gutters, a continuous protecting sheet of similar construction adequately supported and braced, properly rimmed, pitched and drained, may be provided over any such motor, and extending 2'-0" in all directions beyond the motor, over which such piping has to run.

END OF SECTION 13053

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SECTION 13055 - FIRE PROTECTION MOTORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes basic requirements for factory-installed and field-installed motors.
- B. Related Sections include the following:
 - 1. Division 13 Section Fire Protection Vibration and Seismic Controls for mounting motors and vibration isolation and seismic-control devices.
 - 2. Division 13 Sections 13921, 13922, 13926, or 13927 Fire Pumps for application of motors and reference to specific motor requirements for motor-driven equipment.

1.3 DEFINITIONS

- A. Factory-Installed Motor: A motor installed by motorized-equipment manufacturer as a component of equipment.
- B. Field-Installed Motor: A motor installed at Project site and not factory installed as an integral component of motorized equipment.

1.4 SUBMITTALS

- A. Product Data for Field-Installed Motors: For each type and size of motor, provide nameplate data and ratings; shipping, installed, and operating weights; mounting arrangements; size, type, and location of winding terminations; conduit entry and ground lug locations; and information on coatings or finishes.
- B. Shop Drawings for Field-Installed Motors: Dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Include the following:
 - 1. Each installed unit's type and details.
 - 2. Nameplate legends.

3. Diagrams of power and control wiring. Provide schematic wiring diagram for each type of motor and for each control scheme.
- C. Coordination Drawings: Floor plans showing dimensioned layout, required working clearances, and required area above and around field-installed motors. Show motor layout, mechanical power transfer link, driven load, and relationship between electrical components and adjacent structural and mechanical elements. Show support locations, type of support, and weight on each support. Indicate field measurements.
 - D. Manufacturer Seismic Qualification Certification: Submit certification that motors, accessories, and components will withstand seismic forces defined in Division 13 Section "Fire Protection Vibration and Seismic Controls." Include the following:
 1. Basis of Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
 - b. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
 2. Dimensioned Outline Drawings of Motorized Equipment: Identify center of gravity and locate and describe mounting and anchorage provisions.
 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
 - E. Qualification Data: For testing agency.
 - F. Test Reports: Written reports specified in Parts 2 and 3.
 - G. Operation and Maintenance Data: For field-installed motors to include in emergency, operation, and maintenance manuals.
- 1.5 QUALITY ASSURANCE
- A. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, with the experience and capability to conduct the testing indicated, as documented according to ASTM E 548 and NFPA.
 - B. Source Limitations: Obtain field-installed motors of a single type through one source from a single manufacturer.
 - C. Product Options for Field-Installed Motors: Drawings indicate size, profiles, and dimensional requirements of motors and are based on the specific system indicated. Refer to Division 1 Section 01600 Product Requirements.
 - D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

- E. Comply with NFPA 70.

1.6 PROJECT CONDITIONS

- A. 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 Architect at least two days in advance of proposed utility interruptions. Identify extent and duration of utility interruptions.
 - 2. Indicate method of providing temporary utilities.
 - 3. Do not proceed with utility interruptions without Architect's written permission.

1.7 COORDINATION

- A. Coordinate features of motors, installed units, and accessory devices. Provide motors that are:
 - 1. Compatible with the following:
 - a. Reduced-voltage controllers.
 - 2. Matched to torque and horsepower requirements of the load.
 - 3. Matched to ratings and characteristics of supply circuit and required control sequence.
- B. Coordinate motor support with requirements for driven load; access for maintenance and motor replacement; installation of accessories, belts, belt guards; and adjustment of sliding rails for belt tensioning.
- C. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 3 Section.

PART 2 - PRODUCTS

2.1 DRIVE GUARDS:

- A. For machinery and equipment provide guards.
- B. Materials: Sheet steel, cast iron, expanded metal or wire mesh rigidly secures so as to be removable without disassembling pipe, or electrical connections to equipment.
- C. Access for Speed Measurement: One inch diameter hole at each shaft center.

2.2 ELECTRICAL MOTORS, MOTOR CONTROLS, AND WIRING:

- A. Provide all electric motors for driving fire protection equipment. All motors shall be of proper power and speed to suit the specified makes of equipment; if other makes of equipment (other than specified) are accepted in any case, the proper adjustment of motor speed and power must be included without additional cost to Owner. Sizes and type shall be submitted for approval before the equipment is purchased.
- B. All motors and accessories shall comply in all respects with the most recent practice of the I.E.E.E., the National Board of Fire Underwriters and National Fire Protection Association.
- C. Motors shall be thoroughly ventilated. When running continuously at full load and full speed, temperature rise above surrounding air shall not exceed 40 degrees C.
- D. All motors shall be of proper power and speed to suit the specified working condition under which they will function, the proper adjustment of motor speed and power must be included without additional cost to Owner. Motors shall have a service factor of 1.15.
- E. Motors shall be suitable for use at the available supply voltage. Nameplate voltage ratings shall be as follows:
 - 1. Single phase motors 115 volts
 - 2. Three phase motors:
 - a. Supplied at 208 volts 200 volts
 - b. Supplied at 460 or 480 volts 460 volts

Note that 208 volt or 208-230 volt or 208- 230/460 Volt Motors Will Not be acceptable.
- F. Each motor shall be equipped with suitable electric lead wire positioning gasket at the point where such leads pass through the motor frame into the motor terminal box. Such gaskets shall be arranged to insure that under no condition will the lead wires be subjected to abrasion against the metal of the motor frame.
- G. All motors and special apparatus, as required, shall be equipped with suitable undervoltage time delaying tripping mechanisms for protection against sustained undervoltage and to avoid automatic interruption of equipment as a result of momentary voltage disturbances. All three phase motors shall also be equipped with suitable protection to prevent single phase operation. Wiring to equipment shall be arranged to prevent improper direction of rotation and excessive heating.

2.3 MOTOR REQUIREMENTS

- A. Motor requirements apply to factory-installed and field-installed motors except as follows:

1. Different ratings, performance, or characteristics for a motor are specified in another Section.
2. Manufacturer for a factory-installed motor requires ratings, performance, or characteristics, other than those specified in this Section, to meet performance specified.

2.4 MOTOR CHARACTERISTICS

- A. Motors 3/4 HP and larger: Three phase.
- B. Motors Smaller Than 3/4 HP: Single phase.
- C. Frequency Rating: 60 Hz.
- D. Voltage Rating: NEMA standard voltage selected to operate on nominal circuit voltage to which motor is connected.
- E. Service Factor: 1.15 for open dripproof motors; 1.0 for totally enclosed motors.
- F. Duty: Continuous duty at ambient temperature of 105 deg F (40 deg C) and at altitude of 3300 feet (1005 m) above sea level.
- G. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.
- H. Enclosure: Open dripproof.

2.5 POLYPHASE MOTORS

- A. Description: NEMA MG 1, Design B, medium induction motor.
- B. Efficiency: Standard efficiency according to NEMA MG 1, Para. 12.59 and Table 12-10
- C. Stator: Copper windings, unless otherwise indicated.
 1. Multispeed motors shall have separate winding for each speed.
- D. Rotor: Squirrel cage, unless otherwise indicated.
- E. Bearings: Double-shielded, prelubricated ball bearings suitable for radial and thrust loading.
- F. Temperature Rise: Match insulation rating, unless otherwise indicated.
- G. Insulation: Class F, unless otherwise indicated.

2.6 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

- A. Motors Used with Reduced-Inrush Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.
- B. Rugged-Duty Motors: Totally enclosed, with 1.25 minimum service factor, greased bearings, integral condensate drains, and capped relief vents. Windings insulated with nonhygroscopic material.
 - 1. Finish: Chemical-resistant paint over corrosion-resistant primer.
- C. Source Quality Control: Perform the following tests on each motor according to NEMA MG 1:
 - 1. Measure winding resistance.
 - 2. Read no-load current and speed at rated voltage and frequency.
 - 3. Measure locked rotor current at rated frequency.
 - 4. Perform high-potential test.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas to receive field-installed motors for compliance with requirements, installation tolerances, and other conditions affecting performance.
- B. Examine roughing-in of conduit systems to verify actual locations of conduit connections before motor installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 MOTOR INSTALLATION

- A. Anchor each motor assembly to base, adjustable rails, or other support, arranged and sized according to manufacturer's written instructions. Attach by bolting. Level and align with load transfer link.
- B. Install motors on concrete bases complying with Division 3 Section 03300 Concrete.
- C. Comply with mounting and anchoring requirements specified in Division 13 Section 13071 "Mechanical Vibration and Seismic Controls."

3.3 FIELD QUALITY CONTROL

- A. Prepare for acceptance tests as follows:
 - 1. Run each motor with its controller. Demonstrate correct rotation, alignment, and speed at motor design load.
 - 2. Test interlocks and control features for proper operation.
 - 3. Verify that current in each phase is within nameplate rating.
- B. Testing: Owner will engage a qualified testing agency to perform the following field quality-control testing:
- C. Testing: Engage a qualified testing agency to perform the following field quality-control testing:
- D. Testing: Perform the following field quality-control testing:
 - 1. Perform each electrical test and visual and mechanical inspection stated in National Electrical Testing Association ATS, Section 7.15.1. and NFPA 20. Certify compliance with test parameters.
 - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
- E. Manufacturer's Field Service: Engage a factory-authorized service representative to perform the following:
 - 1. Inspect field-assembled components, equipment installation, and piping and electrical connections for compliance with requirements.
 - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - 3. Verify bearing lubrication.
 - 4. Verify proper motor rotation.
 - 5. Test Reports: Prepare a written report to record the following:
 - a. Test procedures used.
 - b. Test results that comply with requirements.
 - c. Test results that do not comply with requirements and corrective action taken to achieve compliance.

3.4 ADJUSTING

- A. Align motors, bases, shafts, pulleys and belts. Tension belts according to manufacturer's written instructions.

3.5 CLEANING

- A. After completing equipment installation, inspect unit components. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.
- B. Clean motors, on completion of installation, according to manufacturer's written instructions.

END OF SECTION 13055

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**SECTION 13060 - FIRE PROTECTION
HANGERS AND SUPPORTS**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes hangers and supports for mechanical system piping and equipment.
- B. Related Sections include the following:
 - 1. Division 5 Section 05500 "Metal Fabrications" for materials for attaching hangers and supports to building structure.
 - 2. Division 13 Section 13915 on fire-suppression piping for fire-suppression pipe hangers.

1.3 DEFINITIONS

- A. MSS: Manufacturers Standardization Society for the Valve and Fittings Industry.
- B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.4 PERFORMANCE REQUIREMENTS

- A. Design channel support systems for piping to support multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.
- B. Design heavy-duty steel trapezes for piping to support multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.
- C. Design seismic restraint hangers and supports for piping and equipment.
- D. Design and obtain approval from authorities having jurisdiction for seismic restraint hangers and supports for piping and equipment.

1.5 SUBMITTALS

- A. Product Data: For each type of pipe hanger, channel support system component, and thermal-hanger shield insert indicated.
- B. Shop Drawings: Signed and sealed by a qualified professional engineer for multiple piping supports and trapeze hangers. Include design calculations and indicate size and characteristics of components and fabrication details.
- C. Welding Certificates: Copies of certificates for welding procedures and operators.

1.6 QUALITY ASSURANCE

- A. Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
- B. Engineering Responsibility: Design and preparation of Shop Drawings and calculations for each multiple pipe support and trapeze by a qualified professional engineer.
- C. Systems, installation, equipment and materials shall conform to requirements of the local Building Code, Owners Insurance Underwriters, Factory Mutual, Industrial Risk Insurers, local Fire Department, NFPA, ANSI/ASME B31.9 "Building Service Piping" and all authorities having jurisdiction. Equipment and materials Underwriters listed, labeled and approved as required.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements of Factory Mutual, Underwriters Laboratory; provide products by one of the following:
 - 1. Pipe Hangers:
 - a. AAA Technology and Specialties Co., Inc.
 - b. B-Line Systems, Inc.
 - c. Carpenter & Patterson, Inc.
 - d. Empire Tool & Manufacturing Co., Inc.
 - e. Globe Pipe Hanger Products, Inc.
 - f. Grinnell Corp.
 - g. GS Metals Corp.
 - h. Michigan Hanger Co., Inc.
 - i. National Pipe Hanger Corp.
 - j. PHD Manufacturing, Inc.
 - k. PHS Industries, Inc.
 - l. Piping Technology & Products, Inc.
 - 2. Channel Support Systems:
 - a. B-Line Systems, Inc.
 - b. Grinnell Corp.; Power-Strut Unit.

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- c. GS Metals Corp.
 - d. Michigan Hanger Co., Inc.; O-Strut Div.
 - e. National Pipe Hanger Corp.
 - f. Thomas & Betts Corp.
 - g. Unistrut Corp.
 - h. Wesanco, Inc.
- 3. Thermal-Hanger Shield Inserts:
 - a. Carpenter & Patterson, Inc.
 - b. Michigan Hanger Co., Inc.
 - c. PHS Industries, Inc.
 - d. Pipe Shields, Inc.
 - e. Rilco Manufacturing Co., Inc.
 - f. Value Engineered Products, Inc.
 - 4. Powder-Actuated Fastener Systems:
 - a. Gunnebo Fastening Corp.
 - b. Hilti, Inc.
 - c. ITW Ramset/Red Head.
 - d. Masterset Fastening Systems, Inc.

2.2 MANUFACTURED UNITS

- A. Pipe Hangers, Supports, and Components: MSS SP-58, factory-fabricated components. Refer to "Hanger and Support Applications" Article in Part 3 for where to use specific hanger and support types.
 - 1. Galvanized, Metallic Coatings: For piping and equipment that will not have field-applied finish.
 - 2. Nonmetallic Coatings: On attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- B. Channel Support Systems: MFMA-2, factory-fabricated components for field assembly.
 - 1. Coatings: Manufacturer's standard finish, unless bare metal surfaces are indicated.
 - 2. Nonmetallic Coatings: On attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- C. Thermal-Hanger Shield Inserts: 100-psi (690-kPa) minimum compressive-strength insulation, encased in sheet metal shield.
 - 1. Material for Piping: ASTM C 552, Type I cellular glass or water-repellent-treated, ASTM C 533, Type I calcium silicate with vapor barrier.
 - 2. For Trapeze or Clamped System: Insert and shield cover entire circumference of pipe.
 - 3. For Clevis or Band Hanger: Insert and shield cover lower 180 degrees of pipe.
 - 4. Insert Length: Extend 2 inches (50 mm) beyond sheet metal shield for piping operating below ambient air temperature.

2.3 MISCELLANEOUS MATERIALS

- A. Powder-Actuated Drive-Pin Fasteners: Powder-actuated-type, drive-pin attachments with pull-out and shear capacities appropriate for supported loads and building materials where used.
- B. Mechanical-Anchor Fasteners: Insert-type attachments with pull-out and shear capacities appropriate for supported loads and building materials where used.
- C. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars, black and galvanized.
- D. Grout: ASTM C 1107, Grade B, factory-mixed and -packaged, nonshrink and nonmetallic, dry, hydraulic-cement grout.
 - 1. Characteristics: Post hardening and volume adjusting; recommended for both interior and exterior applications.
 - 2. Properties: Nonstaining, noncorrosive, and nongaseous.
 - 3. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
- E. All hanger rods shall be dipped in zinc chromite primer before installation or shall be galvanized, all hanger rods shall be double nutted.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT APPLICATIONS

- A. Specific hanger requirements are specified in Sections specifying equipment and systems.
- B. Comply with Factory Mutual, Underwriters Laboratory, NFPA and MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Specification Sections.
- C. Chain straps, perforated bars, wire hangers are not permitted except for seismic bracing.
- D. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
 - 1. Adjustable Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 4" to NPS 30 (DN100 to DN750).
 - 2. Steel Pipe Clamps (MSS Type 4): For suspension of cold pipe, NPS ½ to NPS 24 (DN15 to DN600), if little or no insulation is required.
 - 3. Pipe Hangers (MSS Type 5): For suspension of pipes, NPS ½ to NPS 4 (DN15 to DN100), to allow off-center closure for hanger installation before pipe erection.
 - 4. Adjustable Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated stationary pipes, NPS ¾ to NPS 3 (DN20 to DN80).
 - 5. Adjustable Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, NPS ½ to NPS 8 (DN15 to DN200).
 - 6. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated stationary pipes, NPS ½ to NPS 8 (DN15 to DN200).

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7. Adjustable Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated stationary pipes, **NPS ½ to NPS 2 (DN15 to DN50)**.
 8. Split Pipe-Ring with or without Turnbuckle-Adjustment Hangers (MSS Type 11): For suspension of noninsulated stationary pipes, **NPS 3/8 to NPS 8 (DN10 to DN200)**.
 9. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated stationary pipes, **NPS 3/8 to NPS 3 (DN10 to DN80)**.
 10. U-Bolts (MSS Type 24): For support of heavy pipe, **NPS ½ to NPS 30 (DN15 to DN750)**.
 11. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
 12. Pipe Saddle Supports (MSS Type 36): For support of pipes, **NPS 4 to NPS 36 (DN100 to DN900)**, with steel pipe base stanchion support and cast-iron floor flange.
 13. Pipe Stanchion Saddles (MSS Type 37): For support of pipes, **NPS 4 to NPS 36 (DN100 to DN900)**, with steel pipe base stanchion support and cast-iron floor flange and with U-bolt to retain pipe.
 14. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes, **NPS 2-1/2 to NPS 36 (DN65 to DN900)**, if vertical adjustment is required, with steel pipe base stanchion support and cast-iron floor flange.
 15. Single Pipe Rolls (MSS Type 41): For suspension of pipes, **NPS 1 to NPS 30 (DN25 to DN750)**, from two rods if longitudinal movement caused by expansion and contraction might occur.
 16. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes, **NPS 2-1/2 to NPS 20 (DN65 to DN500)**, from single rod if horizontal movement caused by expansion and contraction might occur.
 17. Complete Pipe Rolls (MSS Type 44): For support of pipes, **NPS 2 to NPS 42 (DN50 to DN1050)**, if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
 18. Pipe Roll and Plate Units (MSS Type 45): For support of pipes, **NPS 2 to NPS 24 (DN50 to DN600)**, if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
 19. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes, **NPS 2 to NPS 30 (DN50 to DN750)**, if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.
- E. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, **NPS 3/4 to NPS 20 (DN20 to DN500)**.
 2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, **NPS 3/4 to NPS 20 (DN20 to DN500)**, if longer ends are required for riser clamps.
- F. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment up to **6 inches (150 mm)** for heavy loads.
 2. Steel Clevises (MSS Type 14): For **120 to 450 deg F (49 to 232 deg C)** piping installations.
 3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
 4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.

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5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F (49 to 232 deg C) piping installations.
- G. Building Attachments: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
 2. Top-Beam C-Clamps (MSS Type 19) (Provide retainer clip with each C-Clamps): For use under roof installations with bar-joist construction to attach to top flange of structural shape.
 3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
 4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
 5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
 6. C-Clamps (MSS Type 23) (Provide retainer clip with each C-Clamps): For structural shapes.
 7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
 8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
 9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
 10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
 11. Malleable Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
 12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:
 - a. Light (MSS Type 31): 750 lb (340 kg).
 - b. Medium (MSS Type 32): 1500 lb (675 kg).
 - c. Heavy (MSS Type 33): 3000 lb (1350 kg).
 13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
 14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
 15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where head room is limited.
- H. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
1. Steel Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
 2. Protection Shields (MSS Type 40): Of length recommended by manufacturer to prevent crushing insulation.

3. Thermal-Hanger Shield Inserts: For supporting insulated pipe, 360-degree insert of high-density, **100-psi (690-kPa)** minimum compressive-strength, water-repellent-treated calcium silicate or cellular-glass pipe insulation, same thickness as adjoining insulation with vapor barrier and encased in 360-degree sheet metal shield.
- I. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
 2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed **1-1/4 inches (32 mm)**.
 3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41 roll hanger with springs.
 4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
 5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from hanger.
 6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from base support.
 7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from trapeze support.
 8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:
 - a. Horizontal (MSS Type 54): Mounted horizontally.
 - b. Vertical (MSS Type 55): Mounted vertically.
 - c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.

3.2 HANGER AND SUPPORT INSTALLATION

- A. Pipe Hanger and Support Installation: Comply with Factory Mutual, Underwriters Laboratory, NFPA and MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.
- B. Channel Support System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled channel systems.
 1. Field assemble and install according to manufacturer's written instructions.
- C. Heavy-Duty Steel Trapeze Installation: Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated, heavy-duty trapezes.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
 2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D-1.1.
- D. Install building attachments within concrete slabs or attach to structural steel. Space attachments within maximum piping span length indicated in Factory Mutual, Underwriters Laboratory, NFPA, and MSS SP-69. Install additional attachments at concentrated loads, including valves, flanges, guides, strainers, and expansion joints, and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
 - E. Install powder-actuated drive-pin fasteners in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
 - F. Install mechanical-anchor fasteners in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
 - G. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.
 - H. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
 - I. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
 - J. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by Factory Mutual, Underwriters Laboratory, NFPA, and ASME B31.9, "Building Services Piping," is not exceeded.
- 3.3 EQUIPMENT SUPPORTS
- A. Fabricate structural-steel stands to suspend equipment from structure above or to support equipment above floor.
 - B. Grouting: Place grout under supports for equipment and make smooth bearing surface.
- 3.4 METAL FABRICATION
- A. Cut, drill, and fit miscellaneous metal fabrications for heavy-duty steel trapezes and equipment supports.
 - B. Fit exposed connections together to form hairline joints. Field-weld connections that cannot be shop-welded because of shipping size limitations.

- C. Field Welding: Comply with Factory Mutual, Underwriters Laboratory, and AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and 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. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

- A. Hanger Adjustment: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

3.6 PAINTING

- A. Touching Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
- B. Apply paint by brush or spray to provide a minimum dry film thickness of **2.0 mils** (0.05 mm).
- C. Touching Up: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 9 Section "Painting."
- D. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 13060

**NEW PASSENGER TERMINAL
DULUTH INTERNATIONAL AIRPORT
DULUTH, MINNESOTA**

**SECTION 13075 - FIRE PROTECTION
IDENTIFICATION**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following mechanical identification materials and their installation:
 - 1. Equipment nameplates, markers and signs.
 - 2. Pipe markers.
 - 3. Valve tags and schedules.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples: For color, letter style, and graphic representation required for each identification material and device.
- C. Valve numbering scheme.
- D. Valve Schedules: For each piping system, furnish to Owner's Representative three (3) complete framed plastic laminated valve tag schedules. Schedule shall indicate tag number, valve location by floor and nearest column number, valve size and service controlled. Furnish extra copies of the valve and equipment schedules (in addition to mounted copies) to include in maintenance manuals.

1.4 QUALITY ASSURANCE

- A. ASME Compliance: Comply with ASME A13.1, "Scheme for the Identification of Piping Systems," for letter size, length of color field, colors, and viewing angles of identification devices for piping.

1.5 COORDINATION

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with location of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 EQUIPMENT IDENTIFICATION DEVICES

- A. Equipment Nameplates: Stainless steel or anodized aluminum, with data engraved or stamped, for permanent attachment on equipment.
 - 1. Data:
 - a. Manufacturer, product name, model number, and serial number.
 - b. Capacity, operating and power characteristics, and essential data.
 - c. Labels of tested compliances.
 - 2. Location: Nameplate shall be located on the equipment in a location which is accessible and visible when the equipment is installed.
 - 3. Fasteners: As required to mount on equipment in a permanent (tamper resistant) manner.

2.2 PIPING IDENTIFICATION DEVICES

- A. Manufactured Pipe Markers, General: Preprinted, color-coded, with lettering indicating service, and showing direction of flow.
 - 1. Apply Opti-code pressure sensitive vinyl color coded pipe markers identifying pipe contents and direction of flow.
 - 2. On exposed piping apply markers on 30 foot centers of straight runs, at valve locations, at points where piping enters and leaves a partition, wall, floor or ceiling.
 - 3. On concealed piping installed above removable ceiling construction apply markers in manner described for exposed piping.
 - 4. On concealed piping installed above non-removable ceiling construction, or in pipe shafts, apply markers at valve or other devices that are made accessible by means of access doors or panels.
 - 5. Marker widths shall be 8" for pipes up to 2" diameter and 12" wide for 2-1/2" to 6" diameter piping and 24" wide for larger diameter piping. Letter heights stating service shall be preprinted on marker 3/4" high for 8" markers 1-1/4" high for 12" markers and 2-1/2" high for 24" markers.
 - 6. For painted or insulated pipes apply markers after insulation and painting work has been completed.
 - 7. Colors shall conform to ANSI Standard A13.1. Provide 24 additional markers of each type for future use by Owner's personnel.

8. Follow manufacturer's instructions for application procedures using non-combustible materials and contact adhesives. Loop 3/4" wide pressure-sensitive tape of same color as marker background around pipe at both ends of marker and overlap tape on itself a minimum of 2".
 9. Markers and tape manufactured by Seton Name Plate Co. or other approved.
 10. Colors: Comply with ASME A13.1, unless otherwise indicated.
 11. Lettering: Use piping system terms indicated and abbreviate only as necessary for each application length.
 12. Pipes with OD, Including Insulation, Less Than 6 Inches (150 mm): Full-band pipe markers extending 360 degrees around pipe at each location.
 13. Pipes with OD, Including Insulation, 6 Inches (150 mm) and Larger: Either full-band or strip-type pipe markers at least three times letter height and of length required for label.
 14. Arrows: Integral with piping system service lettering to accommodate both directions; or as separate unit on each pipe marker to indicate direction of flow.
- B. Pretensioned Pipe Markers: Precoiled semirigid plastic formed to cover full circumference of pipe and to attach to pipe without adhesive.
- C. Shaped Pipe Markers: Preformed semirigid plastic formed to partially cover circumference of pipe and to attach to pipe with mechanical fasteners that do not penetrate insulation vapor barrier.
- D. Self-Adhesive Pipe Markers: Plastic with pressure-sensitive, permanent-type, self-adhesive back.
- E. Plastic Tape: Continuously printed, vinyl tape at least 3 mils (0.08 mm) thick with pressure-sensitive, permanent-type, self-adhesive back.
1. Width for Markers on Pipes with OD, Including Insulation, Less Than 6 Inches (150 mm): 3/4 inch (19 mm) minimum.
 2. Width for Markers on Pipes with OD, Including Insulation, 6 Inches (150 mm) or Larger: 1-1/2 inches (38 mm) minimum.

2.3 VALVE TAGS

- A. Attach a 2" square engraved anodized aluminum or brass tag stamped with designating numbers 1/2" high filled in with black enamel to each valve, except those on fixtures. Tags shall contain the abbreviation "F.P. above designating number.
- B. Securely fasten valve tag to valve spindle or handle with a brass chain.
- C. All valves that have an alarm wired back to an alarm panel, shall be identified and coordinated with the numbering system of the alarm panel.
- D. Provide approved ceiling tile markers in areas where removable ceilings occur to indicate location of valves or other devices, equipment and fittings which require maintenance service.

2.4 VALVE SCHEDULES

- A. Valve Schedules: For each piping system, on standard-size bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
 - 1. Valve-Schedule Frames: Glazed display frame for removable mounting on masonry walls for each page of valve schedule. Include mounting screws.
 - 2. Frame: Extruded aluminum.
 - 3. Glazing: ASTM C 1036, Type I, Class 1, Glazing Quality B, 2.5-mm, single-thickness glass.

PART 3 - EXECUTION

3.1 APPLICATIONS, GENERAL

- A. Products specified are for applications referenced in other Division 13 Sections. If more than single-type material, device, or label is specified for listed applications, selection is Installer's option.

3.2 EQUIPMENT IDENTIFICATION

- A. Install and permanently fasten equipment nameplates on each major item of fire protection equipment that does not have nameplate or has nameplate that is damaged or located where not easily visible. Locate nameplates where accessible and visible. Include nameplates for the following general categories of equipment:
 - 1. Pumps, compressors, and similar motor-driven units.

3.3 PIPING IDENTIFICATION

- A. Install manufactured pipe markers indicating service on each piping system. Install with flow indication arrows showing direction of flow.
- B. Locate pipe markers and color bands where piping is exposed in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior nonconcealed locations as follows:
 - 1. Near each valve and control device.
 - 2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
 - 3. Near penetrations through walls, floors, ceilings, and nonaccessible enclosures.
 - 4. At access doors, manholes, and similar access points that permit view of concealed piping.
 - 5. Near major equipment items and other points of origination and termination.

6. Spaced at maximum intervals of **50 feet (15 m)** along each run. Reduce intervals to **25 feet (7.6 m)** in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced markers.

3.4 VALVE-TAG INSTALLATION

- A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; shutoff valves and hose connections. List tagged valves in a valve schedule.
- B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions as indicated in the previous articles:
 1. Valve-Tag Size and Shape:
 - a. Fire Protection: **1-1/2 inches (38 mm)**, round
 2. Valve-Tag Color:
 - a. Fire Protection: Red
 3. Letter Color:
 - a. Fire Protection: Black.

3.5 VALVE-SCHEDULE INSTALLATION

- A. Mount valve schedule on wall in accessible location in each major equipment room.

3.6 WARNING-TAG INSTALLATION

- A. Write required message on, and attach warning tags to, equipment and other items where required.

3.7 ADJUSTING

- A. Relocate mechanical identification materials and devices that have become visually blocked by other work.

3.8 CLEANING

- A. Clean faces of fire protection identification devices and glass frames of valve schedules.

END OF SECTION 13075

**NEW PASSENGER TERMINAL
DULUTH INTERNATIONAL AIRPORT
DULUTH, MINNESOTA**

**SECTION 13520 - FIRE PROTECTION
CABINETS**

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Fire-protection cabinets for the following:
 - a. Fire hose valves.
 - b. Fire hoses and racks.
 - c. Fire extinguishers and fire hoses cabinets.
 - 2. Fire-protection accessories.

1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Related Sections include the following:
 - 1. Division 7 Section 07200 "Firestopping" for firestopping sealants at fire-rated cabinets.
 - 2. Division 9 Section 09910 "Painting" for field-painting fire-protection cabinets.
 - 3. Division 10 Section "Signs" for directional signage to out-of-sight fire extinguishers and cabinets.
 - 4. Division 11 Section "Food Service Equipment" for fire extinguishing systems provided as part of exhaust hoods.
 - 5. Division 13 Section 13975 "Standpipes and Hoses" for hose systems and racks.

1.3 SUBMITTALS

- A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for fire-protection specialties.
 - 1. Cabinets: Include roughing-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type, trim style, and panel style.
 - 2. Show location of knockouts for hose valves.
 - 3. Fire rating of assembly.

- B. Samples for Initial Selection: Manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available for each type of cabinet finish indicated.
- C. Samples for Verification: For each type of exposed cabinet finish required, prepared on Samples of size indicated below and of same thickness and material indicated for the Work. If finishes involve normal color and texture variations, include sample sets showing the full range of variations expected.
 - 1. Size: 6-by-6-inch- (150-by-150-mm-) square Samples.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain fire cabinets through one source from a single manufacturer.

1.5 COORDINATION

- A. Coordinate size of cabinets to ensure that type and capacity of fire extinguishers indicated and provided by Owner under separate Contract are accommodated.
- B. Coordinate size of cabinets to ensure that type and capacity of hoses, hose valves, and hose racks indicated are accommodated.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- 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:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Fire-Protection Cabinets:
 - a. Croker Corporation.
 - b. Potter-Roemer; Div. of Smith Industries, Inc.
- C. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the products specified in the Fire-Protection Cabinet Schedule at the end of Part 3.
- D. Products: Subject to compliance with requirements, provide one of the products indicated for each designation in the Fire-Protection Cabinet Schedule at the end of Part 3.

2.2 MATERIALS

- A. Cold-Rolled Steel Sheet: Carbon steel, complying with ASTM A 366/A 366M, commercial quality, stretcher leveled, temper rolled.
- B. Aluminum: Alloy and temper recommended by aluminum producer and manufacturer for type of use and finish indicated, and as follows:
 - 1. Sheet: **ASTM B 209** (**ASTM B 209M**).
 - 2. Extruded Shapes: **ASTM B 221** (**ASTM B 221M**).

2.3 FIRE-PROTECTION CABINETS

- A. Cabinet Construction: Provide manufacturer's standard box (tub), with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated. Weld joints and grind smooth. Miter and weld perimeter door frames.
 - 1. Fire-Rated Cabinets: Listed and labeled to meet requirements of ASTM E 814 for fire-resistance rating of wall where it is installed.
 - a. Construct fire-rated cabinets with double walls fabricated from **0.0478-inch- (1.2-mm-)** thick, cold-rolled steel sheet lined with minimum **5/8-inch- (16-mm-)** thick, fire-barrier material.
 - b. Provide factory-drilled mounting holes.
 - 2. Cabinet Metal: Enameled-steel sheet.
 - 3. Shelf: Same metal and finish as cabinet.
- B. Cabinet Type: Suitable for the following:
 - 1. Fire extinguisher and fire hose valve.
- C. Cabinet Mounting: Suitable for the following mounting conditions:
 - 1. Recessed: Cabinet box recessed in walls of sufficient depth to suit style of trim indicated.
- D. Cabinet Trim Style: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.
 - 1. Trimless: Surface of surrounding wall finishes flush with exterior finished surface of cabinet frame and door, without overlapping trim attached to cabinet.
 - a. Provide recessed flange, of same material as box, attached to box to act as plaster stop.

- E. Cabinet Trim Material: Manufacturer's standard, as follows:
 - 1. Same metal and finish as door.
- F. Door Material: Manufacturer's standard, as follows:
 - 1. Steel sheet.
- G. Door Glazing: Manufacturer's standard, as follows:
 - 1. Clear Float Glass: ASTM C 1036, Type I, Class 1, Quality q3, as follows:
 - a. Thickness: 3 mm.
 - 2. Tempered Float Glass: ASTM C 1048, Kind FT, Condition A, Type I, Quality q3, as follows:
 - a. Class 1 (clear).
 - 3. Break Glass: Clear float glass, ASTM C 1036, Type I, Class 1, Quality q3, 1.5 mm, single strength.
 - 4. Tempered Break Glass: ASTM C 1048, Kind FT, Condition A, Type I, Quality q3, 1.5 mm.
 - 5. Wire Glass: ASTM C 1036, Type II, Class 1, Form 1, Quality q8, Mesh m1 (diamond), 6 mm thick.
 - 6. Mirror Glass: ASTM C 1036, Type I, Class 1, Quality q2, 3 mm thick, double strength.
 - 7. Acrylic: Smooth or textured sheet, as follows:
 - a. Thickness: 1.5 mm.
 - b. Color: Clear.
 - 8. Bubble: One-piece clear break acrylic.
 - 9. Bubble: One-piece molded acrylic.
 - a. Color: Clear.
- H. Door Style: Manufacturer's standard design, as follows:
 - 1. Fully glazed, frameless, backless, acrylic panel.
 - 2. Fully glazed panel with frame.
 - 3. Full bubble, frameless.
 - 4. Full bubble with frame.
 - 5. Full bubble with frameless, rotating turntable.
 - 6. Horizontal duo panel with frame.
 - 7. Vertical duo panel with frame.
 - 8. Center glass panel with frame.
 - 9. Solid opaque panel with frame.
 - 10. Flush opaque panel, frameless, with no exposed hinges.
- I. Door Construction: Fabricate doors according to manufacturer's standards, of materials indicated, and coordinated with cabinet types and trim styles selected.

1. Provide minimum ~~1/2-inch-~~(13-mm-) thick door frames, fabricated with tubular stiles and rails, and hollow-metal design.
2. Provide inside latch and lock for break-glass panels.

J. Door Hardware: Provide manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated. Provide either lever handle with cam-action latch, or exposed or concealed door pull and friction latch. Provide concealed or continuous-type hinge permitting door to open 180 degrees.

2.4 ACCESSORIES

- A. Mounting Brackets: Manufacturer's standard steel, designed to secure extinguisher, of sizes required for types and capacities of extinguishers indicated, with plated or baked-enamel finish.
 1. Provide brackets for extinguishers not located in cabinets.
 2. Provide brackets for extinguishers located in cabinets.
- B. Break-Glass Strike: Provide manufacturer's standard metal strike, complete with chain and mounting clip, secured to cabinet.
- C. Lettered Door Handle: Provide one-piece, cast-iron door handle with the word "FIRE" embossed into face.
- D. Door Locks: Provide cylinder lock, with all cabinets keyed alike.

2.5 COLORS AND TEXTURES

- A. Colors and Textures: Match Architect's samples.
- B. Colors and Textures: As indicated by referencing manufacturer's designations.
- C. Colors and Textures: As selected by Architect from manufacturer's full range for these characteristics.

2.6 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. 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 the 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.

- D. Cabinet and Door Finishes: Provide manufacturer's standard baked-enamel paint for the following:
1. Exterior of cabinets and doors, except for those surfaces indicated to receive another finish.
 2. Interior of cabinets and doors.

2.7 ALUMINUM FINISHES

- A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
- B. Class II, Clear Anodic Finish: AA-M12C22A31 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.010 mm or thicker) complying with AAMA 607.1.
- C. Class I, Color Anodic Finish: AA-M12C22A42/A44 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker) complying with AAMA 606.1 or AAMA 608.1.
1. Color: As selected by Architect from the full range of industry colors and color densities.
- D. Baked-Enamel Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Apply baked enamel complying with paint manufacturer's specifications for cleaning, conversion coating, and painting.
1. Organic Coating: Thermosetting, modified-acrylic enamel primer/topcoat system complying with AAMA 603.8 except with a minimum dry film thickness of **1.5 mils (0.04 mm)**, medium gloss.
 2. Color: As indicated by manufacturer's designations.
 3. Color: Match Architect's sample.
 4. Color: As selected by Architect from manufacturer's full range.

2.8 STEEL FINISHES

- A. Surface Preparation: Clean surfaces of dirt, oil, grease, mill scale, rust, and other contaminants that could impair paint bond using manufacturer's standard methods.
- B. Factory Priming for Field-Painted Finish: Apply shop primer specified below immediately after surface preparation and pretreatment.
1. Shop Primer: Manufacturer's or fabricator's standard, fast-curing, lead- and chromate-free, universal primer, selected for resistance to normal atmospheric corrosion, for compatibility with substrate and field-applied finish paint system indicated, and for capability to provide a sound foundation for field-applied topcoats despite prolonged exposure.

- C. Baked-Enamel Finish: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-enamel finish consisting of prime coat and thermosetting topcoat. Comply with paint manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils (0.05 mm).

- 1. Color and Gloss: As selected by Architect from manufacturer's full range.

2.9 STAINLESS-STEEL FINISHES

- A. General: Remove or blend tool and die marks and stretch lines into finish. Grind and polish surfaces to produce uniform, directionally textured polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.
- B. Finish:
 - 1. Polished and Buffed Finish: Oil-ground, 180-grit finish followed by buffing.
 - 2. Bright, Cold-Rolled, Unpolished Finish: No. 2B finish.
 - 3. Bright, Directional Polish: No. 4 finish.
 - 4. Satin, Directional Polish: No. 6 finish.
 - 5. Satin, Reflective, Directional Polish: No. 7 finish.
 - 6. Mirrorlike Reflective, Nondirectional Polish: No. 8 finish.
- C. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in for hose valves, hose racks, and cabinets to verify actual locations of piping connections before cabinet installation.
- B. Examine walls and partitions for suitable framing depth and blocking where recessed and semirecessed cabinets are to be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Comply with manufacturer's written instructions for installing fire-protection specialties.
- B. Install in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.
 - 1. Prepare recesses for cabinets as required by type and size of cabinet and trim style.
 - 2. Fasten mounting brackets to structure and cabinets, square and plumb.
 - 3. Fasten cabinets to structure, square and plumb.

3.3 INSTALLATION OF FIRE-RATED HOSE OR VALVE CABINETS

- A. Install cabinet with not more than **1/16-inch (1.5-mm)** tolerance between pipe OD and knockout OD. Center pipe within knockout.
- B. Seal through-penetrations with firestopping sealant specified in Division 7 Section "Firestopping."

3.4 ADJUSTING, CLEANING, AND PROTECTION

- A. Adjust cabinet doors that do not swing or operate freely.
- B. Refinish or replace cabinets and doors damaged during installation.
- C. Provide final protection and maintain conditions that ensure that cabinets and doors are without damage or deterioration at the time of Substantial Completion.

END OF SECTION 13520

**NEW PASSENGER TERMINAL
DULUTH INT'L AIRPORT
DULUTH, MINNESOTA**

**SECTION 13700 – PART 1542 COMPUTER
CONTROLLED ACCESS
SYSTEM (CCAS) AND CCTV SYSTEM**

PART 1 - GENERAL

1.1 SUMMARY

- A. The scope of the work includes complete and integrated 49 CFR Part 1542 Computer Controlled Access System (CCAS). The integrated CCAS shall include access controls, CCTV and other systems as specified herein and indicated on the drawings.
- B. The work includes furnishing all labor, materials, tools, and equipment, and the performance of all operations necessary for coordinating, detailing, fabricating, inspecting, documenting, delivering, installing and testing the hardware, software and firmware for a complete and integrated CCAS in accordance with this section, including but not limited to the following:
 - 1. Operator Consoles and Photo Identification System.
 - a. Security Center Security Control Console (SCC) as indicated on drawings.
 - b. Photo Identification Subsystem (PIDS) Terminal and Badging.
 - 2. Paging and E-mail notifications
 - a. All alarms shall be transmitted via paging and e-mail system in addition to the SCC. The intent is to alert assigned personnel. Provide system necessary for remote notification as specified in paragraph 2.3.E.
 - 3. Data Processing Subsystem (DPS)
 - a. Fault Tolerant Servers, as indicated on the drawings and specified herein.
 - 4. Data Transmission Subsystem (DTS).
 - a. Network Based Intelligent Field Panels (IFPs).
 - 5. Controlled Access Subsystem (CAS).
 - a. Card Readers with PINpads.
 - b. Electronics Interface Boxes (EIB).
 - c. Exit Pushbuttons.
 - d. Interface with door locking sub-system.
 - e. Interface with delayed egress Panic Hardware.
 - f. Gate Control Panel for vehicle gates.
 - g. Signage.
 - 6. Intrusion Detection Subsystem (IDS).
 - a. Tamper Switches.
 - b. Door and Gate Position Switch (Balanced Magnetic Switch).
 - c. Duress Alarm Devices.
 - d. Vehicle Presence Sensor (ground loops).
 - 7. Surveillance and Assessment Subsystem (SAS).
 - a. Complete Integrated Video Management System.
 - b. Day / night IP Fixed Cameras.
 - c. Day / night IP Autodome PTZ Cameras.
 - d. Camera Mounting.
 - e. Camera Power Supply and Cabling.
 - f. Video Servers and Storage.

- g. Intelligent Video Analytics: Intelligent Video Analytics (IVA) is a separate system that is not required to be integrated with the Video Servers and Storage (NVR) and CCAS other than to transmit alarms to CCAS. References throughout the specifications for integration of the IVA apply only if the selected products normally offer those features.
- 8. Other CCAS Components.
 - a. Battery Backup Units (BBU).
 - b. Workstations.
 - c. Color Video Camera.
 - d. Photographic Lighting Unit.
 - e. Signature Input Unit.
 - f. ID Badge Printer.
 - g. ID Badges.
 - h. ID Badge Programmer.
 - i. ID Badge Encoder / Decoder.
 - j. Die Cutter.
 - k. Laminator.
 - l. Wireless transmitter / receiver.
- 9. Electrical Power Communication and Control Wiring and Conduit System.
 - a. Provide all conduit and wiring required to provide a complete and operational system.
- 10. Miscellaneous Provisions.
 - a. Nonstandard Test Equipment, Tools, Adaptors and Fittings.
 - b. Portable Intelligent Field Panel Analyzer shall include a laptop computer similar in capacity of administrative workstation.
- 11. Other Items.
 - a. Connections to existing perimeter gates as indicated on drawings.

1.2 RELATED WORK

- A. All Division 16 Electrical sections apply to the work specified in this section.
- B. The CCAS shall interface with the following Contract items to be provided in other sections:
 - 1. Network Electronics. (Provided under this contract).
 - 2. Uninterruptible Power Supplies. (Provided under this contract).

1.3 REFERENCES, CODES AND REGULATIONS

- A. It is not the intention of this section to provide all details of design and fabrication. The Contractor shall ensure that the equipment has been designed and fabricated in accordance with applicable engineering codes and standards. When specific requirements are stated in this section that exceed and / or overlap those requirements of the codes and standards referenced herein, this section shall govern.
- B. This section is based on the latest applicable codes and standards in force at the time the Specification is issued for bid. Should the applicable codes or standards listed herein be revised before or after the award of the Contract, the Contractor shall inform the Architect / Engineering (A/E) immediately, in writing, upon receipt of such information. Before adoption of any subsequent issue, the Contractor shall identify the changes in writing and shall not proceed with engineering, material and / or fabrication changes without A/E's written permission.

- C. Design, material, fabrication, testing, inspection, certification, documentation and operation shall conform to the following referenced codes, regulations, standards and specifications.
1. Regulations Transportation Security Administration 49 CFR:
 - a. Part 1520 - Protection of Sensitive Security Information.
 - b. Part 1540 - Civil Aviation Security.
 - c. Part 1542 - Airport Security.
 - d. Part 1544 - Aircraft Operator Security.
 2. Guidelines.
 - a. Recommended Security Guidelines for Airport Planning, Design and Construction - DOT/FAA/AR-00-52 June 2001.
 - b. RTCA/DO-230 Standards for Airport Security Access Control Systems.
 3. American National Standards Institute (ANSI):
 - a. C2 - National Electrical Safety Code.
 - b. C37.90A - Guide for Surge Withstand Capability Tests.
 - c. C62.41 - Guide for Surge Voltage in Low Voltage AC Power Circuits.
 - d. C63.12 - Recommended Practice on Procedures for Control of System Electromagnetic Compatibility.
 - e. X3.4 - American Standard Code for Information Interchange (ASCII).
 4. American Society of Testing and Materials (ASTM):
 - a. ASTM B 8 - Concentric-Lay Stranded Copper Conductors.
 - b. ASTM D 635 - Rate of Burning and / or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position.
 5. Federal Communications Commission (FCC):
 - a. FCC Rules and Regulations, Part 15 and 68.
 6. General Services Administration (GSA):
 - a. FS W-A-450B - Federal Specification (Interim): Components for Interior Security Alarm Systems.
 7. Institute of Electrical and Electronics Engineers (IEEE):
 - a. IEEE Transaction Volume COM-21 - Lightning Surges in Open Wire, Coaxial and Paired Cables.
 - b. IEEE C62-1990 - Guides and Standards for Surge Protection.
 - c. IEEE 802 - Standard for Local Area Networks.
 - d. IEEE 802.2 - Standards for Local Area Networks: Media Access Control (MAC) Bridges.
 - e. IEEE 802.3 - Ethernet local area network.
 - f. IEEE 802.11a - Wireless local area network.
 8. International Standards Organization (ISO):
 - a. ISO/IEC 8802-3 - Information Processing System - Local Area Networks - Part 3.
 - b. ISO/IEC 8802-4 - Information Processing System - Local Area Networks - Part 4.
 9. Insulated Cable Engineer Association (ICEA):
 - a. S-19-81 - Rubber Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.
 10. National Electrical Manufacturers Association (NEMA):
 - a. NEMA 250 (1985) - Enclosures for Electrical Equipment.
 11. National Fire Protection Association (NFPA):
 - a. NFPA 70 (1996) - National Electrical Code (NEC).
 12. Occupational Safety and Health Act (OSHA):
 - a. OSHA 2206 - General Industry Safety and Health Standards.
 13. Underwriters' Laboratories (UL):
 - a. UL 6 - Rigid Metal Electrical Conduit.

- b. UL 198 (1988) - Fuses.
- c. UL 294 (1987) - Standard for Access Control Systems.
- d. UL 437 - Key Locks.
- e. UL 512 (1987) - Fuse Holders.
- f. UL 634 (1985) - Connectors and Switches for Use with Burglar Alarm Systems.
- g. UL 639 (1986) - Intrusion Detection Units.
- h. UL 796 (1984) - Printed Circuit Boards.
- i. UL 1076 (1988) - Proprietary Burglar-Alarm Units and Systems.
- j. UL 1449 (1985) - Standard for Safety Transient Voltage Surge Suppressors.

14. Applicable Federal, state and local laws, regulations, ordinances and codes.

- D. In the event of conflicting requirements between the authorities cited above or between authorities cited and those specified, such disagreements shall be resolved by the A/E or Owner.
- E. Nothing in this section, including invocation of certain specific codes, standards or specifications, shall relieve the Contractor of the responsibility for compliance with the codes, standards or specifications which are generally recognized to be applicable to the work specified herein.

1.4 SYSTEM DESCRIPTION

- A. The Computer Controlled Access System (CCAS) as outlined in this section and detailed in Part 2 of this document is the key central component for managing physical security and the bridge between physical and logical security for this project. The system shall provide a variety of integral functions including the ability to regulate access and egress; provide identification credentials; monitor, track and interface alarms; and view, record and store digital surveillance video linked to CCAS events.
- B. The CCAS shall utilize a single seamlessly integrated relational database for all functions utilizing a fully multi-tasking multithreading Microsoft Windows 2000/2003 or Windows XP Operating System. CCAS software shall be written so that all modules (Access Control, Alarm Monitoring, ID / Credential Management, Visitor Management and Digital Video Management) are developed and built from a unified single 32-bit source code set.
- C. Upgrades or expansion of the CCAS to a larger size system in scale shall not require installation of a different and / or new CCAS application or require the administrator / operator to learn a different and / or new interface from the previous version.
- D. CCAS software shall be written using Unicode format. Unicode enables a single software product to be targeted across multiple platforms and languages without re-engineering and allows for data to be transported through different systems without corruption.
- E. CCAS software shall be written to Microsoft's published standards for User Interface Design, Secure Coding Practices and Database Implementation Guidelines (Microsoft⁷ Open Database Connectivity (ODBC) interface).

- F. CCAS software shall be written to ISO Standards on Software Development for C++ and C#.
- G. CCAS and its software shall seamlessly interface with and monitor intelligent system controllers, reader interface modules, I/O panels, burglar alarm panels, burglar alarm panel receivers, biometric devices, personal protection devices, intercom systems, fire alarm panels (secondary monitoring only), building management systems and digital video recorders approved for use by the CCAS manufacturer.
- H. The CCAS shall be able to communicate via RS-485, RS-232, TCP-IP/Ethernet and dial-up via modem.
- I. All tasks shall be accessible from any compatible client workstation on the network utilizing one or all of the following.
 - 1. Traditional client server architecture.
 - 2. N-tier architecture where the CCAS shall support the expansion of the system architecture and allow for end-user deployment based upon their system architecture needs. The CCAS shall allow but not require the separation of the database, application server, web server and client interface. The system shall require that all connections to the database are performed through a trusted link from the client or internet browser interface.
 - 3. Centralized distribution (publishing) of applications using Windows Terminal Server and Citrix on Windows, Unix, Linux or Apple Macintosh based systems through any compatible internet browser application and / or by means of a mobile computing platform using a wearable computer, Tablet PC or PDA device.
- J. The CCAS shall utilize an open architecture where all data must reside on a single database and must be accessible in real time to every / any CCAS workstation or web based client connected to the network. The system shall be configurable to support all of the following databases: Microsoft SQL Server 2000 Personal and Standard editions with SP3a, Microsoft SQL Server 2005 Standard and Enterprise editions and Microsoft SQL Server 2005 Express, Oracle Server 9.i. and Oracle Server 10g. Oracle data may reside on Windows or UNIX platforms.
- K. The system architecture shall support Microsoft Windows Clustering, Hot-Standby, Fault Tolerant Servers and Fault Tolerant Hot Standby Servers.
- L. The CCAS shall support an unlimited number of Access Control Readers, an unlimited number of Inputs / Outputs, an unlimited number of Client Workstations, and an unlimited number of Cardholders

1.5 SUBMITTALS

- A. The Contractor shall submit all items in accordance with the requirements of, Section 01300 - SUBMITTALS.
- B. Unless noted otherwise in General Conditions, within thirty (30) days of award of Contract, the Contractor shall submit manufacturer's specification or data sheets for all subsystem equipment to be utilized in the CCAS.
- C. The Contractor shall submit the following:
 - 1. Shop Drawings: Provide complete shop drawings which include the following:

- a. Indicate all system device locations on 1/8" scale architectural floor plans. No other system(s) shall be included on these plans.
 - b. Include full schematic wiring information on these drawings for all devices. Wiring information shall include cable type, conductor routings, quantities, and connection details at device.
 - c. Include a complete CCAS one-line, block diagram.
 - d. Include a statement of the system sequence of operation of each access control portal and overall system performance.
 - e. Include a statement indicating seamless integration of various systems.
2. Product Data: Provide complete product data that includes the following:
 - a. Manufacturer's technical data for all material and equipment at the system and sub system level to be provided as part of the CCAS.
 - b. A system description including analysis and calculations used in sizing equipment required by the CCAS. The description shall show how the equipment will operate as a system to meet the performance requirements of the CCAS. The following information shall be supplied as a minimum:
 - 1) Server(s) processor(s), disk space and memory size.
 - 2) Description of site equipment and its configuration.
 - 3) Network bandwidth, latency and reliability requirements.
 - 4) Backup / archive system size and configuration.
 - 5) Start up operations.
 - 6) System expansion capability and method of implementation.
 - 7) System power requirements and UPS sizing.
 - 8) Device / component environmental requirements (cooling and or heating parameters).
 - 9) A description of the operating system and application software.
 3. Contract Close-Out Submittals: Provide three sets of hard copy manuals and three sets electronic format manuals in PDF format including operating instructions, maintenance recommendations and parts list. Include wiring and connection diagrams modified to reflect as-built conditions as part of this submittal.
 4. Manuals: Final copies of the manuals shall be delivered within thirty (30) days after completing the installation test. Each manual's contents shall be identified on the cover. The manual shall include names, addresses, and telephone numbers of the contractor responsible for the installation and maintenance of the system and the factory representatives for each item of equipment for each system. The manuals shall have a table of contents and labeled sections. The final copies delivered after completion of the installation test shall include all modifications made during installation, checkout, and acceptance testing. The manuals shall consist of the following:
 - 1) Functional Design Manual: The functional design manual shall identify the operational requirements for the system and explain the theory of operation, design philosophy, and specific functions. A description of hardware and software functions, interfaces, and requirements shall be included.
 - 2) Hardware Manual: The manual shall describe all equipment furnished including:
 - a) General description and specifications.
 - b) Installation and check out procedures.

- c) Equipment layout and electrical schematics to the component level.
 - d) System layout drawings and schematics.
 - e) Alignment and calibration procedures.
 - f) Manufacturers' repair parts list indicating sources of supply.
 - 3) Software Manual: The software manual shall describe the functions of all software and shall include all other information necessary to enable proper loading, testing, and operation. The manual shall include:
 - a) Definition of terms and functions.
 - b) System use and application software.
 - c) Initialization, start up, and shut down.
 - d) Reports generation.
 - e) Details on forms customization and field parameters.
 - 4) Operators Manual: The operators' manual shall fully explain all procedures and instructions for the operation of the system including:
 - a) Computers and peripherals.
 - b) System start up and shut down procedures.
 - c) Use of system, command, and applications software.
 - d) Recovery and restart procedures.
 - e) Graphic alarm presentation.
 - f) Use of report generator and generation of reports.
 - g) Data entry.
 - h) Operator commands.
 - i) Alarm messages and reprinting formats.
 - j) System permissions functions and requirements.
 - 5) Maintenance Manual: The maintenance manual shall include descriptions of maintenance for all equipment including inspection, periodic preventive maintenance, fault diagnosis, and repair or replacement of defective components.
- D. As-Built Drawings: During system installation, the Contractor shall maintain a separate hard copy set of drawings, elementary diagrams, and wiring diagrams of the CCAS to be used for record drawings. This set shall be accurately kept up to date by the Contractor with all changes and additions to the CCAS. Copies of the final as-built drawings shall be provided to the A/E in DXF or DWG format.

1.6 ABBREVIATIONS

- A. The following abbreviations are used in this document:
- ABA - American Banking Association
 - ANSI - American National Standards Institute
 - AOA - Air Operations Area
 - AOT - Accumulated Outage Time
 - ARFF - Airport Rescue and Fire Fighting
 - ASCII - American Standard Code for Information Interchange
 - ASTM - American Society for Testing and Materials
 - AWG - American Wire Gauge
 - BMS - Balanced Magnetic Switch
 - bps - Bits Per Second
 - CAS - Controlled Access Subsystem
 - CCAS - Integrated Computer Controlled Access Controls and CCTV System
 - CCD - Charged Coupled Device
 - CCTV - Closed Circuit Television

CFR	-	Code of Federal Regulations
CPU	-	Central Processing Unit
DPS	-	Data Processing Subsystem
DTS	-	Data Transmission Subsystem
DVR	-	Digital Video Recorder
EIA	-	Electronic Industries Association
EIB	-	Electronics Interface Box
FAA	-	Federal Aviation Administration
FAR	-	Federal Aviation Regulation
FCC	-	Federal Communications Commission
FM	-	Factory Mutual
F/O	-	Fiber Optics
FS	-	Federal Specification
GDT	-	Graphics Display Terminal
GSA	-	General Services Administration
HVAC	-	Heating, Ventilation and Air Conditioning
ICEA	-	Insulated Cable Engineer Association
ID	-	Identification
IDS	-	Intrusion Detection Subsystem
IEEE	-	Institute of Electrical and Electronics Engineers
IFP	-	Intelligent Field Panel
I/O	-	Input / Output
ISA	-	Instrument Society of America
KCS	-	Key Control Subsystem
KVA	-	Kilo-Volt-Ampere
LED	-	Light Emitting Diode
NCTA	-	National Cable Television Association
NEC	-	National Electrical Code
NEMA	-	National Electrical Manufacturers Association
NFPA	-	National Fire Protection Association
OSHA	-	Occupational Safety and Health Act
PIDS	-	Photo Identification Subsystem
PIN	-	Personal Identification Number
PTZ	-	Pan / Tilt / Zoom
PVC	-	Polyvinyl-Chloride
RF	-	Radio Frequency
SA	-	Secured Area
SAS	-	Surveillance and Assessment Subsystem
SCC	-	Security Control Console
DLH	-	Duluth International Airport (the Owner)
STS	-	Signal Transmission Subsystem
TDT	-	Test Duration Time
TSA	-	Transportation Security Administration
UL	-	Underwriters' Laboratories
UPS	-	Uninterruptible Power Supply
VCS	-	Voice Communications Subsystem
VDT	-	Video Display Terminal

1.7 GLOSSARY OF TERMS

For the purpose of this document, the following terms are defined:

- A. Access Mode - The mode of operation in which the CCAS shall only annunciate tamper and trouble conditions at a monitored point. Alarm conditions shall not be annunciated in this mode. (Also referred to as alarm shunting or masking.)
- B. Accountability - A feature of the CCAS which keeps track of an individual's last use of a card reader.
- C. Acknowledge - The action taken by a SCC operator to indicate that they are aware of a specific off-normal event. Acknowledging an event shall silence the audible enunciator at the SCC.
- D. Advisory - An off-normal event providing information about controlled access, key control and data processing functions.
- E. Alarm - An off-normal event at a secured, monitored point indicating the supervision circuitry has detected a condition for which the sensor was designed to react.
- F. Card Reader - A device located at selected AOA/SA access points that shall automatically decode the information from an ID badge / keycard and process the access request locally.
- G. Cipher Code - A code number, between 5 and 9 digits in length (site-selectable), associated with an access point and used by an airline / airport group to request access at that point when it is controlled via the PIN pad only.
- H. Clear - The action taken by a SCC operator to remove an off-normal event display from the Video Display Terminal (VDT) at the SCC. Clearing an event shall allow the operator to annotate the alarm record with the cause of the alarm and a summary of the action taken.
- I. Control Level - 1 of 2 additional measures (keyswitch activation or password input) that may be assigned to a keyboard control function to further restrict its use.
- J. False Alarm - An alarm received for which there is no apparent cause (reason unknown). A false alarm may be due to system malfunction, environmental changes or electromagnetic/radio frequency (RF) interference.
- K. Inactive Mode - The mode of operation during which a point shall not be monitored, and alarm, tamper and trouble conditions at that point shall not be annunciated.
- L. ID Badge / keycard - An encoded device that will be presented at a card reader for automatic verification that the access request is authorized at the associated access point.
- M. Keyboard Control Function - An operator-initiated system command, such as securing or accessing a monitored point, entered via a console / terminal keyboard.
- N. Keycard Number - A number assigned to each ID badge / keycard user and linked by the system to the internal coding of the ID badge / keycard. After being linked, the keycard number shall be used by console / terminal operators when performing keyboard control functions associated with the Controlled Access Subsystem, such as, modifying database records and requesting displays, printouts and historical logs.

- O. Line Supervision - The monitoring of subsystem signal paths to verify their integrity.
- P. Nuisance Alarm - An alarm caused by the system detecting changes in its operating environment that it was designed to detect, but that do not represent a security threat. A nuisance alarm may be caused by wildlife, vegetation or weather conditions.
- Q. Off-Normal Event - A change of status signal from a monitored point to include alarm, tamper and trouble conditions and advisories.
- R. Operator Level - A number assigned to each console/terminal operator authorizing access to all keyboard control functions and database fields associated with that number.
- S. Password - A code or word or number, between 5 and 9 alphanumeric characters (site-selectable) in length, used by authorized console / terminal operators to sign on and off the system and to perform keyboard control functions with a Control level 2 restriction.
- T. Personal Identification Number (PIN) - A code number, between 4 and 9 digits in length, assigned to each ID badge / keycard user for use at access points equipped with PIN pads.
- U. Reset - A signal indicating that the status of a monitored point has returned to normal after the occurrence of an alarm, tamper or trouble condition and can be cleared by an operator.
- V. Secure Mode - The mode of operation during which a point shall be monitored for alarm, tamper and trouble conditions and shall annunciate them as specified herein.
- W. Security Area - An area with 1 or more card reader-controlled access points. Security areas shall be assigned individually or in groups to each ID badge / keycard user to authorize access to all access points associated with each area (subject to time zone constraints).
- X. Shall - Whenever the word "shall" is used in this section, it indicates a mandatory requirement that the Contractor must provide or fulfill to comply with the intent of this section.
- Y. Stop List - A computer-generated listing of all ID badges / keycards that have been deleted, deactivated or flagged to preclude their use (e.g., lost, stolen, etc.).
- Z. Tamper - An off-normal event at a secured or access monitored point indicating the tamper switch has been activated.
- AA. Time Zone - A pre-determined (programmable) schedule, consisting of the days of the week and the hours in each day, when an -ID badge / keycard user is authorized access to a particular security area or when the card readers / PINpads associated with a security area are operational.
- BB. Trouble - An off-normal event at a secured or accessed monitored point indicating an equipment malfunction; a loss of power; a loss of communications; and / or a single break, a single ground fault or a wire-to-wire short in signal wiring.

- CC. Will - Whenever the word "will" is used in this section, it indicates a mandatory requirement that the Contractor must provide or fulfill to comply with the intent of this section.

1.8 OPERATIONAL REQUIREMENTS

A. General

1. The CCAS shall be accessible and controllable via the SCC located in the airport Security Center so as to perform the security-related functions described herein.
2. The desired goal is operation of the CCAS by security and operations personnel with minimal technical training.
3. The CCAS shall provide continuous year-round, twenty-four (24) hours-per-day, seven (7) days-per-week operation.
4. The CCAS shall differentiate between group types of AOA/SA access points as indicated on the drawings and specified herein, and shall provide controlled access, intrusion detection, visual surveillance and data / video / audio signal communication as specified in the specifications and drawings.

B. System Capabilities

1. The CCAS shall perform the following functions:
 - a. Continuously collect and process status information from all monitored points.
 - b. Build and maintain monitored point, ID badge / keycard user and other system databases.
 - c. Electronically supervise wiring to and from all monitored points.
 - d. Regulate personnel and vehicle access and maintain accountability at controlled access points.
 - e. Detect alarm, tamper and trouble conditions and advisories at monitored points, as appropriate.
 - f. Initiate and annunciate duress alarms.
 - g. Visually monitor selected remote locations.
 - h. Automatically / manually display / record CCTV camera outputs. Display alarm event CCTV camera output. Record all alarm events by multiple cameras as indicated on the drawings.
 - i. Audibly and visibly annunciate all alarm, tamper and trouble conditions, advisories and keyboard control function input errors.
 - j. Print all alarm, tamper, and trouble conditions, advisories, executed keyboard control functions and keyboard control function input errors.
 - k. Regulate mechanical key issue / return.
 - l. Display and / or print system status information on demand and automatically on a pre-determined (programmable) time schedule.
 - m. Store all alarm, tamper and trouble conditions, advisories, executed keyboard control functions, subsystem test results and access control information.
 - n. Dump / reload historical records, system programs and database information.
 - o. Display and / or print historical logs on demand and automatically on a pre-determined (programmable) time schedule.
 - p. Perform specified keyboard control functions on demand and automatically on a pre-determined (programmable) time schedule.
 - q. Communicate with selected remote locations.
 - r. Provide a continuous source of power for subsystem operation.
 - s. Produce a combination photo ID badge / keycard.

- t. Perform system reprogramming and regeneration and background processing.
 - u. Interface with related items by others as specified.
 - v. Allow the operator to call up and view CCTV video from within the CCAS by selection of an alarm event on screen without having to manually access event in CCTV client application
 - w. Automatically send real time alarm event metadata to the CCTV application database.
2. The CCAS shall meet the following response requirements:
- a. Control shall be transferred from the primary central processor to the hot-standby secondary central processor (or FT server) within 1 second.
 - b. All Intelligent Field Panels (IFPs) in the system shall be polled for status changes at least once every second.
 - c. With a local database of at least 5,000 ID badge / keycard users, the CCAS shall be able to process access requests at each card reader-controlled access point within .5 second. No automated controlled access function shall delay the reporting of an off-normal event beyond 1 second.
 - d. The elapsed time between the occurrence of a single alarm, tamper or trouble condition and its annunciation as an off-normal event at the appropriate monitoring location(s) shall not exceed 2 seconds. When additional conditions occur before a previous condition has been annunciated, the subsequent conditions shall be annunciated as specified at intervals not exceeding 2 seconds each.
 - e. System response to any valid operator control request shall be initiated and visually indicated within 2 seconds.
 - f. System response to any valid operator request for demand displays shall typically be completed within 2 seconds and in all cases less than 5 seconds.
 - g. New and updated ID badge user data files shall be automatically transferred between the CCAS and the Photo Imaging System Upon validation at the initiating location.
 - h. Historical log printouts shall begin printing within 5 minutes of operator request.
 - i. ID badge / keycard inserts containing both textual and image data will be printed within 3 minutes.
 - j. The PIDS will be available for additional image capturing within 15 seconds after a print command is executed.
3. The CCAS design shall permit additional subsystem equipment to be added by inserting appropriate interfaces and entering minor parameter modifications into the software. The CCAS shall provide for a minimum growth capability of 50 percent of its initial capacity without the necessity for the replacement or addition of major hardware or software items.
4. Intelligent field panels shall be configured not to exceed 75 percent capacity in terms of card reader capacity. For example: if the proposed intelligent field panel is capable of supporting 8 card readers, only 6 of the available card reader inputs shall be used, the remaining 2 card reader inputs shall be designated as spares. Total available spare card reader inputs, at a minimum, shall equal 30 percent of initial quantity of card readers to be installed.

C. System Status

1. Monitored points within the system shall be in 1 of 2 modes: SECURE or INACTIVE.
 - a. In the SECURE mode, the system shall be sensitive to alarm, tamper and trouble conditions and shall annunciate them as specified.
 - b. In the INACTIVE mode, the system shall be insensitive to alarm, tamper and trouble conditions.
 2. Monitored point status changes shall be initiated on demand via the SCC, Programmer's Terminal and the PIDS Terminal or automatically based on a pre-determined (programmable) time schedule. Local accessing shall be reported to the SCC as an advisory.
 3. The CCAS shall provide the capability to selectively enable / disable operation of the following devices on demand via the SCC and the Programmer's Terminal or automatically based on a pre-determined (programmable) time schedule, without affecting the operation or status of other CCAS devices at the same point / location:
 - a. Card Readers.
 - b. Electrified Door Hardware.
 - c. Vehicle Gate Operators.
 - d. Automatic Roll-up Doors.
- D. System Monitoring and Control
1. CCAS equipment necessary for performing specified functions shall be incorporated in the Security Control Console (SCC). The console shall be located in the airport Security Center. The SCC layout and equipment arrangement shall be ergonomically engineered to present an efficient and organized appearance and facilitate operation.
 2. The SCC shall be the focal point for all specified functions associated with the monitoring and control of all CCAS and specified existing equipment. The SCC shall be provided with a VDT and keyboard as the primary man-machine interface. The VDT screen shall be formatted to permit simultaneous display of off-normal event annunciations, operator requested status information and keyboard control function request entries.
 3. A Programmer's terminal shall be provided in the airport Security Center to run diagnostic routines, initiate DPS maintenance utilities, perform system reprogramming and regeneration, enter/edit system database information, generate special reports and logs and perform specified keyboard control functions (site-configurable).
 4. ID badge / keycard preparation and encoding shall be monitored and controlled via the PIDS terminal located in the airport badging area.
 5. The man-machine interface portions of the SCC, Programmer's terminal and PIDS terminal shall be identical to facilitate training and operation.
 6. The specific off-normal events that shall be reported at the SCC: and the specific keyboard control functions that can be performed at the SCC, the Programmer's terminal and the PIDS terminal shall be site-configurable. The Programmers terminal will also serve as an alternate monitoring location to automatically annunciate off-normal events in the event that the SCC is not operable.
 7. The PIDS terminal shall be equipped with a card reader and PIN pad. The card reader PIN pad at the PIDS terminal will be used to verify operation of a newly issued ID badge / keycard and to demonstrate proper use.
 8. A key issue / return panel (box) shall be provided at the airport badging Area to control mechanical key issue and return.
- E. Access Control Software

1. Contractor shall state in their technical submittal that transmittal of the software license transfers ownership of the Duluth International Airport CCAS software to Duluth International Airport for the purpose of operation of the CCAS at Duluth International Airport only. It is understood by the owner that any additional software for installations other than at Duluth International Airport will require purchase of additional licenses for each site.

F. Signal Collection and Transmission

1. The central processors shall interface with CCAS equipment via Intelligent Field Panels (IFPs). The IFPs shall be connected to all card readers and monitored points collect and transmit status information to the primary central processor for processing. Each IFP shall be interrogated at least once every second to verify its status and / or report off-normal events and monitored point resets.
 - a. The IFPs shall buffer and retain status change information until transfer of data to the primary processor is verified.
 - b. In the event communications with the central processors is disrupted, each IFP shall have provisions to store a minimum of 4,000 authorized access transactions, off-normal events and monitored point resets locally. Upon restoration of communications, the IFPs shall upload the stored data. Data uploading shall not interfere with the real-time reporting of subsequent off-normal events and resets.
2. The CCAS shall provide a communication backbone for the collection and transmission of data, control, video and audio signals via metallic conductor (hardwire) and fiber optic (F/O) data path utilizing multiplexers with appropriate network equipment as specified below.
 - a. Card readers shall be hardwired to a Reader Module contained in an EIB within 50 feet of the card reader. The EIBs shall utilize a RS-422/485 multi-drop architecture to connect the reader module to the IFP. No more than 3 EIB locators shall be in a single multi-drop unless approved by A/E.
 - b. The EIB shall be hardwired to an IFP within 500 feet of the point as indicated on the drawings.
 - c. Ethernet TCP/IP architecture shall be used for connecting IFPs to the CCAS. An alternate Ethernet or serial to Ethernet port shall be provided as a backup communication in the event the primary communication fails. The backup communication shall be restored automatically with notification that primary communication has failed.
3. Transmission of CCTV video and data signals from cameras as indicated on the drawings, shall be transmitted via TCP/IP to the CCTV controlling equipment in the airport Security Center. Network based CCTV system shall use fiber and Category 6 cabling system.
4. Reliable data transmission shall be utilized between the IFPs and the central processors. The IFP message format will include its unique address to assure a properly directed response to the primary central processor poll. Accurate reception of error-free data will be ensured by the use of redundant message transmission or by the use of error detecting / correcting codes. Transmission failures will be annunciated as trouble conditions.

G. Controlled Access

1. The CCAS shall monitor and control personnel and vehicle access at AOA/SA access points in accordance with the Airport Security Plan FAR 1542 Amendment. Authorized access shall be granted based on the

following criteria in combination or individually as determined by Duluth International Airport:

- a. Possession of a valid ID badge / keycard.
- b. Knowledge of a valid personal identification number (PIN) corresponding to the valid ID badge / keycard.
2. AOA/SA access points shall be controlled via card reader PINpads and related controlled access and intrusion detection equipment.
3. Operation of an access point via card reader only, PIN pad only, or card reader and PIN pad shall be configurable via the SCCs or Programmer's terminal.
4. The CCAS will provide the capability to selectively enable/disable all automated controlled access operations at a card reader-controlled access point on demand from the SCC, Programmer's terminal or automatically based on a pre-determined (programmable) time schedule.
5. Access shall be controlled by assigning any combination of security areas to each ID badge / keycard user for authorized access. Each security area shall consist of 1 or more card reader-controlled access points. A minimum of 128 user-defined security areas shall be provided.
6. Access may be further controlled by assigning a time zone for access at each security area to each ID badge / keycard user. Each time zone shall define the days of the week and the hours in each day when access is authorized. A minimum of 128 time zones shall be provided.
7. Access authorization decisions will be made locally at the card reader or its associated IFP. Sufficient local memory will be provided to store all access authorization data for up to 5,000 individuals. Access authorization data will be automatically downloaded from the central processors to each access point, as appropriate (i.e., after the addition, modification or deletion of an authorized ID badge / keycard user file or upon restoration of communications between an IFP and the central processors). Authorized access transactions will be reported to the primary central processor individually or in groups. The downloading of access authorization data and the uploading of groups of authorized access transactions will not interfere with the real-time operation of the system. Unauthorized access requests will be reported as off-normal events as they occur.
8. Card readers shall operate in a proximity detection mode. When an ID badge / keycard is presented at a card reader, the encoded information shall be compared with the stored data for authorized access. If a PIN is required for access at that access point at that time, the user shall be prompted to enter the number. Each card reader shall be provided with separate visual indications that an ID badge / keycard has been decoded; a PIN entry is required (initial or retry); an incorrect PIN code has been entered; and access has been granted or denied.
 - a. Unauthorized access requests and / or the presentation of an inactive, expired, lost, stolen, unreturned or an improperly encoded ID badge / keycard shall be annunciated as an alarm. Access will not be granted.
 - b. In the event a PIN is not entered within a pre-determined (programmable) time period after the user is prompted (initially or for a retry), the card reader shall reset and an advisory shall be annunciated.
 - c. The number of consecutive incorrect PIN attempts accepted by the system shall be site-configurable (up to 4). After the maximum number of incorrect entries has been made, the card reader shall reset and an alarm shall be annunciated. An alarm shall also be

- annunciated if the maximum number of incorrect entries associated with the same ID badge / keycard user occurs consecutively at several card readers within a pre-determined (programmable) time period.
- d. At the Automatic Vehicle Gate (Type 12) an access request must be accompanied by a signal from the associated vehicle presence sensor. In the event this signal is not received, an advisory will be annunciated. Access will not be granted.
 9. The system shall provide the capability to initiate the access sequences described on drawings at any access point via the SCC or Programmer's terminal. The format for performing this keyboard control function shall require the inputting of the ID card number of the individual requesting access. This information shall be stored with the record for control function execution.
 10. The specific intrusion detection devices that are placed in the ACCESS mode for an authorized access request shall be site-configurable.
 11. The time periods for activating a local locking device and ACCESSING the intrusion detection device(s) shall be independently programmable from the SCC or Programmer's terminal. In the event 2 or more individuals utilize the same card reader or exit pushbutton, each valid request shall reset the time durations for unlocking and ACCESS status to allow sufficient time for the unalarmed entry / exit of each subsequent individual.
 - a. In the event an access point is not closed within the pre-set ACCESS time, an advisory shall be annunciated.
 - b. In the event an access point is not accessed within a predetermined (programmable) time after an entry request is granted, either locally via a card reader or remotely via the SCC, an advisory shall be annunciated and the event shall be recorded by the CCTV system.
 12. Failure to depress the exit pushbutton prior to exiting a security area will be annunciated as an alarm. Doors equipped with an exit pushbutton will be posted to inform the individual of this requirement.
 13. The CCAS shall have provisions to selectively print, at a specified data printer, all authorized automated access transactions at designated card readers or by designated ID badge / keycard users as they occur. All authorized automated access transactions, whether or not printed, shall be stored on the DPS hard disk units. As a minimum, the printed and / or stored information will include the individual's name and keycard number (except when an exit pushbutton is used), the date, the time, and the card reader or access point location or number.
 14. All access points equipped with electrical locking devices (magnetic locks or other locking devices as shown on drawings), automatic roll-up door operators, and gate operators will be remotely controllable from the SCC individually or in groups. These provisions will also allow the access point to remain in a permanently locked / unlocked or open/closed mode for a pre-determined (programmable) time period. An advisory shall be initiated when this time period expires.
 15. Signs shall be provided on the egress side of access points to advise individuals to press the exit pushbutton before opening the door. Signs shall be posted on the public side of door access points to advise individuals to contact the airport Security Center for nonemergency matters or to push on door panic hardware until alarm sound and that door will open in 15 seconds (time duration will be determined by the airport). Exact verbiage for signs shall be coordinated with the owner.

16. A local gate controller will be provided within the associated gate operator enclosure to permit local operation by an authorized user. Operation of the gate via the controller will be annunciated as an alarm.
17. ID badge / keycard encoding will include a facility code unique to Duluth International Airport, an individual code unique to each user and an issue number. An encoder will be provided with the PIDS to permit on-site encoding of the ID badges / keycards.
18. Each ID badge / keycard user will be assigned a keycard number for use by the console / terminal operators when performing keyboard control functions associated with the CAS and PIDS and requesting displays, printouts and historical logs. The keycard number will be linked by the system to the internal coding of the ID badge / keycard during the badge issue process. The system will allow for linking an existing keycard number and associated database record with a new ID badge / keycard by using a subsequent issue number for continuity when a damaged, stolen or lost ID badge / keycard is replaced.
19. Individual ID badge / keycards and PINS will be assigned via the PIDS. All personal database information associated with each ID badge / keycard user (name, address, etc.) and access authorization data (security areas and time zones) will be transferred from the photo information microprocessor to the CCAS central processors upon entry via the PIDS terminal. (Note: The operator level required to add / modify access authorization data will be higher than the one used to enter / modify of personal information.)
20. Existing personnel database files will be modified and / or deleted from the PIDS, SCC or the Programmer's terminal. When an ID badge / keycard is deleted from the system, the user data will be retained in the on-line databases until transferred to long-term storage.
21. The CCAS will provide the ability to automatically deactivate an ID badge / keycard if it has not been used to access a card reader-controlled access point for a pre-determined (programmable) time period. The user data for an inactive ID badge / keycard will be retained in the on-line DPS database. Provisions to reactivate an ID badge / keycard from the SCC, Programmer's terminal and the PIDS terminal will be provided.
22. The CCAS will provide the ability to flag a particular issue of an ID badge / keycard as lost, stolen or inactive. Additional information shall be recorded in a notes or user definable fields from the SCC, Programmer's terminal and the PIDS terminal.
23. An override command will be provided via the SCC to permit all ID badge / keycard users to enter and exit selected security area access points during emergency situations (i.e., access will be based on a valid facility code only).
24. Each ID badge / keycard user will have the ability to discreetly communicate a duress alarm -via a PINpad during the entry of the PIN. The alarm signal will be transmitted to the primary central processor while the access request is processed as specified heretofore.

H. Intrusion Detection

1. All intrusion detection equipment shall be capable of sensing the stimuli for which they are designed to react with at least a 90 percent probability with 95 percent confidence when the sensitivity is adjusted to produce not more than 1 false alarm per week.
2. Selected access points as shown on drawings shall be equipped with balanced magnetic switches to detect authorized and unauthorized openings.

- a. Each balanced magnetic switch will initiate an alarm signal whenever the door, gate or hatch is opened more than one (1) inch while in the SECURE mode.
 - b. Each balanced magnetic switch shall initiate an alarm signal upon increase, decrease or attempted substitution of an external magnetic field while it is in the SECURE mode.
3. Card reader-controlled access points shall be provided with a door status sensor to detect authorized and unauthorized openings and tampering attempts.
 - a. Each door status sensor shall initiate an alarm signal whenever the door is moved more than 1 inch while in the SECURE mode.
4. The Automated Vehicle Gate shall be equipped with a gate position switch to detect authorized and unauthorized openings.
 - a. Any attempt to force a gate open or open a gate via the local gate controller shall be annunciated as an alarm condition.
5. The Automated Vehicle Gate shall be equipped with vehicle presence sensors (ground loop) on the public and AOA/SA side to detect authorized and unauthorized entrée / exit attempts.
 - a. A signal from the vehicle presence sensor on the public or AOA/SA side of a gate without a concurrent signal from the associated card reader shall be annunciated as an alarm.
6. Tamper switches shall be provided inside all CCAS equipment cabinets, consoles, termination boxes and enclosures to detect unauthorized opening or tampering.
 - a. Tamper switches shall be installed and baffled to prevent defeat by deforming or opening the cover and to initiate a signal whenever the cover is displaced more than 1/4 of an inch from the closed position.
7. A manually-initiated flex-response (duress) call button device shall be provided at the airport security screening point as required by TSA.
 - a. A signal from the call button device shall be annunciated as an alarm at the SCC.
 - b. A signal from the call button device shall not be annunciated locally.
 - c. The call button shall be located to enable surreptitious activation.
 - d. The flex-response alarm shall only be reset at the initiating location.
8. Manually-initiated duress alarm devices shall be located at the airport Security Center SCC and other locations shown on the drawings.
 - a. A signal from the duress alarm device shall not be annunciated as an alarm at the initiating location.
 - b. The duress alarm will be located to enable surreptitious activation.
 - c. The duress alarm shall be reset at the initiating location.
 - d. The duress alarm from the Security Center will be annunciated at the Administration reception area or other locations approved by the airport director. The facility annunciation shall be via flashing blue light.
 - e. The duress alarm from check point screening area shall be annunciated in the security area by a flashing blue light as well as at SCC.
 - f. The duress alarm from administration area shall be annunciated at the SCC.
9. End-of-line termination networks shall be provided for all alarm and tamper contacts to provide the appropriate end-of-line impedance for signal line supervision.

I. Surveillance and Assessment

1. Solid-state Closed Circuit Television (CCTV) color cameras shall be provided for visual surveillance of selected areas. Each camera shall be mounted on either a free-standing pole, building exterior / interior wall, roof or hung from the ceiling. The complete system shall be provided as indicated on the drawings and specified herein.
2. Camera locations will be selected so that an individual 6 feet tall standing at the farthest end of the viewing area will be displayed at a height equal to or greater than 10 percent of the CCTV monitor screen.
3. All exterior cameras shall be housed in an environmental enclosure to provide a stable operating environment and to discourage tampering. Exterior cameras shall also be provided with a thermostatically controlled heating and blower system.
4. Display monitors as indicated on the drawings shall be provided for the surveillance and assessment subsystem.
5. Visual identification of which camera output is being displayed on each monitor, whether sequentially, manually or automatically, shall be provided.
6. The SAS shall provide sequence capability at all CCTV monitors. Switching sequence at each monitor shall be independent of the others. The console operators shall have provisions to adjust the sequencing interval and omit or add any camera(s) from the sequence.
7. Digital Video Storage System shall be provided at the airport SCC to automatically record alarm-associated camera outputs and manually record the outputs of any camera displayed on the alarm monitor. Each recording will include the time, the date and the associated camera identification.
8. The SCC will have provisions via a control unit (independent of the VDT keyboard) to manually pan, tilt, zoom and focus any camera. The Surveillance and Assessment Subsystem (SAS) will include provisions to assign up to 10 pre-set positions to each camera equipped with a pan/tilt unit. Upon manual or automatic (alarm condition) selection of a pre-set position, the associated camera will automatically pan, tilt and zoom to the appropriate view. After a pre-determined (programmable) time period, these cameras will automatically return to a pre-set "home" position.
9. The SAS will be designed such that a camera can be displayed on all monitors at the SCC concurrently without degradation of the picture.

J. Off-Normal Event Reporting

1. Alarm, tamper and trouble conditions and advisories shall be annunciated so that there is a visually discernible (color) difference between them. The CCAS shall have the capability to display a minimum of 5 off-normal events simultaneously on the VDTs. The CCAS shall continue to print off-normal events when additional VDT display space is not available. The SCC operators shall be advised via the VDT of pending off-normal events. Provisions for independent call up (scrolling and paging) of those alarm, tamper and trouble conditions and advisories that cannot be initially displayed due to VDT line limitations shall be provided. The VDT displays shall be automatically updated as space becomes available.
2. Off-normal events shall be prioritized by type (alarm, tamper, trouble or advisory) and category (see below) for reporting and historical logging. A minimum of 64 priority groups (programmable) shall be provided. Provisions to assign priority groups to the SCC for primary annunciation will be provided. (Note: Priority grouping will be used to assign monitoring responsibility to the SCC and is not intended to cause one priority group to "bump" a previously displayed priority group at a given VDT.)

3. No alarm, tamper or trouble condition or advisory shall be lost during switchover from normal to backup power (either at the SCC or at a field installed device) or from the primary to hot-standby central processor.
4. The following conditions shall be annunciated as an alarm (alarm categories are shown in parentheses):
 - a. Receipt of a signal from any detector / sensor performing intrusion monitoring functions at a monitored point (intrusion Alarm).
 - b. Unauthorized opening of any SECURED access point (intrusion Alarm).
 - c. Receipt of a flex-response signal from security screening point (Flex-Response Alarm).
 - d. Receipt of a duress signal (Duress Alarm).
 - e. Presentation of an unauthorized, inactive, lost, stolen, unreturned, expired or improperly encoded ID badge / keycard at a card reader controlled access point (Access Alarm).
 - f. Consecutive incorrect PIN entries exceeding the maximum number of tries (Access Alarm).
5. The following condition shall be annunciated as tamper:
 - a. Unauthorized opening of a CCAS equipment cabinet, console, box or enclosure (Tamper Alarm).
6. The following conditions shall be annunciated as trouble (trouble categories are shown in parentheses):
 - a. CCAS equipment malfunction or failure (Equipment Failure).
 - b. Loss of any source supplying power to the CCAS (Power Failure).
 - c. Failure at any portion of the CCAS power conversion or distribution equipment to include equipment power supplies (Power Failure).
 - d. Low battery indication from a UPS or battery backup unit (Low Battery).
 - e. Any attempt to disable or compromise wiring between any monitored point and the IFPs, and between the IFPs and the central processors.
 - f. A single break, a single ground fault, a wire-to-wire short, or any combination of these in the signal wiring between any monitored point and the IFPs, and between the IFPs and the central processors (Line Supervision).
 - g. Signal transmission failure (Communications Failure).
 - h. Automatic switchover from the primary to the hot standby central processor (Processor Failure).
 - i. Loss of video signal (Loss-of-Video).
7. The following conditions shall be annunciated as an advisory (advisory categories are shown in parentheses):
 - a. Failure of a temporarily ACCESSED card reader-controlled access point to close within a specified time after authorized opening (Access Advisory).
 - b. Failure of a temporarily ACCESSED card reader-controlled access point to be opened within a specified time (Access Timeout).
 - c. The time period for an access point opened / unlocked from the SCC has expired (Access Advisory).
 - d. ID badge / keycard user still has an issued key (Key Advisory).
 - e. Manual switchover from the primary to the hot standby central processor (Manual Switchover Advisory).
 - f. Resynchronization of central processors databases started / completed (Resync Started / Complete Advisory).

- g. DPS historical logging storage capacity 85 percent full/about to be overwritten 98 percent full (Historical Storage Advisory).
 - h. ID badge / keycard accountability drops below 95 percent or a predetermined percentage, to include expired, reported lost and stolen ID badge / keycard (Accountability Advisory).
 - i. Failure to enter a PIN within a specified time after being prompted by the card reader (Access Timeout).
 - j. Receipt of an access request from the automated vehicle gate without a signal from the respective vehicle presence sensor (Unauthorized Access Request).
8. Each alarm, tamper or trouble condition and each advisory at a monitored point shall cause an audible annunciator to be sounded and an off-normal event text message to be displayed on the SCC VDTs and printed at the event printer located in the airport Security Center. The displayed and printed text messages shall be in full-word English and shall, as a minimum, include the time of occurrence, the point identification code, the point description, the type and category of event and the required operator response. VDT displays shall contain a minimum of 2 lines per event. The SCC operator shall have provisions to selectively display additional text information (up to 6 lines) for each off-normal event.
- a. The audible annunciator shall be capable of being heard throughout console area. When the console is manned, the volume shall be capable of being reduced not more than 90 percent of its rated output to permit local alarming only. The SCC shall be provided with a momentary silencing switch for the audible annunciator. The audible annunciator shall be capable of being reset but not permanently silenced. The silencing of an audible annunciator in the presence of other unacknowledged off-normal events shall not interfere with the subsequent reporting of these events as specified. The silencing switch shall operate independently of the keyboard control function to acknowledge off-normal events. In addition, the audible annunciator shall be provided at another CCAS workstation as selected by DLH.
 - b. The printed message shall include the time and date and shall be readily distinguishable from other messages printed at the printers.
 - c. Duress alarms shall not be annunciated at the initiating location.
 - d. Subsequent alarm, tamper or trouble conditions at the same point received after the initial signal but prior to operator disposition (clearing) shall not be displayed (i.e., there shall be only 1 VDT text message for each alarm, tamper or trouble condition at the same point regardless of the number of signals received prior to disposition).
 - e. In the event the primary monitoring location is inoperable, an off normal event shall be automatically annunciated at its alternate monitoring location (Programmer's terminal).
9. Upon acknowledgment by any authorized SCC operator, the audible annunciator shall be silenced and cleared at all monitoring locations. The VDT displays shall be updated to indicate an off-normal event has been acknowledged.
- a. The CCAS shall assign each monitored point to a computer-generated color graphic display. Each display shall include a map or floor plan depicting the location of the point, the point identification code and a color-coded flag to identify the status of the point. Upon acknowledgment of an off-normal event, the associated graphic display shall be automatically presented on the GDT at the

acknowledging console. This display shall override any previously displayed graphics at the GDT. In the absence of alarms, the SCC operators shall be able to manually display the graphic associated with a specific point.

- b. The CCAS shall interlock monitored points with a camera output and pre-set position. Upon acknowledgment of an off-normal event, the associated cameras shall be automatically panned, tilted and zoomed (or fixed camera) to the appropriate scene and the output displayed on one of the color CCTV monitor at the acknowledging console. In the absence of alarms, the SCC operators will be able to manually display the camera output associated with a specific point.
- 10. When the cause of an alarm, tamper or trouble condition or advisory has been removed, a reset message shall be displayed and printed at the SCC (or alternate monitoring location on the third floor if the SCC is inoperable). The printed message shall include the time and date of reset, the point identification code, and the point description. Events returning to normal shall not require a separate acknowledgment by the console operators.
 - 11. After a point has been reset, it shall be capable of being individually cleared by any authorized SCC operator. Clearing a point shall remove the displays from all VDTs and GDTs and print an event-cleared message on the event printer. Clearing a point interlocked with an associated video output shall remove the automatically displayed camera output from the CCTV monitor; return the camera to its "home" position.
 - a. As part of the clearing function, each monitoring location shall have provisions to enter an explanation of the event (a minimum of 1 line) for storage with the event data and for printing with the event-cleared message.
 - b. No alarm, tamper or trouble condition or advisory shall be cleared from the VDTs without being stored on the DIPS hard disk units.

K. Test Reporting

- 1. Individual equipment operation and overall system performance shall be verified periodically by simulating or duplicating alarm, tamper and trouble conditions and advisories at each monitored point, as applicable. After annunciation, acknowledgment and reset, as described above, each monitoring location shall have provisions to clear and store these events on the DIPS hard disk units as tests via the keyboard. These provisions shall include at least 2 independent, operator-initiated actions so that a bona fide alarm, tamper or trouble condition or advisory is not accidentally stored as a test.

L. Mechanical Key Control

- 1. A system to monitor and control mechanical key issue and return shall be provided as part of the CCAS. Selective issuing of mechanical keys to authorized ID badge / keycard users shall be performed via PIDS terminal. The operator shall input the respective mechanical key number in the individual's database file and shall log the time, date and mechanical key number. A similar sequence shall be provided for mechanical key return."

M. Demand Display and Printing Functions

- 1. The console terminal operators shall have provisions to display and / or print system status information on a real-time basis. Paging and scrolling capability shall be provided for multi-page displays. Previously displayed information shall be automatically cleared when a new display is requested.

2. Status information shall be displayed on the VDT at the location initiating the request.
3. Status summary requests from the SCC and Programmer's terminal shall be capable of being directed to any printer. If the selected printer is an event printer, off-normal event printing shall be buffered until the printout is completed. Report sorts shall be performed alphabetically or numerically on all fields, as appropriate.
4. The following demand printouts shall be provided at the SCC and Programmer's terminal, as a minimum:
 - a. All INACTIVE monitored points.
 - b. All SECURE monitored points.
 - c. All monitored points in ACCESS.
 - d. All monitored points in ALARM.
 - e. All monitored points in TAMPER.
 - f. All monitored points in TROUBLE.
 - g. All current ADVISORIES.
 - h. All current off-normal events.
 - i. Status of all monitored points.
 - j. All data associated with all monitored points.
 - k. All data associated with all ID badge / keycard users (sort by any set of parameters).
 - l. All data associated with all access points.
 - m. All assigned ID badge / keycards.
 - n. All active, inactive, lost, unreturned, expired or deleted ID badge / keycards (select by type and sort by any set of parameters).
 - o. All access points assigned to each security area.
 - p. The days and times associated with all time zones.
 - q. All ID badge / keycard users assigned to each security area and / or card reader-controlled access point (sort by name and keycard number).
 - r. All ID badge / keycard users assigned to a particular security area and / or card reader-controlled access point (sort by name and keycard number).
 - s. Last card reader used by all ID badge / keycard users (sort by any set of parameters).
 - t. Last ID badge / keycard used at all card readers.
 - u. All unassigned IFP points.
 - v. All mechanical keys assigned to all ID badge / keycard users.
 - w. All mechanical keys issued by key number.
 - x. All keyboard control functions scheduled for automatic execution.
 - y. All ID badge / keycard users sorted by company / tenant.
 - z. All ID badge / keycard users sorted by a company / tenant.
 - aa. Ratio of the number of ID badge / keycards deleted and unreturned or reported as stolen or lost to the number of assigned ID badge / keycards.
 - bb. All Airport and company/tenant personnel with signature authorization.
 - cc. All data associated with all company tenant files.
 - dd. All ID badge / keycards set to expire by a particular date.
 - ee. Sort and print list of ID holder's last training by name or company.
5. The following demand printouts will be provided at the report printer at the PIDS terminal, as a minimum:
 - a. All data associated with all ID badge / keycard users (sort by any set of parameters).

- b. All assigned ID badge / keycards (sort by any set of parameters).
 - c. Status of all assigned ID badge / keycards (select by type (active, inactive, lost, stolen, unreturned, expired, deleted) and sort by any set of parameters).
 - d. All data associated with all company tenant files.
 - e. Time periods of data stored on storage device.
 - f. All ID badge / keycards set to expire by a particular date.
6. The console terminal operators shall have provisions to print the data displayed on their VDT screen at any time.

N. Logging Functions

- 1. Historical logs shall be requested from the hard disk units or other approved storage devices for a particular date or sequence of dates. When a log is requested, the date and the time of day shall be printed along with the log identification.
- 2. Capacity to store up to 500,000 events on-line on the hard disks shall be provided. Historical log data may be transferred to a magnetic tape cartridge for long term storage at any time.
- 3. The CCAS shall monitor the status of all remaining available on-line historical storage space. Routines shall be provided which respond to operator requests to display remaining storage space available and which automatically generate a visual indication when the system's historical storage space capacity is close to being exhausted (e.g. 85 percent full) and when stored data is about to be overwritten (e.g. 98 percent full).
- 4. A file management subsystem shall be provided for maintaining, cataloging and retrieving any historical files with minimum operator interaction. The subsystem shall be designed to accept an operator request specifying the type of data to be retrieved and the associated time period. For data that is stored permanently, the subsystem shall advise the operator which magnetic tape cartridge must be loaded for data retrieval. Upon notification that the appropriate tape cartridge has been loaded, the subsystem shall transfer the data on-line, sort it and generate the requested log.
- 5. Historical logs requests from the SCC, Programmer's terminal, and PIDS terminal shall be capable of being directed to any printer. If the selected printer is an event printer, off-normal event printing shall be buffered until the printout is completed. Historical log sorts shall be performed alphabetically or numerically on all fields, as appropriate.
- 6. The following historical logs shall be provided at the SCC and Programmer's terminal, as a minimum. Provide Crystal Reports or other 3rd party software as required to meet the specifications. The intent is to provide historical log for audit trail and meet TSA reporting requirements. It is recognized that different approved manufacturers may provide the logs in slight variations than as indicated.
 - a. ALARM conditions (sort by point and category).
 - b. TAMPER conditions (sort by point).
 - c. TROUBLE conditions (sort by point and category).
 - d. ADVISORIES (sort by point, category, name and keycard number, as applicable).
 - e. Test results at monitored points (sort by point).
 - f. Access attempts at card reader-controlled access points (sort by point, keycard number and name).
 - g. Authorized automated access transactions (sort by point, keycard number and name).

- h. Authorized access transactions through the keyboard (sort by point, key / card number and name).
 - i. SCC, Programmer's terminal and PIDS terminal operators on duty (sort by console / terminal and operator).
 - j. Operator-initiated keyboard control functions and associated data (sort by control function, console / terminal and operator).
 - k. Database changes (sort by database, console terminal and operator).
 - l. Keyboard control function input errors (sort by console / terminal and operator).
 - m. Keyboard control functions and associated data initiated automatically on a time schedule (sort by control function).
 - n. Mechanical keys issued and returned (sort by individual or key number).
 - o. A stop list of all access authorized changes at each card reader controlled access point and all ID badge / keycards that have been inactivated, deleted or flagged to preclude use (sort by access point and name).
 - p. A list of all ID badge / keycards that have not been used / presented at an access point for a specified time period (sort by individual).
 - q. Number of ID badge / keycards assigned, returned, deleted or reported as stolen or lost (accountability).
 - r. The following historical logs will be provided at the report printer at the PIDS terminal, as a minimum:
 - s. PIDS terminal operators on duty (sort by operator).
 - t. Operator-initiated keyboard control functions and associated data (sort by control function and operator).
 - u. Database changes (sort by database and operator).
 - v. Number of ID badge / keycards assigned, returned, deleted or reported as stolen or lost.
7. A report generator, accessible via the Programmer's terminal or PIDS terminal shall be provided for special reports and logs. After a report has been developed, it shall be available for use by all authorized operators.
8. The capabilities required by this section shall be strictly background mode and shall not interfere with the real-time functions of the system or diminish system throughput or response times.

P. Keyboard Control Functions

- 1. All SCC and Programmer's terminal control functions, except operation of the master intercom station and CCTV equipment, will be performed through the VDT keyboards. The keyboard at the PIDS terminal will be used to perform selected control functions associated with badge preparation and issue.
 - a. The specific keyboard control functions that can be performed at the SCC and the Programmer's terminal shall be site-configurable.
 - b. All keyboard control function requests shall be checked to verify the correctness of all inputted data prior to execution and the operator shall be advised accordingly. Keyboard control function input errors at all consoles / terminals shall be displayed and printed locally and stored on the DPS hard disk units. Input error messages shall be appropriately descriptive and consistent for each control function.
 - c. Keyboard control functions shall be implemented in a manner which minimizes the number of keystrokes required. If the keystrokes are in the form of characters, these characters shall be intuitively obvious for the function they are to perform. If a menu-driven or prompt approach is utilized, provisions to by-pass the menu or prompt shall

- be provided to allow for efficient operation of the system by experienced operators.
 - d. On-line help data for each keyboard control function shall be available to all console / terminal operators.
- 2. A system of operator levels shall be provided at all console / terminals to restrict operator use of keyboard control functions and access to database fields. A minimum of 8 levels shall be provided. Keyboard control functions and database fields shall be assigned to 1 or more operator levels which, in turn, shall be assigned to a console / terminal operator. The operator shall be permitted to perform all keyboard control functions and access all database fields associated with his assigned level (subject also to SCC, PIDS terminal and Programmer's terminal keyboard control function assignment). If the system is menu or prompt-driven, operators shall only have access to those menus / prompts for which they are authorized use.
- 3. Each console and terminal operator shall be assigned a unique password, between 5 and 9 alphanumeric characters in length. This password shall be utilized to log on and off the system and perform keyboard control functions with a Control level 2 restriction. Passwords shall not appear on any system VDT, nor shall they be printed on any system printer.
 - a. An operator shall be automatically logged-off when another operator logs on at that console / terminal.
 - b. An operator shall be automatically logged-off if there has not been any keyboard activity for a pre-determined (programmable for each console terminal) time period.
- 4. Provisions to abort any keyboard control function prior to completion of execution shall be provided. In addition, an "escape" feature shall be provided to cancel a keyboard control function request before execution is initiated.
- 5. The DIPS shall have provisions to automatically initiate keyboard control functions, to include report and historical log printing, based on a predetermined (programmable) time schedule. This schedule shall include both the day(s) and the time(s) when the control function is to be executed. At the time of execution, the keyboard control function shall be displayed at the SCC, printed at the event printer and stored on the DIPS hard disk units.
- 6. Keyboard control functions performed at the SCC, Programmer's terminal, and PIDS terminal shall be displayed at the console / terminal initiating the request at the time of execution and printed on the event printer. All completed keyboard control functions shall be stored on the DPS hard disk units. If keyboard control function request execution is not immediate or obvious, the operators shall be advised when the control function is completed.
- 7. The following keyboard control functions shall be provided at the SCC and Programmer's terminal, as a minimum:
 - a. A command to set and / or reset the internal time and date reference of the central processors.
 - b. A command to selectively define or modify monitored point descriptions.
 - c. A command to interlock a monitored point with a camera output.
 - d. A command to interlock a monitored point with a graphics display.
 - e. A command to selectively define or modify security area identification.
 - f. A command to selectively define or modify time zones.
 - g. A command to selectively assign a keyboard control function to a SCC or Programmer's terminal.

- h. A command to selectively assign any combination of control levels to a keyboard control function.
- i. A command to selectively assign keyboard control functions / database fields to any operator level.
- j. A command to assign or change the operator level for a console / terminal operator on an individual basis.
- k. A command to assign or change the unique password for a console / terminal operator on an individual basis.
- l. Commands to selectively enable / disable CCAS device operation on an individual basis.
- m. A command to inactivate monitored points (individually or in groups).
- n. A command to change the status of monitored points to SECURE (individually or in groups).
- o. A command to selectively change the status of monitored points to ACCESS (individually or in groups).
- p. A command to modify ID badge / keycard user data (individually or in groups).
- q. A command to delete ID badge / keycards (individually or in groups).
- r. A command to reactivate ID badge / keycards (individually or in groups).
- s. A command to initiate the automated access sequence at a card reader-controlled access point. The format for initiating this command shall include inputting the keycard number of the individual requesting access.
- t. A command to program, on an individual basis, the length of time a card reader-controlled access point may remain open without alarm after an authorized access request is granted.
- u. A command to selectively print all automated access transactions at designated card readers or for designated ID badge / keycard users, as they occur.
- v. A command to allow / disallow all active ID badge / keycard users to enter and exit selected card reader-controlled access points based on a valid facility code only.
- w. Commands to lock / unlock access points equipped with electrical locking devices for a pre-determined (programmable) time period (individually or in groups).
- x. A command to selectively acknowledge an alarm, tamper or trouble condition or an advisory.
- y. A command to selectively clear an alarm, tamper or trouble condition or advisory and enter an explanation of the event.
- z. A command to selectively clear and store an alarm, tamper or trouble condition or an advisory as a test.
- aa. Commands to request selected demand displays and printouts.
- bb. A command to selectively clear VDT demand displays.
- cc. A command to print the data displayed on the VDT screen.
- dd. Commands to request selected historical logs.
- ee. A command to halt a historical log in progress.
- ff. Commands to transfer data between the DIPS hard disk units and a DPS magnetic tape cartridge.
- gg. A command to assign a keyboard control function to a time schedule for automatic execution.
- hh. A command to display the graphic display associated with a specified point. This command shall override any manually or automatically displayed graphic previously displayed on the GDT.

- ii. A command to display the camera output associated with a specified point. This command will override any manually or automatically displayed camera output previously displayed on the monitor.
- jj. Commands to configure an access point for controlled access via a card reader only, a PINpad only or both card reader and PINpad.
- 8. The following keyboard control functions will be provided at the PIDS terminal, as a minimum (Note: Any or all of these functions may be performed via a mouse):
 - a. A command to set and / or reset the internal time and date reference of the photo imaging microprocessor.
 - b. A command to selectively assign keyboard control functions / database fields to any operator level.
 - c. A command to assign or change the operator level for a terminal operator on an individual basis.
 - d. A command to assign or change the unique password for a terminal operator on an individual basis.
 - e. A command to modify ID badge / keycard user data (individually or in groups).
 - f. A command to delete ID badge / keycards (individually or in groups).
 - g. A command to reactivate ID badge / keycards (individually or in groups).
 - h. A command to modify company / tenant file data (individually or in groups).
 - i. A command to capture an individual's video image.
 - j. A command to capture an individual's signature.
 - k. A command to print a badge insert (individually or in groups).
 - l. Commands to interrupt, re-order, restart and cancel a badge insert print queue.
 - m. Commands to reformat a badge insert layout.
 - n. A command to encode an ID badge / keycard.
 - o. Commands to calibrate image color, hue, contrast and sharpness.
 - p. Commands to use the PIDS terminal card reader and digital keyboard to test an assigned ID badge / keycard and PIN and train an individual in the proper use of the reader and PINpad.
 - q. Commands to request selected demand displays and printouts.
 - r. A command to selectively clear VDT demand displays.
 - s. A command to print the data displayed on the VIDT screen.
 - t. Commands to request selected historical logs.
 - u. A command to halt a historical log in progress
 - v. Commands to transfer data between the PIDS hard disk unit and the magnetic tape cartridge unit.
 - w. Command to transfer data between fingerprinting equipment and PIDS hard disk.

Q. Power Supply

- 1. Power for all CCAS equipment shall be provided as indicated on the drawings.
- 2. An Uninterruptible Power Supply (UPS) unit shall be provided at the DLH Security Center for the SCC: and other CCAS equipment located there to assure continued operation upon loss of normal ac power for a period of at least 15 minutes. The Airport diesel generators will provide backup power for this equipment during extended power outages.
- 3. The UPS shall be sized to support the following equipment at a minimum. Provide 50 percent space capacity in the UPS for future loads.

- a. All the CCAS equipment located in SCC, PIDS and EOC.
- 4. Battery backup units will be provided for field-installed devices not equipped with integral backup batteries to assure continued operation upon loss of normal ac power for a period of at least 4 continuous hours.
 - a. Battery backup units shall be incorporated into the field equipment cabinets or a separate, adjacent tamper-protected enclosure.
 - b. During normal operation, the battery backup units will be maintained at full charge. In the event of a loss of normal and emergency ac power, the associated load will be automatically transferred to the battery backup unit. Upon restoration of ac power, the load will be automatically re-transferred and the batteries will be recharged to capacity at a rate not to exceed 10 times the discharge time.
 - c. When power is being supplied from its batteries, a battery backup unit will monitor battery voltage and will disconnect the load if the voltage drops below 85 percent of its rated output. Upon restoration of ac power, the load will be automatically re-transferred.
- 5. The status of the UPS unit and battery backup or integral back up unit batteries will be monitored by the CCAS. A low battery condition will be annunciated as trouble.

R. ID Badge / keycard Preparation

- 1. A PIDS will be provided to produce ID badge / keycards for issue to authorized users. Badge preparation will include the inputting of personal and access authorization data, the capture of an individual's video image and signature, the printing of the badge insert, the cutting and laminating of the badge insert to the keycard and the encoding of the keycard.
- 2. Personal and access authorization data will be entered via the PIDS keyboard. Database fields with limited input options (e.g., sex, race, etc.) will utilize pop-up windows with mouse selection to facilitate data entry and minimize input errors.
- 3. A high resolution digital video camera will be utilized to capture a continuous tone color image of an individual. Subject placement will be displayed in a preview window on the PIDS VDT during the capture process and may be moved, via software, for proper centering. Provisions for freezing an image and immediate recapture of an image will be provided. During the capture process, photographic lighting will be controlled by the photo imaging microprocessor.
 - a. The PIDS will support transfer and storage of video images captured via a portable Digital Camera
 - b. The PIDS will be provided with a stored reference frame to calibrate image color, hue, contrast and sharpness.
- 4. The PIDS will support variable size badge inserts and multiple insert formats. The badge insert layout may include a portion or all of the text and image data contained in an individual's database file (site configurable). Text and image arrangements, insert colors (text and background), fonts, typestyles and image sizes will be site-selectable. Background color will be automatically selected by the system based on the badge type (employee visitor), employer affiliation or access authority. Image sizes will be proportionally variable.
- 5. Individual badge inserts with all associated text and image data will be capable of being previewed simultaneously on the PIDS VDT prior to printing (either initially or for reissue). The display will be in a "What You See Is What You Get" format.

6. The PIDS will support single and two-sided printing in a horizontal or vertical alignment. Badge inserts will be printed individually or in groups. The system will be capable of printing a minimum of 100 badge inserts while operating unattended. The print queue will be capable of being interrupted, re-ordered and restarted or canceled.
 7. Badge encoding shall include a facility code unique to the airport, an individual code unique to each user and an issue number.
 8. The laminating process will be tamper-resistant and will securely bond the badge insert to the keycard in such a manner that any attempt to alter or extract the data will be visibly obvious or render the ID badge / keycard unusable.
 9. Video image fingerprint data and signature data will be stored on the PIDS hard disk unit. All other data will be transferred to the DPS for storage. An interactive data link will be provided between the PIDS and DPS for the bidirectional exchange of information.
 10. The PIDS will support the display and printing of full size video images.
- S. Miscellaneous Provisions
1. Physical Barriers
 - a. Bollards will be provided around field-installed equipment at Type 12 access points to preclude accidental damage from vehicles. These bollards will consist of 6" concrete-filled pipes appropriately anchored.
 2. Maintenance Aids
 - a. To facilitate routine preventive and corrective service of the CCAS by Airport Maintenance personnel, the CCAS will be provided with a set of all special or nonstandard test equipment, tools, adaptors and fittings to maintain and service the supplied equipment to include card extenders for each different type of printed circuit card, tools for removing tamper-proof screws and a portable IFP analyzer (laptop computer work station).

1.9 QUALIFICATIONS

- A. The system contractor / integrator responsible for providing the CCAS shall have at least ten (10) years experience in furnishing and installation of such systems.
- B. The system contractor integrator shall have previous experience in installation of systems of similar scope for at least 2 projects in the past five (5) years and airport security system under PART 1542 (or FAR 107.14) for at least one (1) project in the past five (5) years. Contractor shall provide names of the project, year completed and references to the A/E for review and approval with bid.
- C. The system contractor's project manager and on-site superintendent shall have a minimum of fifteen (15) years experience each and shall have worked on the projects listed in Art. 1.9B in similar capacity. Submit name with bid.
- D. Manufacturer Qualifications (submit with product submittal)
 1. Manufacturer of the CCAS shall be an established organization with referenced and documented experience delivering and maintaining Security Systems of equal or higher sophistication and complexity as compared to the system detailed in this specification.

2. CCAS Manufacturer's manufacturing facilities shall be certified ISO-9000:2000 operations, utilize ISO-9000:2000 manufacturing procedures and maintain their ISO certifications.
 3. CCAS Manufacturer shall employ at a minimum the following methods for Quality Control of component and assembly devices.
 - a. Visual inspection of devices shall be performed to verify assembly according to defined procedures.
 - b. End of line operational tests shall be performed to ensure product functionality has been correctly configured.
 - c. A system burn-in period shall be utilized to screen for early life failures of electronic components.
 4. Individual functionality and system level regression testing shall be performed to ensure compliance with product specifications. Single and multiple unit system tests shall be performed to mimic end-user installation configurations. Automated hardware and software testing shall be utilized to verify system performance under published operational loads and shall be compared to published system capabilities.
- E. Access controls and CCTV software experience: The access controls and CCTV system integrator / contractor shall have factory trained personnel from the approved manufacturer with a minimum of five (5) years experience in system integration and a minimum of two (2) years experience in the proposed access controls and CCTV systems for this project. Submit name of the qualified personnel with bid.

1.10 MAINTENANCE SERVICES - WARRANTY

- A. General Requirements: The Contractor shall provide all services required and equipment necessary to maintain the entire CCAS in an operational state as specified for a period of two (2) year(s) after formal written acceptance of the system, and shall provide all necessary material required for performing scheduled service or other unscheduled work.
- B. Personnel: Service personnel shall be factory certified in the maintenance and repair of the equipment installed under this section of the specification. The owner shall be advised in writing of the name of the designated service representative, and of any change in personnel.
- C. Routine Inspection and Warranty Maintenance: This work shall be scheduled in advance with Duluth International Airport.
 1. Inspections: The Contractor shall perform two minor inspections at six (6) month intervals (or more often if required by the manufacturer), and two major inspections offset equally between the minor inspections to effect quarterly inspection of alternating magnitude.
 2. Minor Inspections: These inspections shall include:
 - a. Visual checks and operational tests of all console equipment, peripheral equipment, field hardware, sensors, and electrical and mechanical controls.
 - b. Mechanical adjustments if required on any mechanical or electromechanical devices.
 3. Major Inspections: These inspections shall include all work described under paragraph Minor Inspections and the following work:
 - a. Clean all CCAS equipment, including interior and exterior surfaces.
 - b. Perform diagnostics on all equipment.

- c. Check, walk test, and if required by the manufacturers' maintenance procedures, calibrate each sensor.
 - d. Run all system software diagnostics and correct all diagnosed problems.
- D. Operation: Performance of scheduled adjustments and repair shall verify operation of the CCAS as demonstrated by the applicable tests of the performance verification test.
- E. Emergency Service: The owner will initiate service calls when the CCAS is not functioning properly. Qualified personnel shall be available to provide service to the complete CCAS. The owner shall be furnished with a telephone number where the service supervisor can be reached at all times. Service personnel shall be at site within four (4) hours after receiving a request for service. The CCAS shall be restored to proper operating condition within 8 hours after service personnel arrive on site.
- F. Records and Logs: The Contractor shall keep records and logs of each task, and shall organize cumulative records for each component, and for the complete system chronologically. A continuous log shall be maintained for all devices. The log shall contain all initial settings. Complete logs shall be kept and shall be available for inspection on site, demonstrating that planned and systematic adjustments and repairs have been accomplished for the CCAS.
- G. Work Requests: The Contractor shall separately record each service call request on a service request form. The form shall include the model and serial number identifying the component involved, its location, date and time the call was received, specific nature of trouble, names of service personnel assigned to the task, instructions describing what has to be done, the amount and nature of the materials used, the time and date work started, and the time and date of completion. The Contractor shall deliver a record of the work performed within five (5) days after work is accomplished.
- H. System Modifications: The Contractor shall make any recommendations for system modification in writing to the Owner. No system modifications, shall be made without prior approval of the Owner. Any modifications made to the system shall be incorporated into the operations and maintenance manuals, and other documentation affected.
- I. Software: The Contractor shall provide all software updates during the period of the warranty and verify operation in the system. These updates shall be accomplished in a timely manner, fully coordinated with CCAS operators, shall include training for the new changes / features enabled, and shall be incorporated into the operations and maintenance manuals, and software documentation.

PART 2 - PRODUCTS

2.1 GENERAL DESIGN REQUIREMENTS

- A. Operating Environment
 - 1. All indoor equipment shall be capable of operating in an environment of 50 to 95 degrees F with 20 to 80 percent relative humidity, non-condensing.
 - 2. All outdoor-installed components shall include electric heaters and forced ventilation as required for operation in an ambient environment of:

- a. Temperatures between -20 degrees F and +115 degrees F.
 - b. Relative humidity's up to 100 percent at +100 degrees F.
 - c. Wind gusts up to 100 miles / hour.
 - d. Rainfall rates up to 6 inches / hour for periods up to 60 minutes.
- B. Cabinets and Terminals
- 1. All cabinets and terminals shall be free-standing assemblies with leveling provisions and rear access doors. Where rear access cannot be accommodated, cabinet and terminal equipment shall be provided on racks that slide out from the front. Each cabinet and terminal shall be completely modular, physically and electronically. Each module shall be capable of passing through an opening 2 feet 8 inches wide by 6 feet high, maximum. Racks, shelves, and other structural parts shall be constructed to prevent warping or distortion.
 - 2. Cabinet and terminal doors shall open a minimum of 170 degrees to avoid blocking personnel movement. Each door shall be equipped with a UL-approved cylinder lock (per UL 437, "Key Locks" a tamper switch and a DLHno-type hinge with welded tamperproof pins. All cabinet, console and terminal locks shall be master-keyed by type. Four keys of each type shall be supplied.
 - 3. Racks for the plug-in circuit cards shall permit access to the interconnecting wiring. Initial rack space capacity for circuit cards shall accommodate the requirements specified in Paragraph 1.8B.3. Circuit card identification shall be stenciled or permanently marked on the panel structure adjacent to its location with a minimum letter height of 1/4-inch. All backplane wiring and program allocation for spare slots reserved for future expansion shall be provided so that additional points can be implemented by simply inserting a card into the spare slot and defining the points in central processor memory.
 - 4. Each cabinet and terminal shall contain a copper ground bus running the entire length of the cabinet or console with the enclosure connected to the bus so as to effectively ground the entire structure. A bolted compression-type terminal shall be installed at each end of each ground bus for connection to the facility ground cable.
 - 5. All cabinet, console and terminal materials and paint shall be nonflammable (as defined by ASTM D 635, "Rate of Burning and / or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position"). No preparation or material shall release toxic gases or dense smoke or propagate flames when heated or exposed to open flame.
 - 6. Provisions shall be made for field wiring to enter the cabinets, consoles and terminals at the top and the bottom, except as specified. All cable openings shall be provided with flame-resistant grommets. All wiring for field connections shall terminate on terminal blocks or plug sockets.
 - 7. All unshielded cabinet and terminal wiring, except for off-the shelf equipment, shall be stranded 600 volt Class C stranding in accordance with ASTM B8, "Concentric-Lay Stranded Copper Conductors," or DLH-approved equal. All wiring shall be capable of passing the applicable flame-resistance tests specified in ICEA S-19-81 I A Rubber Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.®
 - 8. Low level signal wiring (100 mV and under) which is designated as having twisted and shielded field wiring shall also have twisted and shielded wiring within the cabinets, consoles and terminals. Each shield shall be connected to a separate terminal point immediately adjacent to the signal wire. Connection to the ground bus, when required, shall be made with insulated No. 12 AWG wire.

9. Each wire shall be identified at both ends with the wire designation corresponding to the wire numbers shown on the wiring diagrams. The wires shall be marked with a sleeve-type, smear-proof, nonconductive, flame-resistant, embossed wire marker or approved equivalent (chlorine or other halogen compounds shall not be used).
10. All exposed wiring within the cabinets, consoles and terminals shall be formed neatly with wires grouped in bundles using non-metallic, flame resistant wiring cleats or bands and with groups substantially supported along their length. Wires shall not be spliced, taped or joined with wire nuts between terminal points. Wiring which crosses hinged joints shall be flexible hinge-type wire. No wiring shall be routed across the face or rear of an instrument, junction box or other device in a manner that will prevent or hinder the opening of covers or will obstruct access to leads, terminals, devices or instruments. Wiring shall not cross a door opening or be fixed to a door. Where wiring must cross sharp metal edges, protection in the form of grommets or equivalent devices shall be provided.
11. Thermostatic control shall be provided for each cabinet, console and terminal equipped with a cooling fan. All fans shall be shaded pole type with fuses and guarded blades. Motor units shall be provided with permanently lubricated bearings for continuous duty and overload protection devices. Replaceable filters shall be provided for all fan vents. These filters shall be removable from outside the cabinet, console and terminal.
12. Nameplates shall be provided for each cabinet, console and terminal. Nameplates for indoor-mounted equipment shall be three-ply laminate, black face, and white core. Outdoor-mounted equipment shall be provided with an engraved metal nameplate.
 1. Where practical, nameplates shall be attached to equipment with two self-tapping stainless steel screws in holes drilled in the equipment.
 2. Where installation of screws is not practical, such as for small nameplates or where equipment cannot be drilled, a permanent adhesive shall be used. The Contractor shall prepare the surface according to the adhesive manufacturer's recommendations.
13. Each cabinet, console and terminal shall be provided with at least one polarized duplex receptacle to facilitate maintenance. Receptacles shall be connected to a separate terminal block with a disconnect switch for the 120 V ac supply. Connect the outlet to a non-UPS circuit.

C. Surge Protection

1. All CCAS power lines shall be equipped with surge protection provisions in accordance with ANSI C62.41, "Guide for Surge Voltage in Low Voltage AC Power Circuits," and UL 1449, "Standard for Safety Transient Voltage Surge Suppressors," as applicable.
2. All data communications lines and sensor inputs shall be equipped with surge protection provisions in accordance with IEEE Transaction Volume COM-21, "Lightning Surges in Open Wire, Coaxial and Paired Cables," as applicable.
3. All protection devices shall be self-restoring and non-destructing and online at all times. Protection devices shall respond within 1 nanosecond on data circuits and within 5 nanoseconds on power circuits.

D. Electromagnetic Interferences

1. Noise suppression shall be provided as required for total system immunity from internally and externally generated sources of electromagnetic and RF interference including that from portable two-way radios. Noise suppression

provisions shall comply with ANSI C63.12, "Recommended Practice on Procedures for Control of System Electromagnetic Compatibility," as applicable.

2. All CCAS equipment shall comply with the standards for electromagnetic interference in FCC Rules and Regulations, Part 15, Subpart J, "Class A Computing Devices," as applicable.

E. Fabrication

1. All metalwork shall be free of sharp edges, burrs, and other imperfections.
2. The interior and exterior surfaces of all enclosures shall be thoroughly cleaned so that the surfaces are free of all rust, mill, scale, oil, and foreign matter. All nonpermanent marks and coatings shall be removed.

2.2 CONSOLES AND EQUIPMENT

A. Operator Consoles and Terminals

1. General.
 - a. All console / terminal equipment shall be as indicated on the drawings. VDTs, GDTs and CCTV monitors shall be located to minimize distortion from angular line-of-sight and glare due to reflected light. PIDS equipment shall be mounted in a manner to facilitate the badge generation process.
 - b. Console / terminal control switches, pushbuttons, indicating lights and nameplates shall be provided on insert modules suitable for rack mounting. These modules shall be located to facilitate visibility and operability. Front mounted modules shall be held in place with tamper-resistant screws that require a special tool for removal. Indicating lights shall be selected to provide long bulb life and ease of bulb replacement. Lamp test capabilities shall be provided. All switches shall be selected and installed to provide protection against contamination that may block operation of the switches or contacts.
 - c. Front cover panels shall be provided for console terminal modules reserved for existing radio and other equipment. The required cutouts in these panels shall be provided to incorporate the equipment neatly and to give the appearance of a single integral unit.
 - d. The consoles / terminals shall have provisions at both ends for terminating printer power and signal wiring. Pre-fabricated cables (10 feet each, minimum) with connectors at both ends shall be provided for the printers.
 - e. Console / terminal cooling provisions shall be sized to accommodate existing radio and other equipment to be integrated into the console terminal layouts.

2.3 MANUFACTURERS

A. CCAS Software.

The integrated Security System software shall be manufactured by the following manufacturers. The specifications are based on products of multiple manufacturers, the products from the approved manufacturers with integrated or 3rd party software to achieve the functionality is acceptable. This shall not be construed to indicate that the approved manufacturers are not required to meet the specifications; however, it recognizes the fact that the approved manufacturers may use 3rd party software to provide specified performance. The specified performance must be met by the approved manufacturers.

1. Access Control.
 - a. Genetec Synergis.
 - b. AMAG Symmetry Enterprise.
 - c. Lenel OnGuard 2009 Enterprise.
 - d. Software House, CCURE 9000.
 - e. HIRSCH Velocity.
 - f. S2 Enterprise.
 - g. Or Approved Equal.
 2. CCTV Storage & Analytics.
 - a. 3VR SmartRecorders.
 - b. iOmniscient.
 - c. Genetec Omnicast.
 - d. ONSSI NDVMS.
 - e. Intransa.
 - f. Pivot3.
 - g. or approved equal.
- B. CCAS Field Hardware as specification indicates Genetec. Equivalent products from approved equal manufacturer may be used.
1. Intelligent Field Panel (IFP) Vertx V1000.
 2. Dual Reader Interface Module (DRM) Vertx V100.
 3. Input Modules (ICM) Vertx V200.
 4. Output Modules (OCM) Vertx V300.
 5. Ancillary devices as required to provide a complete and operational system.
- C. CCAS Authentication Hardware
1. HID I-Class Readers.
 2. L1-Identity Biometric Readers.
 3. or approved equal.
- D. CCAS Credential Printers
1. The CCAS credential management module shall be compatible with printers and printer / encoders from Fargo, Eltron, Magicard and Nisca that support Windows 2000, 2003 and XP drivers.
- E. CCAS Third Party Integrated Devices
1. The CCAS shall interface with third party devices and applications. The Third Part integration shall be accomplished by:
 - a. Direct Serial Interface.
 - b. Virtual Serial Interface (Lantronix controller).
 - c. TCP/IP (DLL, XML, etc).
 - d. Software Development Kit w/ Scripts shall be provided.
- F. Computer Work Stations:
1. The computer work stations shall be as manufactured by Dell. HP or IBM using specified processor. However, all work stations shall be from the same manufacturer.

2.4 DATA PROCESSING SUBSYSTEM (DPS)

- A. General.
1. The DPS shall integrate all access control, credential management, digital video management and functionality into a single database in a networked environment. The DPS shall allow the incorporation and integration of

servers, access control client workstations, badging client workstations, digital video management client workstations, remote access level management client workstations and integrated client workstations sharing the same database on local area or wide area networks. The DPS shall allow future expansion to include additional client workstations without losing functionality.

2. DPS administrative operations shall be available from any client workstation on the DPS that is configured and licensed to do so. System Administrator functions include the creation of maps, alarm response instructions, access levels, time zones, holidays, reports, area control, outputs and all required DPS configurations. System Administration operations shall include changes / configuration to the CCTV image comparison screen, cardholder window, employee capture, and cardholder look-up screen.

B. Fault Tolerant CCAS Server

1. The CCAS Fault Tolerant Server shall be a NEC Express 5800 320 Series server with Intel Xeon series processors. The Server shall be a self-contained fully redundant system (dual module / mirrored components) with on-line serviceability and hot-swappable replacement of all major subsystems including processors, power supplies, PCI bus and SCSI controllers. The server shall provide 99.999% system up time and include the following list of features / hardware:
 - a. NEC Express5800-320Fd-MR Rack mount with Redundant dual Xeon processors, 3.0GHz, 6MBx2 L2 cache.
 - b. Operating Temperature from 50 to 95 degrees F (10 to 35 degrees C) with relative humidity from 20% to 80% (no condensation)..
 - c. Redundant ECC DDR2 SDRAM memory (minimum of 1 GB per module.
 - d. Redundant dual channel Ultra 160 SCSI controllers. (minimum two drives per module, three drives maximum) utilizing 10K RPM Ultra SCSI Disk Drives RAID0/1 configured.
 - e. External 3.5" USB floppy drive, 3 PCI expansion slots, redundant integrated 10/100 and 1000 Ethernet NIC Copper cards, redundant integrated PCI video cards, redundant 24xCDROM drives, 2 serial ports, 2 USB ports, keyboard, mouse and surge suppression strip, USB to PS/2 Converter for KVM Connectivity.
 - f. Windows 2003 Server operating system software with 25 user licenses, ESMPRO system management software suite, Management Workstation Application software (MWA) for remote systems management, VERITAS Volume Manager software for storage management, RDR.

C. CCAS Client Workstation for administrative, programmer, alarm monitoring, CCTV review and badging.

1. The CCAS Client Workstation(s) shall be 100% Windows / Intel Standard compatible, approved for use with Microsoft Windows latest version, and scaled according to the following system application requirements:
 - a. CCAS Client Workstation minimum requirements shall consist of a Dell PowerEdge 2950 or equivalent business class computer.
 - 1) See Plans.

D. Badging System Peripherals

1. Video Camera.

- a. The video camera to capture cardholders' photos shall be highly durable with a built-in auto-focus feature. It shall have an auto iris, an optical power zoom lens and be capable of USB connectivity.
 - b. CCTV Camera shall be Canon Powershot sx110 or equal.
2. Card Printer.
- a. The high definition printer shall be Fargo HDP 5000 or approved equal. Contractor shall develop the card design with the Owner and A/E and provide three different design samples to review prior to implementation and issuance of the cards.
 - b. Specifications:
 - 1) The printer(s) shall be capable of printing full-color images and text on the following card types: ABS, PVC, PET, PETG, matte-finish (clean) and rough finish (clean). The cards may include proximity, contact smart, contactless smart, magnetic stripe, and optical memory technology. The printer must meet the following requirements:
 - 2) Print Method - High Definition Printing Dye-Sublimation / Resin Thermal Transfer.
 - 3) Resolution - 300 dpi (11.8 dots/mm).
 - 4) Colors - Up to 16.7 million / 256 shades per pixel.
 - 5) Print Ribbon Options:
 - a) Provide to print on the specified contactless smart cards.
 - b) Full-color with two resin black panels, Yellow, Magenta, Cyan, 500 prints.
 - 6) High Definition Print Film Options:
 - a) Standard Holographic (500 prints).
 - 7) Overlamine Options:
 - a) PolyGuard Overlamine, .6 mil thick (250 prints).
 - b) All overlaminates, standard holographic design.
 - 8) Print Speed:
 - a) 38 seconds per card / 95 cards per hour in batch mode (YMC with transfer).
 - b) 46 seconds per card / 78 cards per hour in batch mode (YMCK with transfer).
 - c) 70 seconds per card / 51 cards per hour in batch mode (YMCKK with transfer).
 - d) 50 seconds per card / 72 cards per hour in batch mode (YMCK/lamination).
 - e) 75 seconds per card / 48 cards per hour in batch mode (YMCKK/lamination).
 - 9) Accepted Standard Card Sizes - CR-80 (3.370"L x 2.125"W / 85.6mmL x 54mmW).
 - 10) Print Area - Over-the-edge on CR-80 cards.
 - 11) Accepted Card Thickness.
 - a) Print only: .030" (30mil) to .070" (50mil) / .762mm to 1.778mm.
 - b) Print / Lamination: .030" (30mil) to .070" (50mil) / .762mm to 1.778mm.
 - 12) Accepted Card Types - ABS, PVC, PET, PETG, proximity, smart and mag stripe cards, optical memory cards.
 - 13) Input Hopper Card Capacity - 100 cards (.030" / .762mm).
 - 14) Output Hopper Card Capacity - 200 cards (.030" / .762mm).

- 15) Card Cleaning - Replaceable cleaning roller.
- 16) Memory - 16MB RAM.
- 17) Display - User-friendly, SmartScreen LCD Control Panel.
- 18) Software Drivers - Windows® 2000/XP, Windows 2003 or Windows Vista.
- 19) Interface - USB 2.0 (High Speed) and Ethernet with internal print server.
- 20) Operating Temperature - 65° to 90° F / 18° to 32° C.
- 21) Humidity - 20-80% non-condensing.
- 22) Agency Listings:
 - a) Safety: UL 60950, CSA C2.2 No. 60950, CB report (EN 60950), CE mark.
 - b) EMC: FCC Part 15 Class A, EN 55022; 1998 Class A, CRC c1374, EN 61000-3-2: 2000, EN 61000-3-2: 1995, EN 55024; 1998, CE mark, and CCC mark.
- 23) Supply Voltage - 100-240 VAC at 50 Hz / 60 Hz, 3.8A.
- 24) Warranty:
 - a) Printer – 2 year; including 1 year On-Call Express.
 - b) Print head – Lifetime; unlimited pass with Fargo Certified Cards.
- 25) Certified Supplies - Card Printer / Encoders require highly specialized media to function properly. To maximize printed card quality and durability, print head life and printer / encoder reliability, use only Certified Supplies. Warranties are void, where not prohibited by law, when non-Certified Supplies are used.
- 26) Required Options:
 - a) Printer Cleaning Kit.
 - b) Door and cartridge locks.
 - c) Card Lamination Module - dual-sided (simultaneous).
 - d) Dual-sided printing.
 - e) Contactless Smart Card Encoder (HID iCLASS and MIFARE).

E. Report printer

- 1. The report printer shall be a Laser network printer of latest design.
- 2. Specifications:
 - a. Memory: 16 MB of RAM.
 - b. Print Specs:
 - 1) Speed (pages per minute): 19.
 - 2) Resolution: 1200 x 1200 dpi.
 - 3) Language: HP PCL 5e and 6; printer language (emulates Adobe PostScript7 level 2).
 - 4) Fonts: 45 scalable fonts plus 35 postscript fonts built-in.
 - c. Paper Handling:
 - 1) Main input tray capacity: 250-sheet regular weight 20 lb (75 g/m2) paper or up to 30 envelopes.
 - 2) Priority input tray capacity: 10-sheet 20 lb (75 g/m2) paper or 1 envelope.
 - 3) Output bin capacity: 125-sheet 20 lb (75 g/m2) paper or cardstock 16 to 28 lb (60 to 105 g/m2) Straight through paper path handles media 16 to 43 lb (60 to 163 g/m2).
 - d. Paper size:

- 1) Letter 8.5 x 11 and Legal 8.5 x 14 in (215 x 356 mm).
- e. Connectivity: IEEE-1284 compliant bi-directional parallel port and 2.0 compliant USB port; HP Jetdirect 175x print server/ Internet connector; 10/100Base-T Ethernet, Microsoft TCP/IP & IPX/SPX, and LocalTalk protocols.
- f. Environmental Ranges:
 - 1) Operating temperature: 50 to 90.5° F (10 to 32.5° C).
 - 2) Operating humidity: 20 to 80% RH non-condensing.
 - 3) Storage temperature: 32 to 104° F (0 to 40° C).
 - 4) Storage humidity: 10 to 80% RH non-condensing.
- g. Supported OS: Microsoft Windows latest version, Apple Macintosh latest version.
- h. Acoustics:
 - 1) Sound power: LwAd = 6.1 Bels (A) printing, LwAd = 6.5 Bels (A) copying (HP LaserJet 1220).
 - 2) Acoustics are inaudible during powersave mode.
 - 3) Tests per ISO 9296.
- i. Power Requirements:
 - 1) Source: 110 to 120 v (∇ 10%)/127v (∇ 10%)/220 to 240 v (∇ 10%).
 - 2) Frequency: 50 to 60 Hz (∇ 2Hz)/60 Hz NOM/50 to 60 Hz (∇ 3Hz).
- j. Dimensions: (w x d x h) 16.3 x 19.2 x 10.0 in (415 x 487 x 252 mm).
- k. Weight (with cartridge): 18.3 lb (8.3 kg).
- l. Printer shall be HP LaserJet 1035n or approved equal.

F. Modem

- 1. The CCAS modem shall be available for remote diagnostics, downloading of upgrades, dial-in capabilities, and remote communications. The modem shall be plug and play and support the Windows 2000 Operating System. All system servers must include a modem.
- 2. The modem shall have the minimum specifications:
 - a. Data Transmission: 56 Kbps.
 - b. Universal Compatibility: Yes.
 - c. Error Control: V.42/MNP 2-4 error control.
 - d. Data Compression: V.42 bis/MNP5 data compression.
 - e. Approvals: FCC Approved (Part 15 Class B/Part 68), IC (Formerly DOC) Approved, UL Listed and CSA Approved.
 - f. Warranty: five (5) year manufacturer's standard warranty.

G. Backup System

- 1. The system server shall utilize a network backup system for system backups and archiving capabilities. The network backup system must support the Windows 2000/2003 Operating System.
- 2. Scheduled / Unattended Backups: Allows System Administrators to perform backups at pre-determined times. Intervals shall be in hourly, daily, weekly, and monthly intervals.
- 3. Network Backup Storage shall be at minimum same size as CCAS server array.
- 4. Storage shall be connected to network in different location that CCAS servers.

2.5 ACCESS CONTROL FIELD HARDWARE DEVICES

A. General

1. The system shall be equipped with the access control field hardware required to receive alarms and administer all access granted / denied decisions. All field hardware must be designed to meet UL 294 and ULC requirements. Depending upon the configuration, the system field hardware must be able to include any or all of the following components:
 - a. Intelligent Field Panels (IFP).
 - b. Input Control Module (ICM).
 - c. Output Control Module (OCM).
 - d. Dual Reader Interface Module (DRI).
 - e. Proximity Card Readers.
 - f. Panel Power Supplies.

B. Intelligent Field Panel (IFP)

1. The Intelligent Field Panel (IFP) shall link the CCAS Software to all downstream field hardware components (RIMs, ICMs and IOMs). The IFP shall provide full distributed processing of access control / Alarm Monitoring rules and operations. A fully loaded and configured IFP with shall respond in less than one-half (0.5) second to grant or deny access to cardholder.
2. The IFP shall continue to function normally (stand-alone) in the event that it loses communication with the CCAS software. While in this off-line state, the IFP shall make access granted / denied decisions and maintain a log of the events that have occurred. Events shall be stored in local memory, and then uploaded automatically to the CCAS database after communication has been restored.
3. In addition, the IFP shall incorporate the following features:
 - a. UL 294, ULC, and CE Certified.
 - b. Support for Host Communications Speed of 38,400 bps.
 - c. Support for Direct Connect, Remote Dial Up, or Local Area Network (LAN) Connection.
 - d. Support for Dual Path Host Communications - Secondary Path shall be Local Area Network (LAN) Connection, or Remote Dial Up Connection via Lantronix Ethernet controller.
 - e. Support for up to 32 MB of On-Board Memory, min 6MB.
 - f. LAN Support shall utilize RJ45 (10/100baseT) Ethernet Interface.
 - g. Flash Memory for real time program updates and overall host communications.
 - h. Support for four 2 wire downstream ports, two 4 wire downstream ports, or combination one 4 wire downstream port and two 2 wire downstream ports. Downstream ports shall be for connecting card readers and data gathering and output control panels via RS-485 multi-drop wiring configuration.
 - i. Memory storage of up to 250,000 card holders and 65,000 transactions.
 - j. Initial base memory download between IFP with standard memory from the CCAS shall require no more than ten (10) seconds.
 - k. Support for up to 32 devices consisting of RIMs, ICMs, and OCMs in any combination desired with a maximum of 16 I/OCM devices.
 - l. Support of multiple card technologies.
 - m. Supervised Communications between IFP and CCAS Software.

- n. AES 128 bit Symmetrical Block Encryption conforming to the FIPS-197 standard between IFP and CCAS Software communications driver.
- o. Multi drop support for up to eight IFPs per CCAS communications port.
- p. Support of up to eight card formats and facility codes.
- q. Support for SEIWG card formats.
- r. RS-485 Full Duplex, UL 1076 Grade AA communication channel to the CCAS head-end.
- s. Integration to other manufacturer's card readers.
- t. Uninterruptible Power Supply (UPS) with battery backup.
- u. 32-bit Microprocessor.
- v. Biometric Interface Support.
- w. An IFP downstream serial port shall multi-drop 16 access control field hardware devices using an RS-485 UL 1076 Grade A communication format allowing a distance of 4,000 feet using Belden 9842 cable or equivalent.
- x. 12 VDC input power.
- y. Issue Code Support for both Magnetic and Wiegand Card Formats.
- z. Individual Shunt Times (ADA Requirement).
- aa. Up to four Digit PIN Codes.
- bb. Downstream serial RS-232 device support.
- cc. Status LEDs for normal component and communication status.
- dd. RoHS Compliance.

C. Input Control Module (ICM)

- 1. The Input Control Module shall provide 16 UL 1076 Grade A or AA alarm input zones and monitor / report line fault conditions, alarm conditions, power faults and tampers. Status LEDs shall provide information about the sixteen alarm zone inputs, cabinet tamper, and power fault.
- 2. In addition, the ICM shall incorporate the following features:
 - a. UL 294, ULC, and CE Certified.
 - b. Alarm contact status scanning at up to 180 times per second for each zone.
 - c. Eight configuration DIP switches to assign unit addresses and communications speed.
 - d. Elevator control support for 64 floors.
 - e. Variable resistor values for line supervision.
 - f. A low power CMOS microprocessor.
 - g. Filtered data for noise rejection to prevent false alarms.
 - h. Up to 16 Grade A, or AA Supervised Inputs in any combination.
 - i. 12 VDC Input Power.
 - j. 2 Form C 2A, 30 VDC Contacts for load switching.
 - k. 2 dedicated inputs for tamper and power status.
 - l. RoHS Compliance.

D. Output Control Module (OCM)

- 1. The Output Control Modules shall provide 12 Form-C 2A 30 VDC relay contacts for load switching. The relays shall be configurable for fail-safe or fail-secure operation. Each relay shall support "On" "Off" and "Pulse"
 - a. 12 VDC input power.
 - b. Two dedicated digital inputs for tamper and power failure status.
 - c. RS-485 communications, multi-dropped (2-wire or 4-wire RS-485).

- d. Up to 16 OCMs per Intelligent System Controller.
 - e. Onboard termination jumpers.
 - f. DIP switch selectable addressing.
 - g. Status LEDs for communication to the host, heartbeat and relay status.
 - h. Elevator control, support for 64 floors.
 - i. RoHS Compliance.
- E. Dual Reader Interface Module (DRI)
- 1. The DRI shall provide a dual interface between the IFP and authentication devices. The DRI must operate with any authentication device that produces a standard Wiegand (Data 1 / Data 0 or Clock and Data) communication output.
 - 2. In addition the DRI shall incorporate the following features:
 - a. 12 VDC power supply.
 - b. Reader communications (Clock / Data or Wiegand Data1 / Data0) - more than 150 different readers approved for use.
 - c. 4 Form-C 2A at 30 VDC relay outputs.
 - d. Up to 16 different formats (8 card and 8 asset).
 - e. Issue code support for Magnetic and Wiegand formats.
 - f. Door contact supervision (Open / Closed).
 - g. REX push-button monitor.
 - h. Strike Control output.
 - i. Bi-color status LED support and 2-wire LED support.
 - j. Beeper control.
 - k. Dedicated tamper and power failure circuits.
 - l. Support for offline reader access mode.
 - m. Onboard jumpers for termination.
 - n. Elevator control, native support for 6 floors.
 - o. DIP switch selectable addressing.
 - p. UL 294 listed and CE approved.
 - q. RoHS Compliance.
- F. Card Readers
- 1. All readers shall be configured with the card reader and reader interface module mounted separately. The reader interface module shall be mounted in the EIB located on the secure side of the door.
 - 2. Smart Access Control Reader with Keypad: Provide *iCLASS*, contactless smart card reader or equivalent where shown on the drawings. Card reader shall be "single-package" type, combining controller, electronics and antenna in 1 package, in the following configurations:
 - a. RK40 - Card Reader, Wall Mounting (Single-Gang Mounting Applications):
 - 1) Provide "single-gang" mounting style contactless smart card reader for wall mounting, Vehicle Stanchions and Pedestals, and where shown on plans.
 - 2) The reader shall be of potted, polycarbonate material, sealed to a NEMA rating of 4X (IP65).
 - 3) The reader shall contain an integral magnet for use with an external magnetic reed switch to provide tamper protection when connected to an external alarm system. Provide external magnet reed switch and tamper indication.
 - 4) The reader shall be UL/C 294 listed, and shall be FCC and

- CE certified, and shall conform to the following ISO Standards: 15693, 14443A (CSN read-only), 14443B1 (read-only), and 14443B2.
- 5) Transmit Frequency: 13.56 MHz6) The reader shall have an approximate read range of 1 inch to 4.5 inches when used with the compatible access card.
 - 7) The reader shall require that a card, once read, must be removed from the RF field for 1 second before it will be read again, to prevent multiple reads from a single card presentation and anti-passback errors.
 - 8) The reader shall be capable of reading access control data from any *iCLASS* contactless smart card or equivalent, and transmitting that data in SIA standard Wiegand format.
 - 9) The reader shall be capable of reading the CSN (card serial number B a permanent, unique identification number) from any MIFARE[®] card using the S50 chip or equivalent, and transmitting that data in SIA standard Wiegand format.
 - 10) The reader shall be capable of writing to the compatible access card in compliance with ISO 15693 or 14443B2.
 - 11) The reader shall provide 1 Wiegand port, for connection to standard access control panels.
 - 12) The reader shall provide Internal Control for Read-only Access Control applications, transmitting Wiegand Data.
 - 13) The reader shall have separate terminal control points for the green and red LEDs, and for the audible indicator.
 - 14) The reader shall have multiple LEDs for increased visibility
 - 15) The reader shall have a 12-position keypad, with metal keycaps, and backlit numbers located above each key.
 - 16) The reader keypad shall be rugged, waterproof and backlit, and impervious to liquid spills, dirt, and water spray from any direction.
 - 17) The reader shall be configurable so that keypad data may be sent as individual keystrokes or buffered and formatted in a card data format, as required by the Host System.
 - 18) The reader shall allow users to enter a PIN code as a primary, secondary or alternate means of identification, based on configuration of the Host System.
 - 19) The reader shall optionally be configurable to verify the user's PIN entry locally, based on a comparison with PIN data stored on the user's card, transmitting Wiegand data to the host only if the PIN code is valid.
 - 20) The reader keypad shall have keys of sufficient size and with sufficient separation such that users wearing gloves can easily press the individual keys.
 - 21) The reader keypad shall work in conjunction with the audio transducer, such that each keypress shall produce a click or beep signifying that the keypress was received by the microprocessor.
 - 22) The reader keypad should have definite tactile "snap" when depressed, giving the user confirmation that the key was pressed correctly.
 - 23) The reader shall have an audio transducer capable of producing unique tone sequences for various status

- conditions.
- 24) The reader shall have a configurable hold input, which when asserted shall either buffer a single card read or disable the reader, until the line is released. This input may be used for special applications or with loop detectors.
 - 25) Access control data shall be protected using 64-bit diversified security keys, encrypted RF data transmission, and mutual authentication using a proprietary symmetrical key-based algorithm.
 - 26) Security keys in the cards and readers shall be required to match, and may be customized for individual sites by using the *iCLASS* Card Programmer (or equivalent) or by special order from the factory.
 - 27) The reader shall have flash memory to allow future feature enhancements to be added in the field.
 - 28) The reader shall have a lifetime warranty against defects in materials and workmanship.
 - 29) Color shall be selected by the Architect: gray, black or white
 - 30) HID Model RK40, or equivalent, compatible with selected card media.
- b. Biometric Card Reader.
- 1) Reader shall use the combination of the fingerprint and *iCLASS* contactless smart card technology from HID. Both the fingerprint and *iCLASS* technology shall be designed to meet the needs of access control. The card reader shall be as manufactured by Bioscript or HID.
 - 2) Reader shall offer a RS-232, RS-485 and Weigand connection.
 - 3) Using the ISO 7816 protocol, the standard for contact smart card applications, the RWKLB575 allow connection to a PC or microcontroller to support read/write applications. Provide RS-232 to USB converter.
 - 4) Keypad: Offers twelve discrete switches with metal keycaps. Raised tactile mark on "5" key for visually impaired users. Configurable audio feedback. Backlit numbers in bezel overlay, above each key. Lighting is configurable: "Always On", "Always Off", "Triggered by Card Read", or "Triggered by Key Press".
 - 5) User Function Keys: Four programmable user function keys with metal keycaps. User function keys are available with factory default settings or can be customized. In either case, user function keys are easily defined in the graphical LCD display.
 - 6) Security: 64 bit authentication keys are extremely secure. Readers and cards require matching keys to function. All RF data transmission between the card and keypad reader is encrypted, using a secure algorithm. The key management system reduces the risk of compromised or duplicated cards.
 - 7) Cards and keypad readers with site-specific keys shall be provided from the factory.
 - 8) Audiovisual Indication: Audio transducer provides configurable tone sequences to signify access granted, access denied, power up, and configuration card read. A light bar provides a clear visual status indication in red, green, or amber. All units contain an LED to light the sensor area if the biometric option is included.
 - 9) Graphical Display: The backlit graphical LCD display offers a 60 x 18

mm viewing area, 120 x 32 resolution. It is factory preset to provide written instructions to the user. Fully customizable, the display also describes the function of the user function keys.

- 10) Indoor Design: Rugged, weatherized polycarbonate enclosure provides reliable performance and resistance to vandalism. Permanent magnet built into housing facilitates tamper alarm when used with a magnetic reed switch.
- 11) Enrollment: Enrollment software and a reader unit shall be provided to write the biometric template to the cards. The template never enters the PC – it is collected by the reader and written to the *iCLASS* card all in one simple process. To alleviate privacy and database management concerns, the biometric template is stored on the *iCLASS* card rather than in the unit.
- 12) *iCLASS* Credential Compatibility: The reader shall be compatible with all *iCLASS* credentials. The units shall read or read/write to credentials compatible with several ISO standards including:
 - a) 15693 - read/write; 2kbits (256Bytes) and 16kbits (2kBytes) *iCLASS* credentials.
 - b) 14443A - read only; MIFARE® Standard (serial number), Ultralight, or DESFire™.
 - c) 14443B2 – read / write; 16kbits (2kBytes) *iCLASS* credentials.
- 13) Reader shall be HID Model RWKLB575 with high security key management and programmable LED / Beeper / LCD key operation or approved equal.

G. Field Hardware Power Supplies: Power Supplies for field hardware shall be designed specifically for the equipment installed. These power supplies shall be regulated, isolated versions for the IFP, ICM, Card Readers and other equipment. Each shall be available in UPS with battery back-up. All power supplies shall be housed in locked enclosures that also allow mounting space for the IFP, ICM, DRI or other device / panel required.

H. Audible Annunciators

1. The audible annunciators and associated volume and reset controls shall be rack-mounted.
2. The audible annunciators shall not conflict with other audible signals at the SCC.
3. Each audible annunciator shall provide a maximum sound output of at least 60 dbA at 1 foot.

I. Local Audible Annunciators

1. Local audible annunciators shall be self-contained units of rugged, vandal-resistant construction.
2. Each annunciator shall incorporate the following features, as a minimum:
 - a. Audible alarm.
 - b. Visual indicator with a solid-state flasher.
 - c. Solid-state power supply.
 - d. Contacts for remote reset.
 - e. Operates on low voltage dc.
3. The audible alarm shall provide a sound output of at least 60 dbA at 1 foot.

2.6 SURVEILLANCE AND ASSESSMENT SUBSYSTEM (SAS)

- A. System Description: Video
1. Provide a complete and operational IP-based Digital Video Management System (IPDVMS) as specified here and shown on the drawings.
 2. IPDVMS shall provide the following functions:
 - a. IPDVMS shall store video from video cameras. Provide access to video in real-time ("live"), and stored on computer-based storage devices for review at a later time.
 - b. Recorders and servers will consist of rack-mountable PCs connected to a LAN.
 - c. Video and other data managed by the IPDVMS accessible from workstation PCs connected directly to the LAN, WAN or modem connections.
 - d. Includes GUI software designed to run on PCs equipped with the Microsoft Windows latest operating system.
 - e. GUI application software functions include system setup, administration and monitoring; live video viewing and PTZ camera control; video playback; video export; alarm monitoring; and other capabilities as detailed in the following paragraphs.
 - f. Provide access and control cameras via wireless handheld devices.
 3. Compatibility with Digital Video Equipment: The IPDVMS shall be designed to work with a wide variety of IP Cameras. The recorders shall utilize a standard Ethernet connection for video input via TCP/IP.
 4. Scalability and Expandability:
 - a. Cameras: The IPDVMS family of products to include cost-effective solutions for any number of cameras including large sites with 1000 or more cameras in a single system.
 - b. Storage: The IPDVMS to support a wide range of automated storage options ranging from as little as a few hours of online storage capacity to months of long-term storage using digital tape or other cost-effective long-term storage media.
 - c. Workstations: The IPDVMS shall be a distributed, multiuser, multitasking system capable of supporting simultaneous requests from multiple workstations.
 - d. Sites: The IPDVMS shall be capable of supporting large organizations with systems at multiple sites connected via LAN, WAN or dial-up modem connections.

2.7 CONTROLLED ACCESS SUBSYSTEM (CAS)

- A. Card Reader Electronics Interface Box (EIB)
1. Each card reader EIB shall consist of a tamper-resistant enclosure equipped with a tamper switch and a UL-approved cylinder lock (per UL 437, "Key Locks"). The card reader EIB shall normally be mounted on the secure side of each card reader-controlled access point. Mounting screws for surface mounting shall be provided inside the enclosure or, if exposed, shall be tamper-resistant requiring a special tool for removal. All EIB boxes shall be keyed alike.
 2. Card reader EIBs shall incorporate the required local power supply and battery backup unit equipment for operating the card reader(s), and the associated electrical locking device(s) at card reader controlled access points. A trouble signal shall be provided to indicate failure of any portion of this power supply equipment.

3. Each card reader EIB shall be capable of supplying power to a minimum of 2 card reader controlled access points. Power cabling from the card reader EIB to the card reader shall be a maximum of 50 feet.
- B. Exit Pushbutton
1. Each exit pushbutton shall consist of a momentary switch within an enclosure. Mounting screws for surface mounting shall be provided inside the enclosure or, if exposed, shall be tamper-resistant requiring a special tool for removal.
 2. Each switch shall provide 1 set of normally open and normally closed contacts. The switches shall be rated for a minimum of 1,000,000 activations without malfunction.
 3. The exit pushbuttons shall be provided with a 1-1/2 inch mushroom button.
- C. Panic Hardware (Push Bars) - Refer to access point schedule for scope of work in the terminal contract.
1. Push bars shall be external surface-mounted rim devices, UL-listed for accident hazard installations.
 2. Each push bar shall incorporate the following features, as a minimum:
 - a. Nonhanded.
 - b. Field sizeable.
 - c. Both time delay exit and lock/unlock operation
 3. Each push bar shall be provided with a surface-mounted rim strike with a signal switch. The signal switch shall be a normally open momentary switch rated for a minimum of 1,000,000 activations without malfunction.
 4. The device finish shall match existing door hardware.
- D. Signage - Refer to access point schedule for scope of work in the terminal contract.
1. Signage shall be provided as indicated on the drawings at selected access points to provide information for the users.
 2. Signs shall be black acrylic plastic with graphics silk-screen applied to the back side of the sign. Lettering shall be white Helvetica medium. Signs shall be square, with rounded corners and white border line. Provide samples of the signs for approval.
 3. The signs shall be applied with adhesive tape to the door or to metal plates which are mechanically attached on the wall adjacent to the door at a height of 5 feet, 7 inches as follows:
 - a. Wood screws for anchoring to wood.
 - b. Toggle bolts for anchoring to hollow masonry or gypsum board.
 - c. Expansion shields and lag bolts for anchoring to concrete or solid masonry.
- E. Gate Control Panels
1. Each gate control panel shall consist of a tamper-resistant weatherproof NEMA 4X (stainless steel) enclosure equipped with a tamper switch and a UL-approved cylinder lock (per UL 4379 "Key Locks") or padlock. The gate control panel shall normally be mounted on the secure side of the card reader-controlled vehicle gate. Mounting screws for surface mounting shall be provided inside the enclosure or, if exposed, shall be tamper-resistant requiring a special tool for removal.
 2. The gate control panel shall incorporate the required local power supply and battery backup equipment for operating the card reader(s), PINpad(s), and

- gate operator at card reader-controlled vehicle gates. A trouble signal shall be provided to indicate failure of any portion of this power supply equipment.
- 3. The gate control panel shall be provided with a heating element to assure continued gate operation during severe cold temperatures.
- 4. A concrete foundation shall be provided for the gate control panel.

2.8 INTRUSION DETECTION SUBSYSTEM (IDS)

A. Balanced Magnetic Switches

- 1. Balanced magnetic switches will be designed for intrusion detection in security applications.
- 2. Each balanced magnetic switch will consist of two (2) cast nonferrous metal enclosures. Mounting screws for surface mounting will be provided inside the enclosure or, if exposed, will be tamper resistant requiring a special tool for removal. Each magnet will be 778ALNICO V or better.
 - a. The switch enclosure will be mounted on the door frame or other non-movable surface. Each switch enclosure will contain a reed switch, an adjustable bias magnet, a tamper switch, and one (1) set of normally open and normally closed contacts. (Note: In lieu of a tamper switch, the enclosure may be encased in epoxy.) Arc protection will be provided to prevent the reed switch from being fused together by transient current conditions. Each switch will be rated for a minimum of 1,000,000 activations without malfunction. The switch enclosure will be provided with a 1/2-inch threaded conduit connector at one end.
 - b. The magnet enclosure will be mounted on the door or other movable surface, so that when the door is closed, the magnet will be within 1 inch of the reed switch.
- 3. Balanced magnetic switches will comply with the applicable requirements of UL 634, Connectors and Switches for Use with Burglar-Alarm Systems and UL 639, Intrusion Detection Units.

B. Gate Position Switches

- 1. Gate position switches shall be designed for wide gap (up to 3 inches) applications.
- 2. Each gate position switch shall consist of 2 cast nonferrous metal enclosures. Mounting screws for surface mounting will be provided inside the enclosure or, if exposed, shall be tamper resistant requiring a special tool for removal. Each magnet shall be ALNICO V or better.
 - a. The switch enclosure shall be mounted on the fence post or other non-movable surface. Each switch enclosure shall contain a reed switch, an adjustable bias magnet, a tamper switch, and 1 set of normally open and normally closed contacts. (Note: In lieu of a tamper switch, the enclosure may be encased in epoxy.) Arc protection shall be provided to prevent the reed switch from being fused together by transient current conditions. Each switch shall be rated for a minimum of 1,000,000 activations without malfunction. The switch enclosure shall be provided with a 1/2-inch threaded conduit connector at one end.
 - b. The magnet enclosure shall be mounted on the gate post or other movable surface, so that when the door is closed, the magnet shall be within 1 inch of the reed switch.

3. Gate position switches shall comply with the applicable requirements of UL 634, Connectors and Switches for Use with Burglar-Alarm Systems and UL 639, Intrusion Detection Units.
- C. Tamper Switches
1. Each tamper switch shall consist of a single-pole, double-throw momentary switch rated for 5 amps at 120 volts. Each switch shall be rated for a minimum of 1,000,000 activations without malfunction.
 2. Tamper switches shall comply with the applicable requirements of UL 634, Connectors and Switches for Use with Burglar-Alarm Systems and UL 639, Intrusion Detection Units.
- D. End-of-line Termination Networks
1. End-of-line termination networks required to provide the proper impedance for supervision specified in Paragraph 1.09G.5 shall be provided on printed circuit cards. A terminal block shall be provided on each card for connection to the individual devices.
- E. Duress Alarm Devices
1. Each duress alarm device shall consist of a momentary switch and a tamper-resistant enclosure.
 2. The momentary switch shall be rated for 1,000,000 activations. The switch shall be provided with a latched output.
 3. Mounting screws for surface mounting shall be provided inside the enclosure or, if exposed, shall be tamper-resistant requiring a special tool for removal.
 4. The duress alarm devices shall be hand-actuated.

2.9 UNINTERRUPTIBLE POWER SUBSYSTEM (UPS)

- A. Battery Backup Units for IFP, EIB and Gate Control Panels.
1. Each battery backup unit shall incorporate an inverter, battery charger, batteries and a sensing and transfer relay housed in a cabinet.
 2. The battery backup unit inverters shall be the filtered rectangular waveform type with an efficiency of not less than 80 percent at 0.9 power factor, full load and rated output.
 3. The battery chargers shall be solid-state and designed for taper charge operation.
 4. Batteries shall be completely sealed and ready for service. The batteries shall be capable of accommodating a minimum of 500 full discharges / recharges.
 5. The sensing and transfer relays shall monitor the ac input and initiate a transfer to the battery supply upon failure or low voltage. Transfer shall be automatic and shall be completed within 20 milliseconds. The sensing and transfer relays shall continue to monitor battery voltage and shall disconnect the load if the voltage drops below 85 percent of its rated output.
 6. Front panel indication of critical status information shall be provided with contacts for remote monitoring via the DPS. A local audible signal shall be provided for off-normal conditions.

2.10 ID BADGE / KEYCARDS

- A. ID badge / keycards shall have provisions to incorporate a badge insert on the front side and the following information on the back side (preprinted):

1. Guaranteed postage and mailing address for lost devices.
 2. Arrow or similar marking to indicate the proper orientation for presentation at a card reader.
 3. Notice: "THIS BADGE MUST BE WORN ON OUTER GARMENT WHEN IN AOA AND MUST BE RETURNED TO AIRPORT OPS WHEN EMPLOYMENT IS TERMINATED."
- B. ID badge / keycards shall be provided with removable pocket clips.
- C. ID badge / keycards shall be capable of incorporating a printed photograph of the user-without interfering with its operation.
- D. ID badge / keycards shall be resistant to wear and environmental deterioration to include breakage, cracking, delaminating or coding changes or losses from any of the following conditions.
1. Minor impact.
 2. Temperature changes.
 3. Radial-type bend up to 90 degrees in either direction (end to end along the longest dimension of the card) for at least 50 bends.
- E. Access Cards (Credentials): Provide a quantity of 2000 *iCLASS* Contactless Smart Card Credentials (or equivalent) in the following form factor:
1. Access Card:
 - a. Access cards shall be used with access readers to gain entry to access controlled portals (e.g.; doors, gates, turnstiles) and to hold information specific to the user.
 - b. The card shall be available in single technology or multiple technology configurations. Double technology cards shall meet the following criteria:
 - 1) The card shall meet the following standards for contactless smart cards: ISO 15693 and ISO 14443B2.
 - 2) The card shall meet ISO 7810 specifications for length, width thickness, flatness, card construction and durability, and shall be in a form suitable for direct two sided dye-sublimation or thermal transfer printing on the specified badge printer.
 - 3) Presentation to the access control reader at any angle within a minimum of one (1) inch shall result in an accurate reading of the card.
 - 4) Unique 64-bit, fixed card serial number, used for anti-collision and key diversification.
 - 5) The card shall support read / write capability, with a minimum of 16 Kbits [2048 bytes] of EEPROM memory. The 2 Kbit card shall have a minimum of 2 Application Areas, and the 16Kbit shall have either (specify) 2 or 16 Application Areas to support future applications. Data retention shall be ten (10) years, nominal. Wiegand card data up to 84 bits in length shall be factory programmed in Application Area 1 for use with access control systems.
 - 6) Each Application Area on the card shall be secured with a 64-bit unique, diversified security key, such that data stored in that area cannot be accessed or modified until the card and reader have completed a mutual authentication process.

- 7) The card shall be capable of completing any write operation, even if the card is removed from the RF field during that operation.
- 8) The card shall be warranted against defects in materials and workmanship for two (2) years, or if multiple technologies are used: with a magnetic stripe the card shall have a fifteen (15) month warranty.
- 9) The card shall not carry any identification showing the location of the property unless otherwise specified herein.
- 10) The card shall be capable of accepting a slot punch on one end, allowing it to be hung from a strap / clip in a vertical orientation.
- 11) The card shall be PET/PVC composite.
- 12) The card shall support 13.56 MHz *iCLASS* contactless smart chip and antenna plus any or all of the following technologies, simultaneously:
 - a) 125 kHz HID Proximity chip and antenna.

F. Corporate 1000 Program

1. Cards shall be uniquely identified for the location using HID Corporate 1000 Program.

2.11 MISCELLANEOUS PROVISIONS

A. Physical Barriers

1. Wherever mechanical locks and keys (mortise locks, key-in-knob, etc.) and padlocks are required to provide access controls, the proposed locks may become part of the DLH Master-Keyed-System.
 - a. This system will employ high security locks, with keyblanks, key codes and keyways restricted by the manufacturer. Locks will be of the seven-pin tumbler type, combined for six pins. Locks will be furnished with interchangeable cores and pinned to the specifications furnished by the DLH Administration. Each lock will be supplied with at least one spare (uncombined) interchangeable core. Keyblanks will be released by the manufacturer only upon written authorization of a predesignated DLH official. Keyblanks will be stamped "DO NOT DUPLICATE". No other markings will be acceptable.
 - b. Each padlock will be furnished with one padlock chain, preattached to the lock shackle. The padlock chain will be no less than 2 feet in length, and no more than 4 feet in length. The unattached chain end will be equipped with a device to allow rapid attachment of padlock chain to chainlink fencing or other mounting surface as required. The padlock chain will be vinyl coated preformed aircraft cable.
2. Bollards shall be provided around field-installed equipment at Type 11 and Type 12 access points to preclude accidental damage from vehicles. These bollards shall consist of concrete-filled pipes appropriately anchored.

2.12 MAINTENANCE AIDS AND SPARE PARTS

A. Nonstandard Test Equipment, Tools, Adaptors and Fittings

1. One set of all special or nonstandard test equipment, tools, adaptors and fittings required to install, maintain and service the CCAS shall be provided to include card extenders for each different type of printed circuit card in the

system, tools for removing tamper resistant screws and a portable IFP analyzer.

2. The portable analyzer unit shall be able to test the IFPs in either an on-line or off-line mode. This unit shall be capable of exercising all devices connected to the IFP and all functions of the IFP itself.
3. All test equipment and tools provided shall be new, unused, of first-class quality and of suitable material.
4. All test equipment and special tools furnished shall be provided with complete operating instructions.

B. Spare Parts

1. Provide spare parts in the amount of 10% of all hardware furnished on the project. The spare parts shall include, but not be limited to, mag locks, card readers, power supplies, balance magnetic contacts, REX switches, tamper switches and other similar components.
2. Provide at least one quantity when 10% results in a quantity of less than one.
3. Provide two IFP panels completely equipped to support six card readers.
4. Provide two IFP hardware components located in the gate control terminal cabinets.
5. Provide two network switches located in GCTC cabinet.

2.13 SOFTWARE REQUIREMENTS

A. General

1. The CCAS software shall perform all processor-related functions at DLH necessary to satisfy the security requirements defined in FAR 1542. This software shall support all functions required for system operations, system software debugging and I/O handling.
2. Source code for application programs shall be in a high level language.
3. The CCAS shall be supplied with 2 complete sets of software and firmware (running and backup), compiled after the completion of the Field Verification Test, to include, as a minimum:
 - a. Executive programs and operating system.
 - b. Utility programs.
 - c. Software debugging and on-line / off-line diagnostic and test routines.
 - d. On-line / off-line hardware diagnostics.
 - e. I/O drivers.
 - f. Application programs.
 - g. Software spooling to I/O devices.
 - h. Macro-assembler.
 - i. On-line high level language compiler.
 - j. Run-time library for the high level language supplied.
 - k. Relocatable loader.
 - l. Full-screen text editor.
 - m. Database manager with report generator.
4. The Contractor shall be responsible for all required software licenses.
5. The Contractor shall not make any modifications to the standard software package provided by the central processor supplier that would in any way preclude the purchase of a standard maintenance and service contract directly from the supplier.
6. Provisions for system regeneration, reprogramming and background processing using either central processor and other supplied equipment shall be provided. These activities shall not interfere with the real-time functions

of the CCAS or the automatic switchover provision. The program development provisions supplied shall allow operators to utilize a high level language that has efficient access to all information included in the system databases. High level reprogramming capability shall include provisions to modify existing display / printout / log formats and to generate new displays / printouts / logs.

7. All utilities and command files required to compile, link and execute the application programs shall be provided. Application program source code shall be loaded, compiled and linked at the job site at the start of the Field Verification Test.
8. All firmware changes to E-PROMS resulting from the Field Verification Test shall be incorporated into all like devices and fully documented.

B. CCAS Software Capabilities

1. The CCAS Software shall support an unlimited number of card readers, input points, video cameras, intrusion detection points, and relay outputs. The CCAS database server shall support an unlimited number of cardholders, visitors, and assets limited only by the available memory on the IFP. The database server shall also support an unlimited number of system events and System Operator transactions in the history file limited only by available hard disk space. Client Workstations shall be limited only by the limitations of the operating system server software.

C. CCAS Software Functionality

1. Time Zones.
 - a. The CCAS shall be capable of creating and storing up to two hundred fifty four (254) time zones. Each time zone shall have a minimum of six (6) intervals. Each interval shall be assignable to any day of the week.
 - b. Each time zone shall be assignable to an alphanumeric name of up to 40 characters. Time zones shall be applied to access levels, card reader modes, alarm inputs, alarm outputs, and alarm masking and logging functions. Time zones shall be allowed to belong to any or all access levels so that the time zone only has to be defined once.
2. Access Levels.
 - a. The CCAS shall be capable of defining a minimum of 32,000 access levels with a minimum of 32 access levels per cardholder per database segment (see Section 2.04.8 Database Segmentation). Access Levels shall consist of a combination of card readers and time zones.
 - b. Each Access Level shall be assignable to an alphanumeric name using up to 40 characters.
 - c. Card readers shall have the ability to be assigned to any or all access levels defined in the CCAS. Individual card readers shall be capable of having a distinct time zone assigned to it.
 - d. The CCAS shall allow an "Allow User Commands" option to be assigned on a per access level basis where keypad readers are in use.
3. Temporary Access Levels.
 - a. The CCAS shall be capable of assigning Temporary Access Levels inclusive of the 32,000 assignable Access Levels.
 - b. Each Temporary Access Level shall be assignable to an alphanumeric name using up to 40 characters.

- c. Each Temporary Access Level shall be definable with a start and end date.
 - d. Temporary Access Levels shall be stored in the IFP and functionality shall be maintained in the event of disconnection with the IFP.
- 4. Access Groups.
 - a. The CCAS shall be capable of assigning Access Groups with a maximum of 32 Access Levels per Access Group.
 - b. Each Access Group shall be assignable to an alphanumeric name using up to 40 characters.
- 5. Precision Access Levels.
 - a. The CCAS shall be capable of assigning Precision Access Levels in addition to the 32,000 Access Levels with the ability to assign unlimited card reader and time zone combinations.
 - b. Each Precision Access Level shall be assignable to an alphanumeric name using up to 64 characters.
- 6. Holidays.
 - a. The CCAS shall provide a minimum of 255 Holiday assignments using an embedded calendar. Holidays shall be assigned an alphanumeric name using up to 40 characters and shall be grouped into eight (8) types of holidays, and shall be assignable to individual time zones. Access rights, card reader modes, and alarm masking schedules must be able to be altered when the current date is designated a Holiday.
 - b. Dates for Daylight Savings Time changes shall be definable and shall take effect automatically.
 - c. The CCAS shall support Holiday Ranges that allow a single holiday to span across multiple calendar days.
- 7. Database Segmentation.
 - a. The CCAS shall be required to support data segmentation whereby each segment shall have its own set of cardholders, field hardware and system parameters (time zones, access levels etc.). This segmentation shall expand the limitations of the CCAS parameters (i.e. access levels and time zones) to the maximum capacity of each parameter multiplied by the number of segments. The following list shall be made available for segmentation:
 - 1) Access Group.
 - 2) Access Levels.
 - 3) Actions.
 - 4) Action Groups.
 - 5) Alarm Inputs.
 - 6) Alarm Mask Groups.
 - 7) Alarm Outputs.
 - 8) Areas.
 - 9) Badge Types.
 - 10) Card Formats.
 - 11) Cardholders.
 - 12) Card Readers.
 - 13) Central Station Receivers.
 - 14) Device Groups.
 - 15) Digital Video Archive Servers.
 - 16) Fire Alarm Panels.
 - 17) Guard Tours.
 - 18) Global I/O Function Lists.

- 19) Global I/O Links.
 - 20) Holidays.
 - 21) Intercom Panels.
 - 22) Intercom Stations.
 - 23) Intrusion Detection Panels.
 - 24) IFPs.
 - 25) Maps.
 - 26) Monitor Zones.
 - 27) Precision Access Groups.
 - 28) Receiver Accounts.
 - 29) System Operators.
 - 30) Time Zones.
 - 31) Tour Groups.
 - 32) Visitors.
 - 33) User Permission Groups.
9. Field Hardware Communications.
 - a. The CCAS shall communicate with the IFPs by the following protocols:
 - 1) RS-232.
 - 2) RS-485.
 - 3) TCP/IP.
 - 4) Dial-up via Modem.
 - b. Communication baud rate shall be system selectable with a range between 9,600 to 38,400 bits per second.
 - c. Download communication between the CCAS and the IFP shall be fully multi-tasking and shall not interfere with operational functions.
 - d. Upon loss of communications between the CCAS Server and the IFP an alarm shall be created with a time stamp. Upon re-established communication the CCAS and the IFP shall automatically re-synchronize from the point of communication loss without operator intervention.
 10. Dual Path Field Hardware Communication.
 - a. The CCAS shall support Dual Path communications between the CCAS Server and the IFPs. This shall allow for a redundant communication path in the event the primary path fails. The secondary path shall support all primary path protocols.
 - b. In the event of a communication failure of the primary path the IFP shall initiate a switch over to the secondary path. During this fail over period the IFP shall periodically check to see if the primary path has been re-established and will automatically switch back upon a successful connection. Alarms shall be generated upon loss or restoration of communications.
 11. Area Control.
 - a. The CCAS shall provide five (5) area control features: Global Hard Anti-passback, Global Soft Anti-passback, Timed Anti-passback, Two Person Control, and Occupancy Limit. Area control shall be a security method of preventing a person from passing their badge to another person for dual entry into a single location utilizing one card.
 - 1) Global Hard Anti-passback.
 - a) The Global Hard Anti-passback feature shall require that a badge always be used to enter and exit an area. The controlled areas shall have both entry and exit card readers at all portals. Entry and Exit Readers

shall be able to span across multiple Ifps. Areas shall be logically defined under the CCAS, and area control shall not be required at all areas of CUSTOMER facility to be utilized. Global Hard Anti-passback shall work in the following manner. A cardholder must present his / her badge at the entry card reader of the area that the person wishes to enter. Once access has been granted into the area, the cardholder cannot present the badge to another entry card reader within the same area without first presenting his / her badge to the respective exit card reader of that area. Should a cardholder attempt to use any other card reader in the same area besides the occupied area=s exit card reader once access has been granted to that area, the cardholder shall be denied access and an alarm shall be reported to the Alarm Monitoring client workstation. Nested control areas (areas inside areas) shall be definable with a minimum of 64 entry and exit card readers. It shall be possible to have an area within an area and / or multiple areas that are independent of each other in which Global Hard Anti-passback rules shall apply.

- 2) Global Soft Anti-passback.
 - a) The Global Soft Anti-passback feature shall require that a badge be used to enter and exit an area. The controlled areas shall have both entry and exit card readers at all portals. Entry and Exit Readers shall be able to span across multiple IFPs. Areas shall be logically defined under the CCAS, and area control shall not be required at all areas of CUSTOMER facility to be utilized. Global Soft Anti-passback shall work in the following manner. A cardholder must present his / her badge at the entry card reader of the area that the person wishes to enter. Once access has been granted into the area, the cardholder cannot present the badge to another entry card reader within the same area without first presenting his / her badge to the respective exit card reader of that area. Should a cardholder attempt to use any other card reader in the same area besides the occupied area=s exit card reader once access has been granted to that area, the cardholder shall be allowed access (if that cardholder has the appropriate access level to access the new area), and an alarm shall be reported to the Alarm Monitoring client workstation. It shall be possible to have an area within an area and / or multiple areas that are independent of each other.
- 3) The following summary criteria shall apply under Global Hard or Soft Anti-passback:
 - a) Initially (Time 0) all card holders are reset to Area 0.
 - b) Any cardholder shall enter a controlled area anytime after Time 0 by presenting a badge to a CCAS entry card reader.

- c) A cardholder shall not exit the controlled area unless he has entered the area presenting a badge to the CCAS entry card reader.
- d) A cardholder shall not enter the controlled area a second time unless the cardholder has exited that area previously.
- e) A cardholder shall be able to enter through any entry card reader and exit through any exit card reader of a single controlled area.
- f) These options shall include a "forgiveness" feature that will allow the System Administrator to reset the anti-passback of all cardholders to Time 0 Area 0, either through a manual override or a time zone command.
- g) The CCAS shall provide an anti-passback exempt option for privileged or VIP cardholders. Cardholders with this option will not have anti-passback rules applied to them.
- h) The CCAS shall also have a "forgiveness" feature that will allow the System Administrator to assign a "one free pass" to an individual cardholder. This shall allow the System Administrator to reset the anti-passback of an individual cardholder to Time 0 Area 0.
- 4) Timed Anti-passback.
 - a) Timed Anti-Passback shall allow the System Administrator to decide how long after a cardholder has swiped their badge that they will have to wait before the same badge will be accepted again at the same card reader. This helps prevent multiple swipes by an individual to allow access to others through turnstile doors.
- 5) Two Person Control.
 - a) Two Person Rule shall be provided to restrict access to certain areas unless there are two (2) cardholders present. This restricts individuals from being alone in restricted or highly secure areas. When an area is configured for Two Person Rule, the following criteria shall prevail:
 - b) The card reader shall grant access only if two valid cardholders (with authorized access levels) swipe their badges one (1) after the other. In the event that a second authorized card is not presented within ten (10) seconds of the first authorized badge, the card reader shall reset and the first card will have to be swiped again.
 - c) Once two (2) people occupy an area, individual access shall be granted.
 - d) Individual exit shall be permitted until an area is occupied by only two (2) cardholders at which point the Two Person Rule applies for exit.
- 12. Mustering.
 - a. The CCAS shall support advanced Mustering functionality. The Mustering function shall provide an automatic capability for

- registering cardholders that are on site during an incident. Designated exit and entry card readers shall be used to enter and leave hazardous locations and safe locations. When an incident occurs, a Muster Report shall be generated that consists of a listing of all personnel that are within the hazardous locations as well as all personnel that have registered in a safe location.
13. Global Input / Output / Event Linkage.
 - a. The CCAS shall support a global linkage feature whereby any input / output / event shall be linked to any other input / output / event in the CCAS. Input / Output Linkages shall be able to span across Intelligent System Controllers.
 - b. System Administrators shall be able to create global I/O function lists, each consisting of a sequence of actions to be performed, such as changing card reader modes, activating outputs, and opening or closing anti-passback areas. Each function list may include up to six actions.
 14. Cardholder Escort Control.
 - a. The CCAS shall support comprehensive Escort functionality based upon Access Levels. Access Levels shall include options for "Escort Required," "An Escort" and "Not an Escort" and "does not require an Escort"
 - b. The Escort feature shall be capable of one-to-one and one-to-many Escort to Escorted functionality.
 15. Cardholder Use Limits.
 - a. The CCAS shall support a Cardholder Use Limit feature that shall allow System Administrators to specify the maximum number of times that a cardholder may use their credential at card readers in the CCAS.
 16. Extended Individual Strike Times.
 - a. The CCAS shall support Extended Individual Strike Times that allows a card reader's strike to be active for an extended period of time beyond the pre-determined standard strike time on a per cardholder basis. The extended strike time shall be user definable up to 255 seconds. Extended strike times shall be set on a card reader by card reader basis.
 17. Extended Individual Door Held Open Times.
 - a. The CCAS shall support Extended Individual Door Held Open Times that allows a card reader's door to be held open for an extended period of time beyond the predetermined standard held open time on a per cardholder basis. The extended held open time shall be user definable up to 131,070 seconds. Extended held open times shall be set on a card reader by card reader basis.
 18. Extended, on Demand, Door Held Open Times.
 - a. The CCAS shall support extended, on demand, door held times via a command keypad. The Extended Held Open command configuration shall consist of a command key sequence that shall be from 3 to 6 keys used to enter the number of minutes to extend the door held open time (up to 999 minutes) and a pre alarm time (from 0 to 30 minutes).
 - b. Only those cardholders having Command Authority at a given card reader configured for >Allow User Commands= shall have the ability to execute the Extended Held Open command at that card reader. The Extended Held Open command shall be available after a valid

cardholder has received an Access Grant at the card reader. The cardholder shall have a period of fifteen seconds after the Access Grant to enter the extended held open command sequence.

19. Elevator Control.
 - a. The CCAS shall provide elevator control using standard access control field hardware that will permit the restriction of cardholder access to certain floors while also allowing general access to other floors. The elevator control feature shall allow, at the elevator, the use of any card reader and all card reader modes used on any other card reader in the SMS. Each elevator card reader shall control access for a minimum of 64 floors.
 - b. The CCAS shall be able to track which floor was selected by an individual cardholder for auditing and reporting purposes.
20. Graphical System Overview Tree.
 - a. A graphical system overview tree shall display a graphical representation of all field hardware (including IFPs, fire panels, intrusion detection devices, personal safety devices, intercom systems, central station alarm receivers), digital video hardware, access levels, time zones, access groups, holidays, and card formats that have been configured in the CCAS. System Administrators shall be able to modify a device that is depicted on the graphical system overview tree or see its properties by double clicking on the icon and the CCAS shall bring them to the appropriate form.
21. Pre-Alarm.
 - a. The CCAS shall support a pre-alarm feature at the card reader. The pre-alarm will sound a tone at the card reader prior to the door held open alarm. The pre-alarm setting shall be configurable for up to a maximum of 5,940 seconds (99 minutes).
22. Alarm / Event Logging.
 - a. All alarms and events in the CCAS shall by default, always be recorded in the database. The CCAS shall give System Administrators the ability to select on a time zone basis, the times that they require the CCAS to log specific events to the database.
 - b. System Administrators shall have the option for Alarm / Events to be set to log or not to log particular alarms / events on any individual reader and or input.
23. Scheduling Utility.
 - a. The CCAS shall provide an integral Scheduling Utility. The Scheduling Utility shall allow System Administrators to schedule actions to occur on a one-time or a recurring basis. Recurring schedules shall be configured to begin immediately, last indefinitely, or have optional start and end dates.
 - b. The Scheduling Utility shall be available from both the System Administration and Alarm Monitoring modules.
 - c. The types of actions that shall be schedulable include but are not limited to:
 - 1) Action Group.
 - 2) Event Archiving / Purging.
 - 3) Arm / Disarm Area.
 - 4) Start of Guard Tour.
 - 5) Execution of Data Exchange Scripts.
 - 6) Activate, Deactivate, Pulse Device Output and Device Output Groups.

- 7) Global Anti-Passback Reset.
 - 8) Download Database to IFPs.
 - 9) Execute Function List.
 - 10) Mask / Unmask Inputs, Input Groups, Alarm Mask Groups, Door Forced Open or Held Open.
 - 11) Open Door, Open Door Group.
 - 12) Change Reader Mode.
 - 13) Automatic Reports.
 - 14) Reset Use Limit.
 - 15) Move Bulk Badges from an Area.
 - 16) Deactivate Badges.
 - 17) Logout Visitors.
 - 18) Schedule PTZ Presets.
- d. The Scheduling Utility shall maintain a history log in the database for actions that it executes.
24. Multiple Card Formats.
- a. The CCAS shall support an unlimited number of card formats. Magnetic stripe and Wiegand card formats shall be supported. Each IFP shall support a minimum of eight (8) access control card formats and if applicable, eight (8) asset formats. As such, each card reader shall also be able to support a minimum of eight (8) access control card formats. If applicable, asset readers shall be able to support a minimum of eight (8) access control card formats and eight (8) asset management card formats. The CCAS shall support any magnetic stripe format that uses card number, facility code, and issue code combinations with a maximum of a nine digit card number and two digit issue code. The CCAS shall support any industry standard Wiegand card format.
25. Denied Access Attempts Counter.
- a. The CCAS shall support a denied access attempts count on a per card reader basis. The "Denied Attempts Count" value shall be configurable from 0 to 255. The following access denial types shall cause the current denied count to be incremented:
 - 1) Unknown PIN entry at a card reader configured as "PIN or Card" mode.
 - 2) Invalid cipher entry at a card reader in Cipher Mode.
 - 3) Invalid PIN entered for a given card at a card reader configured as "Card and PIN" mode.
 - 4) Non-matching biometric presented for a given card at a card reader in biometric verify mode.
26. Card Reader Time Zone Overrides.
- a. The CCAS shall allow for the pre-defined default card reader settings to be overridden or temporarily changed on a time zone basis. At the beginning of the a selected time zone, the selected card reader=s operational mode shall be modified from it=s default mode to any one of the following modes: locked, unlocked, facility code, card only, card or PIN, card and PIN, card and Biometric, card or PIN and biometric, and / or card and PIN and biometric. The aforementioned options shall be available depending on the type of card reader utilized.
 - b. Each card reader shall have the ability to have multiple time zone setting overrides assigned to them as required by the System Administrator.

27. On-Line Context Sensitive Help.
 - a. The CCAS shall provide on-line context sensitive help files to guide System Administrators and System Operators in the configuration and operation of the CCAS. The help menu shall be available from any window in the CCAS by pressing the F1 function key or clicking on the Help icon in the toolbar. Help windows shall be context sensitive so System Administrators can move from form to form without leaving the help window. The CCAS shall also come with complete on-line documentation on CD.
28. Monitor Zones.
 - a. The CCAS shall provide System Administrators the ability to segment their access control CCAS field hardware devices into various zones or areas where Alarm Monitoring client workstations will monitor. These zones shall be assigned an alphanumeric name using up to 128 characters.
 - b. The CCAS shall allow subset relationship devices (such as card readers or ICMs to Intelligent System Controllers) to be automatically part of the monitoring zone when an IFP is selected AND it shall allow the System Administrator to define which subset devices (card readers, ICMs, etc.) belong to that monitor zone.
 - c. Updating of monitor zones shall take place in real time and without requiring operators to re-login.
29. Alarm / Event Routing.
 - a. The CCAS shall be capable of allowing System Administrators to route alarms and events to various Alarm Monitoring client workstations on the network. The CCAS shall allow any alarm or event to be routed to one or multiple client workstations on the network regardless of where the alarm is generated in the field. Alarms shall be routed to client workstations on a device by device level.
 - b. The CCAS shall be capable of automatic re-routing of an alarm from workstation X to workstation Y if the alarm is not responded to within a user definable time period.
 - c. The CCAS shall implement network synchronization that in the event alarm / event is routed to multiple client workstations, once the first client workstation >grabs= the alarm, the alarm / event shall be cleared from all other client workstations. As such, alarms that are routed to an Alarm Monitoring client workstation which does not have a System Operator logged in shall be queued so that all unacknowledged alarms will report to that client workstation once a System Operator has logged into the CCAS. Alarms / Events shall be routed based on default settings or time zone control.
30. Text Instructions.
 - a. The CCAS shall allow for a set of text instructions to be associated with each alarm that arrives into the CCAS. The text instruction function shall allow the System Administrator to enter a minimum of 32,000 characters of text for procedures to follow for each alarm that arrives at the Alarm Monitoring client workstations. Each alarm or event in the CCAS shall have it=s own unique set of text instructions should the System Administrator desire.
31. Customizable Voice Instructions.
 - a. The CCAS shall allow for a customizable voice instruction to be associated with CCAS alarms. The customizable voice instruction

- feature shall allow the System Administrator to record a voice instruction of unlimited length.
32. Customizable Voice Annunciation.
 - a. The CCAS shall allow for a customizable voice annunciation to be associated CCAS alarms. The customizable voice annunciation shall allow the System Administrator to record a voice annunciation of unlimited length.
 33. Alarm Attributes.
 - a. The System Administrator shall have the ability to configure how the CCAS handles the annunciation of alarms on an individual basis. Each alarm and / or event shall have the option(s) to:
 - 1) Display at one or more Alarm Monitoring client workstation.
 - 2) Allow higher priority alarms to be displayed on the Alarm Monitoring client workstation ahead of lower priority alarms.
 - 3) Require the field device, which generated the alarm to be restored to its normal state before the alarm is cleared.
 - 4) Print the alarm to the local event printer.
 - 5) Have a customized voice message annunciate at the client workstation.
 - 6) Have the alarm breakthrough to the Alarm Monitoring window should the System Operator be working in another application
 - 7) Allow System Operators to amend the journal entry once the alarm has been acknowledged.
 - 8) Insure that the alarm will not be able to be deleted from the Alarm Monitoring window upon acknowledgment.
 - 9) Display text and audio instructions outlining the procedures to follow when responding to the alarm.
 - 10) Automatically call-up associated maps.
 - 11) Automatically call up the associated cardholder record.
 - 12) Automatically call up the associated cardholder photo using the video verification function.
 - 13) Require a password to view the alarm.
 - 14) Require a password to acknowledge the alarm.
 - 15) Require acknowledgment to clear.
 - 16) Allow mandatory journal entry upon acknowledgment.
 - 17) Use pre-defined journal entries for alarms.
 - 18) Select the option for journal entry based upon the specific alarm.
 - 19) Bring up video on defined monitors.
 - 20) Automatically send an e-mail message.
 - 21) Automatically send an alphanumeric page.
 - 22) Have the alarm appear on the Alarm Monitoring window with a flashing colored coded bar across the alarm for high priority alarms.
 - 23) Have the alarm, when acknowledged, display an alternative flashing color coded bar across the alarm than for the original alarm color.
 - 25) Require User Logon for Acknowledgment.
 - 26) Have the ability to mark an alarm as Aln Progress@ where the system shall silence any repeating audio notifications on the Workstation where the alarm was routed and remove the alarm sprite notification on the graphical map. Additional

operators monitoring alarms shall be notified that the alarm has been marked AIn Progress.@

34. Alarm-Event Mappings.
 - a. The CCAS attributes in Alarm Attributes shall be assignable on a >global= basis to all devices that share an alarm description. Thus, the >door forced open= alarm attributes shall apply to any door with a card reader that is forced opened in the CCAS. The CCAS shall have the capability to assign a unique group of alarm attributes to specific device / alarm combinations to override the global settings for specific case settings.
35. System Downloads.
 - a. The CCAS shall provide for the downloading of data to the IFPs. Downloads shall load CCAS information (time zones, access levels, alarm configurations, etc.) into the IFPs first, followed by cardholder information and card reader configurations.
 - b. All IFPs on the CCAS shall be capable of either full or selective downloads to individual Intelligent System Controllers, and bi-directionally so that alarms will still report to their respective Alarm Monitoring client workstations as cardholder information is being downloaded.
 - c. A complete database download of 10,000 cardholder records to all IFPs (regardless of the number of IFPs) must be complete within ten (10) minutes.
 - d. Information on cardholder status, badge status, time zones or access levels shall download in real time as they are added, modified, or deleted from the CCAS.
36. Card Reader Options.
 - a. The CCAS shall include the following options for each reader on the system:
 - 1) Allow User Commands.
 - 2) Rename Auxiliary Inputs.
 - 3) Rename Auxiliary Outputs.
 - 4) Independently Supervise REX and DPS.
 - 5) Configure REX and DPS as Normally Open or Normally Closed.
 - 6) Deny if Duress.
 - 7) Alarm Masking.
 - 8) Activate Outputs.
 - 9) Two Card Control.
 - 10) Checkpoint.
 - 11) Do Not Activate Strike on REX.
 - 12) The ability to allow System Administrators to determine on a time zone basis to log or not to log on a card reader by card reader basis:
 - a) Access Grants.
 - b) Access Denied.
 - c) Card Reader Status Alarms.
 - d) The CCAS shall allow for user definable door strike functionality for each card reader in the CCAS.
 - e) The CCAS shall allow for each card reader to be selected as either an "in" reader, "out" reader, or "none" to allow for ease of reporting time and attendance basic "time in" and "time out" data.

- f) Enforce Use Limit - This option shall enable Card Use Limits at the card reader limiting the number of times that cardholders may use their credential to gain access at the card reader.
 - g) Supervise Door - Sets the CCAS so that the card reader door contact is wired as a supervised input.
 - h) The CCAS shall allow for one or more access points in a specified area to be armed and disarmed directly from the Command Control Keypad.
- 37. Input Control Module (ICM) Options.
 - a. The CCAS shall provide the following options for the Input Control Modules:
 - 1) Alarm Masking B The ability to mask the alarm input on a time zone basis.
 - 2) Local Linkage B The ability to locally link outputs with inputs that are attached to the same ICM/Output Control Module (OCM).
 - 3) Activate Output - The ability to activate an output tied to the ICM/OCM on a time zone basis.
 - 4) Activate Output Always- The ability to activate an output always.
 - 5) Configuration of Debounce Times B The ability to control the amount of time that an input state change must remain consistent in order for it to be considered a real change of state.
 - 6) Configuration of Hold Times - When configuring an Alarm Input, a hold time setting shall be settable from 0-15 seconds.
 - 7) Checkpoint B The ability to configure an input as a designated stop on one or more guard tours.
 - 8) Supervised Input B The ability to specify if a specific alarm contact on the ICM is a supervised or unsupervised contact.
 - 9) Entry / exit Delay B The ability to set up entry / exit delays for inputs that are attached to any ICM, SRI, or DRI. This shall include Non-Latched Entry: When an input activates, the alarm will not be reported until the Entry delay expires. If the input is still active when the entry delay expires, the alarm will be reported. If the input is not active when the entry delay expires, then the alarm will not report; Latched Entry: When an input activates, the alarm will not be reported until the Entry delay expires. If the input is still active when the entry delay expires AND the alarm has NOT BEEN MASKED, the alarm will be reported. If the input has been masked when the entry delay expires, then the alarm will not report; Exit Delay: When an input activates, the alarm will not be reported (operates as if masked) until the Exit delay expires. If the input is still active when the exit delay expires, the alarm will be reported. If the input is not active when the exit delay expires, the alarm will not be reported.
- 38. Alarm Monitoring.
 - a. Alarm Annunciation Configuration - The CCAS shall offer the same functionality as ICM of this document.
- 39. Current Status Indication.

- a. The Alarm Monitoring window shall provide a visual status that displays the current status of all devices in the device tree including child devices downstream from the primary device. Additionally there shall be a numeric display of card readers, IFPs and ICMs that are off line.
- 40. Device Group Support.
 - a. The CCAS shall support device grouping for uniform command and control of groups of devices within the system. Four types of homogeneous device groups shall be supported:
 - 1) Card Reader Groups.
 - 2) Input Groups.
 - 3) Relay Output Groups.
 - 4) Video Camera Groups.
- 41. Color Coding for Alarm Priorities.
 - a. The CCAS shall display alarms in the active Alarm Monitoring window with a flashing colored bar across the alarm based upon priority. Acknowledged alarms may be set with alternate color-coding. A minimum of 255 colors must be available for assignment to a minimum of 255 priority levels.
- 42. Highlighting of Unacknowledged Alarms.
 - a. The CCAS shall provide an Unacknowledged Alarm pop-up window that displays alarms that have been unacknowledged after a user defined period of time.
- 43. Pre-Defined "Canned" Alarm Acknowledgment Responses
 - a. The CCAS shall have the capability for pre-defined alarm acknowledgment responses for alarms in the CCAS. An unlimited number of pre-defined responses shall be able to be configured for each alarm in the CCAS.
- 44. Lost Card Alarm.
 - a. The CCAS shall provide an optional setting to designate a Lost Card Alarm when a badge that is not active. The normal settings would be Terminated or Lost.
- 45. Request to Exit Event.
 - a. The CCAS shall provide an optional setting to annunciate an event when a REX device is used. Normally a REX event is not annunciated.
- 46. Real-Time, Live Video User Verification.
 - a. The CCAS shall have the capability of interfacing to a CCTV system and displaying a live video image next to a stored cardholder image record. This feature shall be system configurable.
- 47. Traces.
 - a. The CCAS shall allow for a live or historical trace on any IFP, ICM, Alarm Input, Credential (Cardholder), Intrusion Detection Device, Monitor Zone, or card reader. If applicable, the CCAS shall allow for a trace on any asset, intercom, or camera. Multiple traces may be run simultaneously. The CCAS shall allow System Operators to filter alarm types from the history trace window. Alarms that shall be filtered from the trace window are access granted alarms, access denied alarms, system alarms, duress alarms, and area control alarms.
- 48. "On the Fly" New Login of System Operators.
 - a. The CCAS shall allow a System Operator to login over another System Operator who is already logged into the same client workstation. This process shall log the first System Operator off of

- Alarm Monitoring and log the new System Operator on, changing any permissions necessary for that System Operator.
49. Auto Exit to Windows 2000 / 2003/ XP Login Window.
 - a. The CCAS shall be configurable to automatically exit the Alarm Monitoring application and log the System Operator out of the Windows 2000 / 2003 / XP Operating System when a System Operator logs off an Alarm Monitoring client workstation. The CCAS shall then bring the System Operator to the Windows / XP Login Window for the next System Operator to log on.
 50. Alarm Monitoring - Column Display & Configuration.
 51. Test Mode.
 - a. The CCAS shall support a Test Mode for Alarm Inputs, Door Forced Open, and Access Grants. Tests on Input Device Groups shall be available to verify that all inputs within the group are operational. Upon entering into Test Mode and for the duration of the test, alarms from members of the group shall either be displayed in a separate window/view on test Alarm Monitoring client workstations or on all Alarm Monitoring client workstations in which the alarms are usually routed. During the test (the duration of the test shall be set by the System Operator), all inputs within the group are manually activated in the field. At the end of the time duration, a report shall be generated flagging any inputs for alarms that were not received. During the Test Mode, all alarm operations carry on as programmed (i.e. Global I/O functions, CCTV commands, printer activity, etc.) so that all functions are tested.
 52. Manual Control.
 - a. The CCAS shall provide the System Operator the option to manually control over all output points or input points connected to the CCAS. Control points are defined as any door strike, auxiliary card reader output, or any other relay output point of an Output Control Module (OCM).
 53. Real-Time, Dynamic Graphical Maps.
 - a. The CCAS shall support graphical maps that display device / group status, function lists and video cameras dynamically in real-time. The maps may be configured to appear on command or when specified alarms are selected for acknowledgment. Map device icons shall have the ability to dynamically change shape and / or color to reflect the current state of the device. The CCAS shall indicate if the field hardware is not operating with the most current version of firmware.
 - b. The CCAS shall support all commands available and used map formats listed below:
 - c. The CCAS shall support user defined icons for field hardware devices. The CCAS shall also give System Operators the ability to affect the mode of card readers, open doors, start a trace on a device, mask / unmask alarm inputs, and activate / deactivate / pulse an output from the map icons.
 - d. The graphical maps shall have the ability to be printed to a local printer.
 54. Automatic Credential Deactivation by Lack of Use.
 - a. The CCAS shall have an automatic credential deactivation function where a cardholder's credential will automatically deactivate after an extended period of inactivity based upon a predetermined time

- period. The credential status may be reset by authorized System Operators.
55. Automatic Credential Deactivation based upon an Event.
 - a. The CCAS shall have a programmable ability to deactivate an active badge based upon a pre-determined event.
 56. Alarm Filtering.
 - a. The CCAS shall have the capability for filtering out alarm types from the Alarm Monitoring window. Alarms that may be filtered are access granted alarms, access denied alarms, system alarms, duress alarms, and area control alarms. If applicable, fire alarms, asset alarms, intercom alarms, central station receiver alarms, intrusion detection alarms, video event alarms, and transmitter alarms may also be filtered.
 57. Manual Override of Card Readers.
 - a. The CCAS shall support System Operator overrides of card readers from the Alarm Monitoring window, graphical maps or the real-time system status tree. The CCAS shall also support the ability to manually set a reader back to default mode.
 58. Alarm Masking.
 - a. The CCAS shall support the masking of alarms to be controlled on a time zone basis or by manual control.
 - b. The CCAS shall support the ability to configure inputs to be "Unable to Mask."
 59. On-Line Context Sensitive Help,
 - a. The CCAS shall provide on-line context sensitive help. The help menus shall be available from any window in the CCAS by pressing the F1 function key or clicking on the help icon in the toolbar.
 60. Sorting Capabilities,
 - a. The CCAS shall allow System Operators to arrange the way that alarms and / or events in the Alarm Monitoring window are listed by sorting the alarms and events. Sort criteria shall be based on priority, time / date, IFP, Card Reader, ICM, Input Device, or Cardholder. Additionally alarms and events can be sorted based on asset scan ID, asset name, intercom station, intrusion panel, transmitter, or transmitter input.
 61. Paging Interface,
 - a. The CCAS shall support a paging interface seamlessly integrated within the CCAS Alarm Monitoring module. System Operators shall have the ability to manually or automatically send numeric or alphanumeric paging messages on demand regarding any alarm currently displayed in the Main Alarm Monitoring window. Pages shall have to ability to be sent to multiple pagers if desired. The CCAS shall allow any pager to be accessed through a paging terminal that communicates through the TAP (Telocator Alphanumeric Paging) protocol.
 62. E-mail Interface,
 - a. The CCAS shall provide an e-mail interface seamlessly integrated within the CCAS Alarm Monitoring module. System Operators shall have the ability to manually or automatically send ASCII text e-mail messages from the Alarm Monitoring module on demand regarding any alarm currently displayed in the Main Alarm Monitoring window. E-mails shall have to ability to be sent to multiple e-mail accounts if desired. The CCAS shall integrate with Microsoft Exchange Server.

63. Credential Management,
 - a. The CCAS shall incorporate a Credential Management (PIDS) and Enrollment module that is integral to the CCAS source code with the ability to create and maintain the Cardholder database. Features shall include the ability to:
 - 1) Add, Modify and Delete records based upon permissions.
 - 2) Capture photo images, biometric information and signatures.
 - 3) Print Credentials.
 - 4) Boolean Search on any single or multiple fields.
 - 5) Determine single or multiple active badges.
 - 6) Assign Access Levels and Access Groups.
 - 7) Bulk Assignment / Modification / Deletion of Access Levels.
 - 8) Bulk Deletion of Cardholder Records.
 - 9) Native support for U.S. Government CHUID standard.
 - 10) Limit the number of times the credential can be printed.
 - 11) Limit the access for searching the database based upon user defined criteria.
64. Mobile Badging Operations.
 - a. The CCAS shall support seamlessly integrated Mobile Badging Operations that allow the CCAS cardholder database to be replicated onto an off the shelf laptop computer. The laptop computer shall then have the ability to go to remote sites to enroll cardholders into the CCAS and later synchronize the data.
65. Credentials.
 - a. The CCAS shall support the following credential types and allow for direct Thermal Dye Sublimation printing onto the credential surface.
 - 1) Composite Credentials - 3.375" x 2.125", UPVC Composite credentials with an ISO standard 30 mil thickness.
 - 2) Proximity credentials.
 - 3) Smart Cards B Contact-less.
 - b. The CCAS shall support HID ICLASS contact-less smart card technology. Security for ICLASS cards shall be handled via challenge and response authentication techniques, data ciphering, message authentication checking and unique unalterable serial numbers. The system shall support HID OEM- 100/150 encoders and allow for 2K and 16K ICLASS encoding.
66. Credential Management Enrollment Features.
 - a. The CCAS shall allow for automation of enrollment procedures with the following attributes based upon badge type:
 - 1) Default Deactivation Date.
 - 2) Default Access Levels.
 - 3) Badge Design Layout.
 - 4) Badge Printer Selection.
 - 5) Encoding Format (if required).
 - 6) Badge ID if set to automatic generation.
 - b. The CCAS Credential Management module shall incorporate a seamless interface to IDScan models CSS-800 and CSS- 1000 series scanners that scan, import text and / or photo data and automatically populates the associated CCAS database fields from drivers licenses, passports, government issued and DOD issued credentials.
67. Cardholder Image Capture.

- a. The CCAS must be compatible with flash lighting, USB sources and digital cameras and allow the capturing of the cardholder image at a minimum resolution of 640 x 480.
 - b. CCAS image capture, storage, and hardware compression techniques must be in compliance with the ANSI standard or JPEG (Joint Photographic Experts Group). Cardholder images must be stored as Binary Large Objects (BLOB) within the cardholder record.
 - c. The CCAS shall provide the ability to capture a cardholder's image through the use of any industry standard scanner or digital camera that utilizes a TWAIN interface. Images shall be able to be scanned in at up to 16.7 million colors for a true color scanned image. When using a digital camera that supports multiple resolutions, the system shall allow the operator to select the desired resolution.
68. Image Import.
- a. The CCAS shall allow for System Operators to have the ability to import a cardholder's image at the time of enrollment. The CCAS must support all standard and commonly used image formats:
69. Biometric Verification.
- a. The CCAS shall allow for the viewing, capturing and deletion of biometric templates.
 - b. All biometric templates shall be stored within the CCAS database, and depending on the Biometric device and the CCAS configuration, in the IFP or on a smartcard chip.
 - c. The CCAS shall support Biometric Verification for the following platforms:
 - 1) RSI Handkey with template on IFP.
 - 2) Identix V20 with template on IFP.
 - 3) Biocentric with template on IFP.
 - 4) Bioscrypt with template (one or two finger capture) on iClass, Mifare ISO 14443A and 1569 technologies or on IFP (model dependant).
 - 5) LG Iris Scan with template on iClass.
 - 6) Ultra-Scan with template on iClass.
 - 7) Cross Match ID-500 ten fingers for ID verification and use with access control authentication.
 - d. The CCAS shall be capable of a search of cardholder records to view biometric template images that are currently associated with that cardholder.
70. Digital Certificate Management.
- a. The CCAS shall support Digital Certificate Services to enable System Operators to securely obtain and manage digital certificates for smart card cardholders. The CCAS shall allow a System Operator to enroll and issue a smart card to each cardholder during enrollment process. This shall allow the issuing of a Smart Card Logon certificate (which provides authentication) or a Smart Card User certificate (which provides authentication plus the capability to secure e-mail) for the purpose of Smart Card Login to PCs.
 - b. The CCAS shall support any smart card reader(s) that have been tested by the Microsoft Windows Hardware Quality Lab and have obtained the Windows-compatible logo and that are to be installed on Windows 2000/2003/XP computers.
71. Smart Card Encoding Support.

- a. The CCAS shall include the ability to support Off-line and In-Line SmartCard Encoding for the following readers and technologies
 - 1) Bioscrypt V-Smart (iClass & Mifare) Off-line and Inline.
 - 2) Integrated Engineering (Mifare) Off-line and Inline.
 - 3) Biometric Container (iClass and DESfire) In-line.
 - 4) Texas Instruments (15693 Vicinity) Off-line.
 - 5) GSC (iClass and DESFire) In-Line.
 - 6) LG Iris Access (iClass) In-line.
 - 7) Ultra Scan (iClass) In-Line.
 - 8) Badge Design.
 - b. The CCAS shall incorporate a Badge Design module that is integral to the CCAS source code with the ability to create and maintain badge designs. Features shall include the ability to support:
 - 1) Complete Badge design and Layout tools.
 - 2) Image Import.
 - 3) Signature Capture.
 - 4) Barcode.
 - 5) Smart chip Support.
- 72. ID Badge Printers.
 - a. The CCAS shall support any printer with industry standard and Microsoft Certified Windows 2000/2003/XP drivers. The CCAS shall support.
 - 1) Double-sided full color printing.
 - 2) Edge to edge printing.
 - 3) High-speed printing.
 - 4) Holographic overlays.
 - 5) In-line Magnetic Stripe Encoding.
 - 6) In-line Smart Card Encoding (printer model specific).
- 73. Avery Dennison Badge Label Templates.
 - a. The CCAS shall provide pre-defined badge layouts that are specific to match Avery Dennison=s US and International self adhesive ID labels.
- 74. Image Export.
 - a. The CCAS shall have the ability to export a captured and cropped cardholder image to an industry standard JPEG (.jpg) file format.
- 75. Intelli-Check ID Check Integration.
 - a. The CCAS shall integrate with the Intelli-Check ID Check 1400 product for the scanning of credentials including driver's licenses, military and government issued IDs. This integration will populate cardholder form during the enrollment process. Provide the specified or equivalent product to achieve the function.
- 76. Remote Access Level Management.
 - a. The CCAS shall provide a client / server based or N-Tier architecture browser based Remote Access Level management option. This optional shall allow users with the correct permission to administer and allocate access levels to specific pre determined devices.
- 77. IP Based Integrated Digital Video Management System (IPDVMS).
 - a. The CCAS shall support an integrated IP Based Digital Video Management recording solution that provides the following features and capabilities:
 - 1) Integration with the CCAS.
 - 2) Stand alone operation without connection to the CCAS.

- 3) The IPDVMS shall be computer hardware independent and must meet or exceed the manufacturer's minimum specification for the computer and related devices.
- 4) The IPDVMS shall incorporate a modular architecture and be able to support an unlimited number of cameras.
- 5) The IPDVMS shall be able to simultaneously record and display live video and display recorded video.
- 6) The IPDVMS shall support both event based and continuous recording.
- 7) The IPDVMS shall mark all events and they shall be available for playback and or archiving at any time.
- 8) Video events shall be linked to CCAS events in the CCAS database and only one database shall be acceptable for this interface.
- 9) Up to 32 simultaneous users shall be able to access any video feed from any recorder on the network.
- 10) User defined profiles shall be available for tailoring granular access to configuration and operation.
- 11) Shall have the ability to enhance a frame of video with embedded features or off the shelf software while providing security for the original video image to preserve integrity.
- 12) Shall be capable of independent camera setup for, compression rate, brightness, contrast and other factor setups.
- 13) The IPDVMS shall support Ethernet 10BT, Ethernet 100BT and 1000BT. Network protocols shall be supported including TCP/IP, IPX, and UDP.
- 14) The network interface shall allow remote access of the IPDVMS from anywhere on the end-users LAN/WAN.
- 15) Shall support limiting of frame rate transmission to individual clients.
- 16) The IPDVMS shall support either Multicast or Unicast streaming technology.
- 17) The IPDVMS shall be have the ability to playback stored video over the LAN / WAN for remote access of video clips.
- 18) The IPDVMS shall support World Time Zone.
- 19) Any alarm / event in the CCAS shall have the ability to be associated with a digital video clip in real time. The IPDVMS shall support user defined pre and post roll.
- 20) Each camera shall be configurable for a 32 alphanumeric character name and shall allow for the setup and adjustment of brightness, contrast, archiving, motion detection, Pan / Tilt / Zoom, on a per camera basis.
- 21) The IPDVMS shall support CCTV PTZ control via the CCAS video interface.
- 22) The IPDVMS shall support Analog CCTV PTZ control via approved Video Encoding Devices.
- 23) The IPDVMS shall support MJPEG, H.264 and MPEG4 formats for multiple IP Video Cameras and IP Video Encoders from approved sources.
- 24) The IPDVMS shall support integral time stamping upon receipt of video from the camera.

- b. The IPDVMS shall support the following configuration and customization parameters:
 - 1) Compression percentage.
 - 2) Pre and Post Roll in seconds.
 - 3) Motion Detection Alarms.
 - 4) Set Time Lapse Recording.
 - 5) Continuous Recording Mode.
 - 6) The ability to enforce user authentication to specify individuals or groups that have the ability to view live or recorded video or make modifications to the system.
 - 7) The ability to change any or all of the associated IP camera passwords manually or on schedule.
 - 8) User determination of Event Locking method.
 - 9) Dual Path Fail Over support.
 - 10) Blind Camera (Obstructed View) Alarm reporting.
 - 11) Presets on Alarm.
 - 12) Event Locking to protect specific video events from being overwritten.
 - 13) UNC path support for Network Attached Storage Devices.
 - 14) Configuration of Off-line cameras.
 - 15) Support for Intelligent Motion Video Searching.
 - 16) Advanced Video Analytics and Video Searching.
 - 17) Facial Detection.
 - 18) Object Direction.
 - c. Device Linkages.
 - 1) An unlimited number of access control hardware / device links shall be configurable.
 - 2) A camera viewing priority shall be given to each access control hardware device link.
 - 3) Each alarm / event condition shall have the ability to mark the start of a video event or the end of a video event in real time.
 - d. The IPDVMS shall support automatic firmware downloads to select IP cameras.
 - e. The IPDVMS shall support both internal camera video storage and external camera video storage. Internal storage shall allow the camera to store video events and then download these events to the IPDVMS on a predetermined schedule or on demand.
78. Pan / Tilt / Zoom Control from Alarm Monitoring.
- a. The IPDVMS shall support PTZ control from the Alarm Monitoring workstation. The PTZ control shall support approved IP PTZ cameras and Analog Cameras connected to approved IP Servers.
 - b. The IPDVMS shall support the following PTZ features:
 - 1) Priority Levels.
 - 2) Device Group Control.
 - 3) PTZ Override (Lockout).
 - 4) Proportional PTZ Control.
 - 5) Preset Lock via video screen.
 - 6) Preset Tour.
79. Video Archiving.
- a. The Archive Server software shall be hardware independent, providing the ability to utilize commercial off-the-shelf mass storage devices, including SAN (Storage Area Network) solutions, Tape Libraries, and direct connect external storage drive arrays.

- b. The Archive Server software shall provide the ability to manage and store video information from multiple video recorders to a central location, without operational degradation.
 - c. Each DVMS / IPDVMS shall have the ability to set its own unique archiving properties. Video shall automatically be archived based on user defined "percentage full" settings. When the IPDVMS (** Select either DVMS or IPDVMS) reaches the designated capacity threshold, video shall be automatically copied to the archive storage media and space on the recorder is released for over-write by new video information.
 - d. Regardless of the storage location (local on the recorder or in archive) the system will automatically retrieve video associated with an event on demand. The actual storage location shall be transparent to the user.
80. Browser Based Video Viewer.
- a. IPDVMS shall allow monitoring of real time video from an optional web browser based video viewer using N-Tier architecture and Microsoft Internet Explorer @ 1024x768 resolution. The browser based viewer shall have the ability to select multiple viewing templates. The browser based viewer shall provide the following functionality:
 - 1) Display live video.
 - 2) Digital zooming and panning.
 - 3) PTZ camera control.
 - a) Drag or double click to center.
 - b) Continuous click to center.
 - c) Click and hold to move.
 - 4) Ability to access video from multiple recording sources.
 - 5) PTZ locking.
 - 6) Priority based camera control takeover.
81. Real Video Time Monitoring.
- a. IPDVMS shall allow monitoring of real time video from any Alarm Monitoring client workstation. DVS and Camera status shall be displayed on a System HardwareTree.
82. Video Viewing Layouts.
- a. IPDVMS shall support the ability to save the list of camera views currently being displayed along with the currently selected template with a user defined name to be loaded as needed by the system operator.
83. Video Player.
- a. IPDVMS shall support an advanced matrix view of multiple On-line camera views. Up to a total of 128 fps @ CIF resolution and 72 fps @ 4CIF resolution shall be available for viewing in the Matrix View. The 128 frame rate limitation of video shall be any combination of Live or Recorded video. The number of open video windows shall be dependent on the frame rate and resolution of the cameras. The Video Player shall allow operator sizing of the video windows in the matrix view.
84. Video Camera Groups / Video Camera Tours.
- a. IPDVMS shall support camera grouping to allow for video camera tours in the CCAS Alarm Monitoring Module.
 - b. An unlimited number of camera groups shall be supported in the CCAS and each camera group shall support an unlimited number of

- cameras. Cameras within a camera group shall span multiple digital video servers. Cameras shall have the ability to be placed into multiple camera groups.
- c. The CCAS shall provide for video camera tours that rotate live video between each of the cameras defined in the video camera group at a user defined increment. The time increment shall be user definable in whole seconds.
- 85. Still Image Capture / Save.
 - a. During playback or monitoring of video, the System shall have the ability to create and save a still picture. This operation shall not affect any other operation and shall not alter the recorded video. The file format shall be an industry standard format allowing for file transfer via email, printing or file transfer to other media.
 - 86. Export Video Clip to File.
 - a. The CCAS shall have to ability to save and export recorded video to a file for the purpose of sharing and reviewing video clips. The start and end times for each video segment shall be user defined. The exported video clip shall be viewable via a standard Windows media player.
 - 87. Video Image Processing.
 - a. IPDVMS shall support video image processing of a single frame captured image through use of an integral image processing module which shall offer the following features:
 - 1) Intensity, Contrast and Saturation.
 - 2) Gamma Correct.
 - 3) Histo-Contrast and Histo-Equalize.
 - 4) Flip, Reverse, Invert and Rotate.
 - 5) Shear.
 - 6) Add Noise, Average, Sharpen, Mosaic, Posterize and Median.
 - 7) Halftone.
 - 8) Emboss.
 - 9) Gray Scale.
 - b. IPDVMS shall allow the ability to save any combination of effects as a defined profile. Profiles shall have the ability to be added or deleted from the CCAS at any time.
 - 88. Video Loss Detection.
 - a. The CCAS shall detect video loss from any or all cameras and activate an alarm.
 - 89. Automated Motion Video Searching.
 - a. IPDVMS shall support advanced automated motion video searching against pre-recorded video. The automated motion video search shall analyze frames in a video segment to detect motion activity from image to image. It shall display thumbnail images of the frames with activity, complete with a histogram depicting the relative amount of activity within each frame.
 - b. The search shall be defined by selecting a specific camera and a specific time period in which the suspected activity took place and all motion events associated with that camera and time period shall be displayed in either a trace or thumbnail format for review.
 - 90. Remote Monitoring Application.

- a. IPDVMS shall support a Remote Monitoring Application that allows the operator to monitor video from any computer connected to the CCAS network.
- 91. Video Authentication.
 - a. IPDVMS shall support imbedded authentication of video where the video is watermarked with an authentication key / signature during recording of live video to a hard drive. The video player shall have the ability to verify the authenticity during playback. This authentication shall provide the recorder name, camera name, video time and user information. The authentication shall have the ability to be password protected.
- 92. Intelligent Video Analysis System (IVAS).
 - a. The CCAS shall provide an option for an Intelligent Video Analysis solution that shall seamlessly integrate with the IPDVMS. The set of Intelligent Video Analysis algorithms shall provide the following functionality. In addition to the approved manufacturers of CCAS system, 3rd party integration with Vidient, 3M, and Object Video is acceptable. Provide the following IVAS functions.
 - 1) Alert Types.
 - a) Smart Video Motion Detection (the IVAS shall ignore minor vibration and provide motion masking).
 - b) Camera Tampering (shall occur when the IVAS detects a camera is moved from its original position, when the camera view is obstructed or when the focus is changed).
 - c) Sudden Change in Light Intensity (shall occur when the IVAS detects an extreme change in ambient light B light to dark or dark to light).
 - d) New Object in Scene (shall occur when the IVAS detects an object not present when the IVAS originally learned the scene view is left in that view).
 - e) Object Removed from Scene (shall occur when the IVAS detects an object that was present when the IVAS originally learned the scene view).
 - f) Object Detected in Scene (shall occur when the VAS detects an object defined by specific properties including people, automobiles or an object of a specific color).
 - g) Congestion in Defined Area (shall occur when the IVAS detects congestion in a specific region).
 - h) Directional Motion (shall occur when the IVAS detects an object moving in a direction specified in the setup of this feature).
 - i) Object Crosses a Defined Region (shall occur when the IVAS detects an object moving across a virtual boundary or area from a specified direction).
 - j) Moving Object Stops (shall occur when the IVAS detects a moving object in the scene ceases to move).
 - k) Static Object Starts to Move (shall occur when the IVAS detects a static object in the scene starts to move).

- l) Object moves too fast (shall occur when a pre-defined speed has been exceeded).
 - m) Loitering (shall occur when the IVAS detects a person in the scene slows down or ceases to move for a specified period of time).
 - n) Detection of a Human Face (shall occur when the IVAS detects a frontal view of a human face is detected in the scene).
 - o) People Counting (shall occur when the IVAS is set for a top down view of a portal. This feature shall provide an alarm with a positive count for entry and a negative count for exit).
 - 2) The IVAS shall support the ability to store the graphical output for a specific event for use with IVAS alarms. This feature shall allow the graphical output of a specific event to be stored as a file and later used as an overlay to be used and associated with an alarm for historical searching.
 - 3) The IVAS shall support CIF, 4CIF and D1 video resolutions during video processing.
 - 4) The IVAS shall support video infra-red imaging.
93. TSA Reporting Functions:
- a. Provide Crystal Reports or similar 3rd party software to provide various reports required by TSA. Contractor shall work with DLH in developing all required reports in electronic formats for submittal to TSA. In addition, provide customized software if required, to automatically check the badge holder's information with TSA "watch list". The cross check shall be made during the initial issuance and renewal of the badge as well as on a periodic basis as required by TSA.

2.14 INTERFACE REQUIREMENTS

A. Local Power

- 1. Local power at the locations specified on the Contract drawings will be 120 V ac, 60 Hz, single phase. Coordinate work with the terminal construction contractor. Extension or modifications to the power locations shown on the terminal contract shall be performed by this contractor.
- 2. The Contractor shall provide the necessary power conversion, distribution and isolation equipment to ensure the specified operation and protection of all CCAS equipment when fed from the normal and backup sources.
- 3. All power supply components by the Contractor shall be provided with indicating fuses or circuit breakers located to permit convenient and rapid identification and maintenance in accordance with UL 198, "Fuses," UL 512, "Fuse Holders," and NFPA 70, National Electrical Code," as applicable. Fuse holders shall be labeled to indicate fuse type, size, and identification. Circuit breakers shall be labeled to indicate their intended function.

B. Fire Alarm System

- 1. The Contractor shall interface with the Fire Alarm System to provide a common alarm annunciation at the SCC wherever a fire alarm is received.
- 2. The Contractor shall provide the hardware and software necessary to interface these for operation as specified heretofore.

3. The Contractor shall interface with F.A. control relay (ZAM) to type 4 access point panic device to release them upon activation of the relay. The relay is activated upon activation of smoke detectors or sprinkler system flow switch. Coordinate with terminal construction contractor.
- C. Baggage Belt System
 1. The contractor shall interface the baggage belt systems as indicated on the drawings.
- D. Automatic Vehicle Gates
 1. The contractor shall interface with the sliding gate at Access Points as indicated on drawings with gate operators and card reader PINpad to operate as specified.
 2. The Contractor shall provide the hardware and software necessary to interface these for operation as specified heretofore.

PART 3 - EXECUTION

3.1 DELIVERY, STORAGE AND HANDLING

- A. CCAS components shall be delivered properly packaged in factory-fabricated type containers or wrappings which properly protect equipment from damage. The Contractor shall be responsible for all damaged equipment due to improper preparation for shipment.
- B. Equipment subject to deterioration by humidity at the project site shall be provided with plastic covers forming a vapor seal and an adequate quantity of desiccant. Desiccant shall be either visible or stored in a manner which can be easily reached for inspection and replacement. Equipment so protected shall be noted on the packing list.
- C. CCAS components shall be stored in original cartons in a clean dry space protected from weather and construction traffic. The Contractor shall be responsible for observing the equipment manufacturers storage and handling procedures as required to maintain any implied or stated warranty.
- D. CCAS components shall be handled carefully to avoid breakages, impacts, denting and scoring finishes. Damaged equipment shall not be installed but returned for replacement.

3.2 INSTALLATION REQUIREMENTS

- A. Examination
 1. The Contractor shall examine areas and conditions under which the CCAS components are to be installed and notify the A/E, in writing, of conditions detrimental to proper completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in an acceptable manner.
- B. Installation
 1. CCAS components shall be installed in accordance with equipment manufacturer's written instructions, in compliance with NFPA 70, "National Electrical Code (NEC)," and ANSI C2, "National Electrical Safety Code," and

with recognized industry practices, to ensure that the CCAS meets all requirements stated herein and serves its intended purposes.

2. The Contractor shall coordinate installation of CCAS components with work performed by others.
3. Surface-mounted equipment shall be securely fastened to indicated structural supports. The Contractor shall ensure that this equipment is plumb and level.
4. Connectors and terminals, including screws and bolts, shall be tightened in accordance with equipment manufacturer's published torque tightening values. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with the tightening torques specified in UL 486A/13, "Wire Connectors and Soldering Lugs for Use with Copper / Aluminum Conductors," and the NEC.

C. Grounding

1. Equipment grounding connections for CCAS components shall be provided. Ground connections shall be tightened to comply with the tightening torques specified in UL 486A to assure permanent and effective grounds.
2. The Contractor shall ensure and demonstrate that resistance to solid earth for signals is less than, or equal to, 3 ohms.

D. Adjusting and Cleaning

1. Upon completion of installation of CCAS components, the Contractor shall set all field-adjustable controls / components and align and calibrate all equipment for the required performance and operation as specified herein.
2. The Contractor shall touch-up scratched and marred surfaces to match the original finishes.
3. Installed CCAS components shall be protected from damage during the remainder of the construction period.

E. Field Quality Control

1. Prior to energization, the Contractor shall test all field-run wires and cables for electrical continuity and short circuits and to ensure proper polarity of all connections.

3.3 INSPECTIONS AND TESTS

A. Inspections

1. The prime responsibility for inspection of all materials and work furnished by the Contractor pursuant to the Contract rests with the Contractor. The inspection or waiving of inspections by the airport shall not relieve the Contractor of any obligations or responsibilities to perform in accordance with the Contract.
2. The Contractor shall assure that components procured from Subcontractors comply with the requirements of the Contract. Suggested methods of providing this assurance are audits of the Subcontractor and its Quality Control program or receipt inspections and tests designed to demonstrate that the device(s) functions properly and complies with the specified requirements. The airport's "release" of any materials being furnished by the Contractor's Subcontractors shall not be construed to imply acceptance of same in the end product and shall not in any way relieve the Contractor of its responsibility of inspection.

3. The Contractor shall cooperate fully with Duluth International Airport's representatives and shall grant Duluth International Airport free access to all documents and work areas which the airport deems necessary to perform thorough and meaningful tests and observations. The airport's representatives shall have the right to inspect the equipment, workmanship, labor, testing procedures and any other item or task performed, furnished or used by the Contractor under the Contract, and the airport may reject, without cost or liability, any which are defective or unsuitable for the use and purposes intended or which are not in accordance with the intent of the Specification. The Contractor, upon demand by the airport, shall remedy or replace, at the Contractor's expense, such defective or unsuitable equipment or performance item. The Contractor shall act promptly to obtain the airport's approval of corrective or remedial action(s) and shall implement these actions promptly after receipt of Duluth International Airport's approval.
4. The Contractor shall give the airport's representatives at least ten (10) working days notice of events or conditions specifically requested by the representatives. Where specific inspections are required, the work involved shall not proceed beyond that point until the representatives have made or waived such inspection. The Contractor shall provide the representative with appropriate drawings and technical documentation for use during the inspection visits, as required.

B. Field Verification Tests

1. Field tests to verify that the system hardware and software, as approved for shipment, function in the same demonstrated manner after installation of the CCAS will be performed by DLH at the site. The Contractor shall provide any technical assistance required during the tests. A test procedure will be developed by Contractor and reviewed by DLH, prior to performance. These tests shall be performed on the entire system.
2. Where possible, malfunctioning components shall be corrected at the site; otherwise, the Contractor shall remove and replace. Upon correction / replacement, the component shall be retested.
3. System hardware acceptance will be provided by DLH upon satisfactory completion of the approved system hardware verification tests at the site.
4. System software acceptance will be provided by DLH upon satisfactory completion of the approved system software verification tests at the site.

C. Availability Test

1. The Contractor shall demonstrate a continuous operation of the CCAS at the site over a period of 1,440 hours with an availability of 99.5 percent or more to include all supplied hardware and software. This shall be demonstrated after the Field Verification Test of the CCAS.
2. Availability shall be calculated as follows:

$$\text{Availability} = \text{Percent } \frac{\text{TDT} - \text{AOT}}{\text{TDT}} \times 100$$
 TDT where:
 - a. Test Duration Time (TDT) is the total elapsed time from start of the test to completion of the test. This time shall be a minimum of 1,440 hours. The TDT shall equal the time the WAS is undergoing testing less the time allocated for pre-scheduled preventive maintenance as required by the Contractors maintenance manual.
 - b. Accumulate Outage Time (AOT) is the total amount of time after start of the test when any part of the system or its function are not available (downtime) as specified below.
3. Downtime shall be calculated according to the following rules:

- a. The duration of any outage shall be calculated from the time that a functional deficiency is first recognized to the time the deficiency has been corrected to the satisfaction of DLH.
 - b. If an intermittent failure (those which occur and then disappear three (3) or more times) occurs, the problem shall be isolated and repaired. The system shall be considered unavailable while corrective maintenance is being performed.
 - c. Central processor failure not specifically attributed to system hardware malfunctions shall be considered a system failure and downtime shall be accumulated when it occurs at any rate greater than once per week.
 - d. No minimum time shall be charged against any occurrence.
 - e. All time shall be recorded to the nearest minute.
 - f. In the event of the failure of existing equipment, site conditions and / or accidental operator damage to the equipment caused by actions of DLH, its agents or employees, the effect of which is to render the equipment unavailable as described above, the testing shall cease. Upon return to normal operation, the testing shall begin again. No downtime shall be accumulated during this outage.
4. The CCAS shall be considered available under the following conditions:
 - a. Loss of the primary central processor or any on-line memory section or I/O controller attributable specifically to hardware malfunction if backup units or features are automatically activated and all lost functions are successfully transferred to an operating unit without disruption of any real-time functions of the CCAS.
 - b. Loss of either 1 printer or 1 VDT at the SCC attributable specifically to hardware malfunction, if the other display/printing items are operational during the outage.
 5. Commencement of the Availability Test shall be mutually agreed upon, but in no event shall it start prior to DLH's receipt and review of all manuals, working drawings and software documentation, unless prior waiver is obtained from DLH. In addition, the test shall not begin until training of DLH's operating personnel has been completed, recommended spare parts purchased by DLH are in stock and all scheduled preventive maintenance has been completed.
 6. In the event that the AOT exceeds 22 hours, the start time shall be shifted to delete some of the earliest outages until the accumulated outages during the 1,440-hour test no longer exceed 20 hours. The shifted start date time shall be mutually agreed upon between DLH and the Contractor. No time shift shall be permitted until at least 25 percent (1100 hours) of the test has been completed.
 7. A new test shall be started if major modifications are required to either hardware or software in order to conform to specified functional requirements.
 8. The CCAS shall be maintained (parts and labor included) by the Contractor at its expense until completion of a successful Availability Test.
 9. The Contractor shall provide a service representative on call 24 hours a day, 7 days a week for the duration of the Availability Test. The contractor has an option for on site availability of service representative or other appropriate means to ensure successful availability test as specified.
 10. The CCAS must be operating at 100 percent at the end of the test.
 11. During the Availability Test:

- a. Alterations to software shall not be permitted unless required to correct an error and DLH's approval is obtained.
- b. Alterations to the hardware shall not be permitted unless required to correct a failure or, if in the opinion of the Contractor, such changes will improve system reliability.
- c. DLH shall be permitted to verify system performance as specified.
- d. Any redesign or modification to the system that is a result of the Availability Test shall be made to and documented for all equipment supplied under the Contract.

3.4 TRAINING AND INSTRUCTION

A. General

1. The Contractor shall provide on-site training for operating, servicing and programming personnel designated by DLH and end-users (employees and tenant personnel).
 - a. Operating personnel shall receive detailed instruction in operating procedures, routine preventive maintenance and routine servicing of console and terminal equipment. The training of operating personnel shall be completed prior to the start of the Availability Test.
 - b. Servicing personnel shall receive detailed instruction in principles of operation, setup, adjustment, routine preventive maintenance, diagnosis and corrective repair of all CCAS equipment. The training of servicing personnel shall be completed at least 180 days prior to the end of the maintenance period.
 - c. Programming personnel shall receive detailed instruction in software architecture, addressing and instructions, device capabilities and program capabilities. The training of programmers shall be completed at least 180 days prior to the end of the maintenance period.
 - d. End-users shall receive detailed instruction in the operation and use of CCAS access point equipment.
2. Training shall be conducted by experienced, knowledgeable personnel, supported by modern training aids and shall utilize the actual system being supplied as much as possible. Participants shall receive individual copies of all pertinent technical manuals and documentation which apply specifically to the CCAS hardware and software.
3. Each training program shall be video-recorded by the Contractor for use by DLH for future training. Record each session on DVD and include 2 copies with the OEAM submittal.
4. DVD shall be of sufficient video quality such that all personnel and equipment involved with the training can be seen. In addition, the audio quality should be of sufficient quality such that all voices can clearly be heard throughout the recording. If these conditions are not met, the contractor will be required to perform the training and videotaping until these conditions are met.
5. Training shall be scheduled at the convenience of DLH.

B. Operator Training

1. Operating personnel must be familiar with the scope, operation and capabilities of the CCAS. This training shall include system concepts, general design features and detailed familiarization with the man machine interface. This training must be reinforced with hands-on experience on all

equipment. All operator courses shall be conducted at the site and must be structured to minimize the length of the instructional periods. It shall be necessary to repeat each course several times to accommodate all personnel on each shift.

2. The Contractor shall provide the operator training for up to 20 of DLH's personnel. This course shall have a duration of at least one (1) week.

C. Maintenance Training

1. DLH's servicing personnel shall attend courses designed to instruct them in the internal operations of the CCAS hardware and in diagnostic software. It is expected that the courses will be divided into a series pertinent to maintenance and troubleshooting on the console and terminal equipment including the central processors, peripherals and communications hardware and a series pertaining to field devices (IFPs, card readers, CCTV cameras etc.). This will permit selective assignment of personnel by DLH to optimize the skills of the maintenance staff.
2. Maintenance training courses shall include operation and troubleshooting using both test hardware and diagnostic programs and failure repair of actual system hardware. If actual system hardware is not available, an equivalent hardware system which simulates as closely as possible the system supplied, may be used in the training process.
3. The maintenance training program offered by the Contractor shall familiarize DLH's personnel with a comprehensive preventive maintenance program structured specifically for the system supplied.
4. The Contractor shall provide the hardware training for up to 20 of DLH's personnel.

D. Software Training

1. The Contractor's software training program shall familiarize DLH's programming personnel with off-line and on-line procedures for generation and modification of programs and the database, operation of peripherals, use of documentation, use of the Programmer's terminal, start-up and shut-down procedures, the use of off-line and on-line diagnostics and other pertinent operating, maintenance and development procedures. The courses shall include:
 - a. A course offering a detailed study of the specialized software supplied by the Contractor and the detailed logical structure of all standard software used by the system.
 - b. A course detailing the programming required to expand the database to include new monitored points, new security area access points and new types of I/O devices.
2. The Contractor shall provide the software training for up to 20 of DLH's personnel.

E. End-user Training

1. Airport employees and tenant personnel shall attend courses designed to instruct them in the proper operation of each access point type and in the use of its associated CCAS equipment. The course shall cover normal and emergency access procedures.
2. The end-user course shall be repeated a sufficient number of times to accommodate all individuals assigned an ID badge / keycard.

F. ID Badge / keycard Preparation Training

1. DLH personnel shall attend courses designed to instruct them in the preparation, encoding, printing, and controlling ID badges and Keycards.
2. The training shall have a minimum duration of one (1) week, and shall occur sixty (60) days prior to activation of the system.
3. The Contractor shall provide the ID badge / keycard preparation training for up to 20 of DLH's personnel.

3.5 MAINTENANCE SERVICES (WARRANTY)

- A. The Contractor shall provide "on-call" warranty maintenance service for all equipment supplied under this Contract for two (2) years after acceptance of the entire CCAS (hardware and software) by DLH. The service shall consist of all material, labor and travel expenses, as indicated in paragraph 1.10 "Maintenance Services" of this section.

END OF SECTION 13700

**NEW PASSENGER TERMINAL
DULUTH INTERNATIONAL AIRPORT
DULUTH, MINNESOTA**

**SECTION 13742 – MULTI-USER
FLIGHT INFORMATION
DISPLAY SYSTEM (MUFIDS)**

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Display Devices
 - 2. Computer Control System
 - 3. Networking Hardware
 - 4. System Support Hardware
 - 5. Software
 - 6. Spare Parts

1.2 ABBREVIATIONS

ADA	Americans with Disabilities Act
AODB	Airport operational database
ASP	Application Service Provider
CUTE	Common use terminal equipment
DDC	Device display controller
MUFIDS	Flight Information Display System
GB	Gigabyte (approximately one billion bytes of memory)
GUI	Graphical user interface
IVA	Integrated voice announcement system
IVR	Interactive voice response system
LAN	Local area network
LCD	Liquid crystal display
LED	Light emitting diode
MB	Megabyte (approximately one million bytes of memory)
MUFIDS	Multi-User Flight Information Display System
MUSE	Multi-user system environment
DLH	Duluth International Airport
SNMP	Simple Network Management Protocol
SQL	Structured Query Language
VPN	Virtual Private Network
WYSIWYG	What-you-see-is-what-you-get
XML	Extensible Markup Language
XSL	Extensible Style sheet Language

1.3 SYSTEM DESCRIPTION

- A. Flexibility - The system must be scalable and easily adaptable to 3rd party add-ons - including multimedia advertising display and airline host interfaces - utilizing industry standard technologies. The database must be designed to extend through the MUFIDS field and lookup tables
- B. Open - The system must use industry standard language and interface standards language and tools.

- C. Cost Effective - The system provided must require minimal hardware and software overhead and include all necessary software and hardware for a fully functional flight information display system.
- D. Expandability - The system must accommodate application and hardware growth.. Hardware must be expandable by adding additional memory, disk, or processors, as well as by clustering multiple servers.
- E. Easy to Manage and Support - The MUFIDS operating system and database must provide a seamless solution. The MUFIDS provider must provide remote dial-in support to minimize involvement of airport's personnel.
- F. User friendly – The system must be easy to learn and use industry standard interfaces, including pop-up form windows, to minimize learning time. The Visual Page Designer must come supplied with many templates which can be modified in font, style, color, graphics and more
- G. Easy to Maintain – Operation and Maintenance Manuals must be provided for each piece of equipment. Cable pathways and identification must be recorded.

1.4 PERFORMANCE REQUIREMENTS

- A. The MUFIDS shall provide the following functionality:
 - 1. Manage flight schedules and data and distribute it to flight, gate, and baggage information displays throughout the terminal as indicated on drawings.
 - 2. Provide easy-to-use client access capability to allow users, with the appropriate security rights, to update, change, and modify master and daily schedules and security access, and generally administer the operation of the system.
 - 3. Provide a design tool which includes templates and allows a user to modify screen template designs for flat panels and video monitors
 - 4. Provide interface to generate and distribute current and accurate flight information to the Airport's existing Web site and cellular portable devices.
 - 5. Provide visual paging that is easily accessible from the client workstations.
 - 6. Provide an integrated solution to continuously monitor hardware, software application, system and database performance and availability. Provide an integrated automatic notification system to alert Operational, IT, or Administrative Personnel of any failure.
 - 7. Provide interface with each Airline MUFIDS system to receive automated flight information updates.
 - 8. Provide HTTP/XML Web Server for XML Airline Host feeds.
- B. Provide all supports and hardware required to install all devices in neat and workman-like manner. All exposed wiring to the devices shall be limited to final connection points to the devices.
- C. Provide housing and cabinets for display devices as shown on the drawings.

1.5 REFERENCES

- A. Electronic Industries Assn / Telecommunications Industries Assn (EIA/TIA)
 - 1. EIA/TIA 568 Commercial Building Communications Wiring Standards
 - 2. EIA/TIA 569 Commercial Building Standard for Telecommunications Pathways and Spaces
 - 3. EIA/TIA 606A Administrative Standard for Commercial Telecommunications Infrastructure
 - 4. EIA/TIA 607 Commercial Building Bonding and Grounding Requirements for Telecommunications
- B. National Fire Protection Association (NFPA)
 - 1. NFPA 70 National Electric Code (NEC)
- C. Underwriters Laboratories (UL)
 - 1. UL 969 Marking and Labeling Systems

1.6 SUBMITTALS

- A. Shop Drawings: Submit complete including:
 - 1. System components detailed drawings and engineering data.
 - 2. Installation instruction for each piece of equipment.
 - 3. 1/8-inch scale, floor plan drawings, rack layouts and riser diagrams indicating detail wiring and system components.
 - 4. Software and firmware information.
- B. Product data in manufacturers catalog cuts, description and drawing components.
- C. Within thirty (30) days of the contract award, the Contractor shall submit a detailed work schedule and approach to the system installation.
- D. Qualification Data: For qualified Installer list experience and certifications. Personnel shall be trained and certified by manufacturer for installation of equipment required for this project.
- E. Software and Firmware Operational Documentation updated at project completion:
 - 1. Software operating and upgrade manuals.
 - 2. Operator Manuals, System Administrator Manual, and the off-the-shelf Manufacturers' Product Documentation.
 - 3. Manufacturer's documentation on the LAN, Operating System, Windows Applications, and database.
 - 4. Program Software Backup on compact disk, complete with data files.
 - 5. Printout of software application and graphic screens.
- F. Display Cabinets: Provide a 1/4" scale shop drawing for the display cabinet. Provide all details indicating the mounting of the specified monitors.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: Firm shall have at least five years successful installation experience with similar FID systems. Personnel shall be trained and certified by manufacturer of equipment required for this project.

- B. Compliance: Comply with the applicable requirements of the referenced standards and specifications.
- C. Source Limitations for FID System and Components: Obtain system from single source from single manufacturer.
- D. 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.

1.8 DELIVERY AND STORAGE

- A. Deliver all materials in manufacturer's packing in undamaged condition.
- B. Store all materials in clean, dry place and protect them from dirt, fumes, water, and physical damage.
- C. Handle components carefully to avoid damage to materials and finish.

1.9 WARRANTY AND SUPPORT

- A. The contract shall include a 12 month (one year) warranty for all system software and hardware commencing with completion of the successful reliability test period. Warranty shall include twenty-four (24) hours a day, seven (7) days a week, 365 days a year Help Desk facility for remote hardware and software support, OEM return-to-factory repair, overnight parts replacement, and emergency on-site service. The Help Desk must have a toll-free telephone number and be staffed by the MUFIDS provider's own employees.
 - 1. All hardware support shall be handled via Help Desk support.
 - 2. The MUFIDS provider shall coordinate return-to-factory repair, if applicable.
 - 3. Primary software support will be handled by telephone and dial-up modem by manufacturer's expert technicians at no additional charge during the warranty period.
- B. Provide 24 months (two years) of warranty service in addition to the one year of full warranty on installation. The maintenance agreement shall include site visits at the 3rd month, 12th month and 24th month to update software and restore system performance (total 3 trips).
- C. Software: The upgrade of all software shall be performed at no cost to the Owner during the warranty and maintenance service period. The proposal shall include labor and material for three upgrades. The fixing of errors in the system shall not be considered an upgrade.
 - 1. Provide all software licenses required for the project. All commercial software packages furnished as a part of the system shall have "DLH" as the owner of the software. All original software (CD-Rom, media and documentation) shall be turned over to the Owner with O&M manuals.
 - 2. Technical Support: Commencing with completion of the successful reliability test period, provide software support for three years.
 - 3. Upgrade Service: Update software to latest version at project completion. Install and program software upgrades that become available within three years from date of Substantial Completion. Upgrading software shall

include the operating system. Upgrades shall include new or revised licenses for use of software.

4. Provide thirty (30) days' notice to Owner to allow scheduling and access to system and to allow Owner to upgrade computer equipment if necessary.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide system by Com-Net or comparable product by one of the following:
 1. Com-Net Software Specialty, Inc.
 2. Air IT
 3. INFAX, Inc.
 4. Or approved equal.
- B. Display System Components:
 1. LCD display panel shall be as manufactured by NEC, Philips, Sony, LG, Mitsubishi, Samsung or approved equal. Section 2.6 – Display Devices
 2. Device Display Controller (DDC) shall be a computer as manufactured by Dell, HP, IBM or approved equal per Section 2.5 – MUFIDS Hardware Description.
- C. Control System Products
 1. Control system servers and workstations shall be computers as manufactured by Dell, HP, IBM or approved equal per Section 2.5 – MUFIDS Hardware Description.
 2. All computers including DDCs shall be manufactured by the same manufacturer

2.2 SYSTEM OVERVIEW

- A. System Requirements
 1. Whenever possible, the equipment and software specified with this system shall be off-the-shelf products from recognized sources in the industry
- B. System Architecture
 1. The architecture shall be client-server based and use industry-standard, off-the-shelf Internet/Web display tools and technologies. All display applications shall be developed with XML/XSL technology.
 2. The architecture shall be scalable and expandable to accommodate hardware and application changes and growth.
 3. The server operating system shall be Windows 2003 Server.
 4. The client operating system shall be Microsoft Windows XP Professional. Microsoft Internet Explorer shall be installed on each client.
 5. The MUFIDS components shall use existing security network switches. Contractor shall program and utilize VLANs to separate networks. Contractor shall verify no inter-VLAN routing is turned on between the Security network and MUFIDS network. Provide additional network switches as required.

6. The system shall be an open system that connects easily to external systems, such as airline host data feeds and gate management, interactive voice response (IVR), and MUSE/CUTE systems.
 7. The system's annual uptime shall be rated at 99.5% or better.
- C. System Management and Support
1. The system shall include system capability management tools, including Simple Network Management Protocol (SNMP)-compliant hardware and application-level support software. Approved tools include HP Openview or WhatsUp Gold.
 2. The MUFIDS provider must provide VPN or remote dial-in support to minimize involvement of Airport personnel
- D. Database management
1. The MUFIDS operating system and database must provide a seamless solution. The database management software used to store the MUFIDS operational data shall be an industry standard, scalable, reliable, relational, multi-user database, such as Microsoft SQL Server.
 2. The proposed MUFIDS must have the capability such that the MUFIDS provider can add database fields quickly without making changes to the MUFIDS application software or the database scheme.
- E. Operator Access
1. Operators shall access the system using client workstations. Each client workstations shall use XP Professional operating system and shall use Internet Explorer to access the MUFIDS application and flight information on the MUFIDS server. It shall be unnecessary for a MUFIDS client application to be installed on each workstation. An operator with the appropriate user privileges shall be able to access the MUFIDS application on the MUFIDS server from any browser-equipped client workstation on the MUFIDS network.
- F. Output Display Architecture & Formatting
1. Each device display controller (DDC) shall use the Windows XP Professional operating system and shall have its own TCP/IP address on the Ethernet-based LAN. The MUFIDS server transmits information, including public and private page data and miscellaneous system control information, to all display devices.
 2. To reduce network bandwidth and improve screen update speeds, the display device shall update only the areas that have actually changed rather than the entire page.
 3. Display output shall use Web technologies, such as HTML/DHTML for pages on display devices and XML/XSL for portable data transfer and data transformation
- G. Remote Management of DDCs
1. Each device display controller (DDC) shall be accessible using remote management software from the MUFIDS server and Airport Operations Client workstations.
 2. Remote Management shall allow the operator to view and fully interact with each DDCs active desktop.
 3. Remote Management software shall be Radmin 3.2, VNC Enterprise edition or equal.

2.3 MUFIDS APPLICATION

- A. The MUFIDS application shall be a Windows 2003 Server-based, browser-based application, such as Com-Net's ECLIPSX system or equal by an approved manufacturer.
- B. Database
 - 1. The MUFIDS application shall use two schedules to maintain flight information: a main (or master) schedule and a daily schedule. The main schedule shall be a long-term schedule from which the daily schedule is generated each day. The daily schedule shall allow the user to easily check schedules from yesterday, today and tomorrow. Both schedules shall be stored in the database and shall be maintained manually and through automated data feeds.
 - 2. The system shall not be designed with hard constraints that would limit the number of flights per day. The number of flights per day shall be only a matter of scalability based upon the hardware platform.
- C. User Interface
 - 1. The user interface shall take advantage of the Windows and Web graphical user interface (GUI) standards as appropriate throughout the system. Whenever possible, pick lists, buttons, and dialog boxes shall be implemented to enhance data entry and reduce data entry time. The user interface shall be designed for ease of use to minimize training time.
 - 2. User Flight Data Input:
 - a. The user shall use the main and the daily schedules to view and modify flight information. To eliminate the need to scroll through a schedule to view or modify data, the user shall be able to open a form-like dialog box. The dialog box shall allow the user to enter and modify easily all information that is associated with a particular flight in the schedule.
 - 3. User Definable Interface:
 - a. The user shall be able to customize the appearance of the user interface based upon roles and individual needs. The user shall be able to filter the data displayed in main and daily schedules to only those fields that he wants to view, such as city, gate, and actual time.
 - b. The user shall be able to customize the appearance of the user interface by changing the character and background colors of the user interface. The system shall retain each user's customizations, so that they are available to the user at any client workstation.
 - 4. Display Attributes:
 - a. The user interface shall provide an easy-to-use tool to modify the display attributes of flight information. Depending on the capabilities of the display device (that is, flat panel display, monitor, LED) the user shall be able to display text as bold, underlined, italicized, and blinking or foreground or background text color change. For example, the user shall be able to change the flight status "boarding" to display as blinking text. The user shall be able to select the attributes from easy to use pick lists.
 - 5. Canned Reports:

- a. The user interface shall allow the user to easily generate, view, and print standard reports containing on-time statistics and gate utilization, daily flight, and flight audit information. Only authorized users shall have access to the reporting feature
- D. Video Scheduling
 - 1. The MUFIDS software shall provide a fully integrated video scheduling system with tracking and reporting for billing purposes, to display full-motion advertising videos on flat panel displays and video monitors during owner determined timeframes.
- E. Report Generator
 - 1. A report generator shall be included with the MUFIDS. The report generator shall provide the ability to generate, and print custom information reports, using any data defined in the SQL database. Only authorized users shall have access to the reporting feature.
- F. World-Wide-Web Integration
 - 1. The MUFIDS software shall generate and distribute current and accurate flight information in HTML or XML format to the Airport's existing Web site. MUFIDS information shall be updated automatically
- G. MUFIDS Monitoring
 - 1. An integrated monitoring application shall be included to continuously monitor application, system, and database performance and availability. The monitoring application shall query the system's DDCs using SNMP methods. Other devices, such as print servers, shall also be monitored for availability.
 - 2. The monitoring application shall provide visual feedback and must be capable of automatically notifying the MUFIDS provider's Help Desk Facility if a failure occurs. A failure is defined as a minor event, such as a DDC failure, or a major event, such as server failure.
 - 3. The monitoring application shall allow a system administrator to configure the severity levels of error codes, the types of alerts, which diagnostic items you want to monitor, and the frequency level of each diagnostic check.
 - 4. Notification capabilities shall include e-mail, pager, network messaging, and SNMP forwarding to a higher-level network monitoring system.
- H. Visual Paging
 - 1. The visual paging system must be a user friendly, integrated component of the MUFIDS client application. To create and display messages, the user shall be able to access the paging function from any client workstation.
 - 2. The visual paging system shall provide a method of displaying a visual paging message, emergency messages, and other visual information to hearing-impaired travelers, accurately and completely via dynamic electronic display media. The visual paging system is intended for disabled passenger information paging and emergency messages only.
 - 3. Free format messages shall be limited to text messages only. No animation display mode shall be used.

4. The user must have the option to display messages immediately or to schedule messages for timed display. Scheduling must allow the user to specify starting day and time and ending day and time.
5. The visual paging system must allow messages to be prioritized. These priorities control which messages get displayed first when there is not enough space to display all messages.
6. The system shall provide predefined messages that the user can select with point-and-click mouse action and use "as is" or modify as necessary. These predefined messages will be maintained in the system database.

I. Airline Host Data Feeds

1. A host data feed allows an airline to download its flight data to the MUFIDS database. The MUFIDS shall interface to and download flight data from host data feeds from the following airlines and their partner airlines:
 - a. American
 - b. Delta
 - c. United
 - d. Allegiant
2. Contractor shall contact each airline a minimum of 45 days prior to interfacing to allow for Airline provided equipment and configurations.
3. Contractor shall provide an HTTP server with customized web services for XML host data feeds.

J. Security

1. The MUFIDS shall support a minimum of 25 security levels. The system administrator shall be able to configure access restrictions for each user level.
2. Users shall have to log on the system by entering a user name and password, which shall be verified by the system.
3. Only the system administrator shall have rights to add and delete users, modify user rights, and access user names and passwords.
4. The system administrator shall be able to restrict a user's rights to any aspect of the MUFIDS, including specific airlines or multiple airlines, specific fields of information in the main and daily schedules, and read-only and read / write permissions.
5. The system administrator shall be able to define rights for single users and to establish roles for a group of users

K. System Administrator Controls

1. The system administrator shall have exclusive access for the modification of system parameters, system time, and system date. The MUFIDS shall allow the system administrator to control access to the system in a number of areas. The system manager shall have the capability to issue and control the user names and passwords needed by users to access the features and functions of the MUFIDS. The system administrator shall have the ability to limit user access to flight data to an individual operator or a group of operators.
2. Additional menu items and entry screens shall be made available to the system administrator who will maintain various databases that are associated with MUFIDS operation. Data shall include (but not necessarily be limited to):
 - a. IATA Code / City Name

- b. Airline Code / Airline
- c. Status Code / Status Explanation
- d. Remark Code / Remarks Text
- e. Gate Remark Code / Gate Remark Text

L. Auditing

1. The MUFIDS shall provide an audit trail of all transactions. The audit trail in the form of a report shall indicate any changes that occurred to any of the databases and shall contain the date and time of the change, the user identification of the user who made the change, and the contents of the changed record.

M. Announcement Control System (ACS)

1. The MUFIDS system shall support an MUFIDS to ACS interface. This interface shall enable the Announcement Control System "Public Address" system to utilize MUFIDS information and for the Visual Paging/MUFIDS to utilize the ACS information.
2. The MUFIDS interface shall enable the ACS system to automatically share MUFIDS database information to ensure Flight Announcement System data is updated and accurate. As flight information is updated in the MUFIDS, this information shall automatically be transferred to the ACS database to prevent the need for duplicate data entry. The following minimum information shall be passed from the MUFIDS to the ACS:
 - a. Primary Airline.
 - b. Flight Number.
 - c. Effective Date.
 - d. Discontinued Date.
 - e. Operation Days of Week.
 - f. Scheduled Arrival Time.
 - g. Estimated Arrival Time.
 - h. Arrival Cities.
 - i. Scheduled Departure Time.
 - j. Estimated Departure Time.
 - k. Departure Cities.
 - l. Gate.
 - m. Baggage Carousel.
 - n. Codeshare Airlines.
 - o. Codeshare Flight Numbers.
 - p. Equipment Used (type of aircraft).
 - q. Gate ID (date / time gate usage starts / stops).
 - r. Baggage Carousel ID (date / time carousel usage starts / stops).
 - s. Frequent Flyer Miles (if available).
 - t. Miscellaneous Audio Take Index (for compensation for overbooking, etc.) (if available).
2. The MUFIDS interface shall also transmit the airport Master Clock System data from Master Clock Network Time Protocol (NTP) Servers (or similar mutually acceptable protocol) to enable the various components of the ACS to be synchronized with other special systems in the terminal. The following information shall be requested by the ACS components via NTP over Ethernet:
 - a. Current Date and Time.

3. Data shall be passed from the MUFIDS to the ACS using a multiple one-way a two-way interface on a standard Ethernet connection utilizing one of the following methods:
 - a. Built-in features of message queuing (MQ) to guarantee delivery of messages, persistence in the event of power outages and other interruptions, via Microsoft's version of MQ, MSMQ. Message content placed in the queue shall be XML (eXtensible Markup Language) compliant text; or
 - b. A standard (proprietary) asynchronous message (using the UDP part of the TCP/IP).
 - c. Data transfers will be monitored and logged within the MUFIDS, including transfer and completion times. The paging system shall inform the MUFIDS that data has been successfully received.

2.4 SCREEN DESIGN APPLICATION

- A. The approved solution shall incorporate templates that can be modified by incorporating text, graphics, full-motion video clips, and even Web sites.

At anytime during the design process, the screen designer shall allow the user to easily preview the screen design, using actual MUFIDS data

- B. Display Pages and Devices:
 1. The screen designer shall be capable of modifying any type of display template; for example, a public arrival screen or gate departure screen. The screen designer shall accommodate page design for monitors, and flat panel displays. The screen designer shall include templates of single pages and split screens, for various aspect ratios and display resolutions, including aspect ratios of 16:9 and 4:3 and their varied corresponding resolutions
- C. Designer Tools
 1. The screen designer shall supply tools that allow the user to cut, copy, and paste both text and graphics.
 2. The user shall be able to place, drag, and size fields that allow graphics, text, columns of text, full-motion video clips, and even Web sites on a page. The user shall be able to reposition and resize these fields with ease. The screen designer shall include features, such as grid lines, sizing handles, and snap-to-grid action, for the easy placement and dynamic sizing of images, rows and text
- D. Screen Designer Features
 1. The screen designer shall offer a variety of Windows fonts and point sizes, and allow the user to specify bold, underlined, and blinking text.
 2. Background and text colors shall be adjustable and shall be selectable from a palette of 16 million colors.
 3. The user shall be able to add time of day and date to each display page
- E. Graphics and Wallpaper
 1. The screen designer shall allow the user to easily select and insert graphical images of a standard format; that is, JPG, PCX, BMP, and GIF. It shall allow multiple images to be placed on a page.

2. The screen designer shall allow the user to easily select and insert background wallpaper graphical images of a standard format; that is, JPG, PCX, BMP, and GIF. It shall allow text and graphics to be placed over the wallpaper
- F. Full-Motion Video
1. The screen designer shall allow the user to easily select and insert full-motion video clips on a flat panel display or monitor page.
- G. Web pages
1. The screen designer shall allow the user to easily select and insert a Web site URL to display an actual Web page on a flat panel display or monitor page
- H. Additional Features
1. The screen designer shall accommodate code sharing on a display by allowing the user to display airline logos or names and flight numbers and cities on the same line or on separate lines or by using a transition that alternately displays code-sharing information, fading from one to the other.
 2. The screen designer shall provide templates that have split-screen displays. Screens must be able to be split into two, three, or four sections for a different display of information in each section. Each section must be individually addressable.
 3. Page templates should be available to ensure uniformity in the appearance of displays throughout the Airport
- I. Live Data Display
1. At anytime during the design process, the screen designer shall allow the user to easily preview the screen design, using actual MUFIDS data.
- J. Templates
1. Include in the scope of work for the production of six templates (3 MUFIDS and 3 BIDS) to be available no later than 30 days before the installation. The Airport administration will provide digitized graphics to be placed into the software for display throughout the system.

2.5 MUFIDS HARDWARE DESCRIPTION

- A. MUFIDS Server
1. The MUFIDS server shall be Windows 2003-certified computers.
 2. MUFIDS Server shall be redundant server configuration.
 3. At a minimum, the servers shall include the following:
 - a. Dual-Core Intel Xeon 5160, 3.0GHz
 - b. 1 GB 667MHz (2 x 512MB), Single Ranked DIMMs
 - c. (3) 80GB 7.2K RPM Serial ATA 3GB/s Hard Drives in a RAID5 configuration
 - d. Dual 10/100/1000 Ethernet network interface cards
 - e. 24X CD-RW/DVD ROM
 - f. 4USB 2.0 Ports
 - g. 2U Rackmounted Chassis
 - h. Windows Server 2003, R2, Standard Edition with SP2 and CALS as required.

- i. Dell PowerEdge 2950 III or equal.
- B. Client Workstation
 - 1. The client workstations shall be Windows XP-certified computers.
 - 2. At a minimum, each client workstation shall include the following:
 - a. Pentium processor, 3.0GHz, 512MB RAM, or greater
 - b. 80GB hard drive
 - c. Ethernet network interface card (100/1000)
 - d. Keyboard, mouse
 - e. 17-inch LCD-TFT flat panel monitor
 - f. 48X CD-R/RW/DVD-ROM Combo drive
 - g. 2 USB 2.0 Ports
 - h. Small or Ultra Small Form Factor Chassis.
- C. Device Display Controller (DDC)
 - 1. Device Display Controller (DDC) computers will provide the interface between the data network and the display devices. DDCs will decode the data and generate the necessary control signals to drive the display devices.
 - 2. DDCs shall be Windows XP-certified computers. Each DDC must be capable of being upgraded with the addition of video cards, to drive one to four display devices.
 - 3. The minimum DDC specifications are as follows:
 - a. Intel Core 2 Duo E8400 3.0 GHz, 6MB, 1333 FSB
 - b. 2GB DDR2 Non-ECC SDRAM, 800MHz
 - c. 80GB SATA 3.0Gb/s, 8MB Cache hard drive
 - d. 10/100/1000 Ethernet network interface
 - e. 8X DVD+/-RW drive, SATA
 - f. 90% Efficient Power Supply
 - g. PCIe riser for Full Height/Half Length Card Support if required.
 - h. 512MB NVIDIA NVS 420 PCIe with quad DVI output or approved equivalent
 - i. 4 USB 2.0 Ports
 - j. Rackmount Shelf
 - k. DDC shall be Dell Optiplex 960 Desktop, SFF or equal.
 - l. Connect DDC onboard video to KVM.
 - 4. DDCs shall use DVI over CAT6 Video Extenders for video distribution to monitors. The minimum video extender specifications are as follows:
 - a. Video Transmitter
 - 1. Video Support: DVI UXGA
 - 2. Resolution: 1600 x 1200 @ 60 Hz & HD modes
 - 3. Rackmountable Kit, 1U (3 TX units) OR 2U (6 TX units)
 - 4. Transmitter shall be Magenta Infinea DVI Tx UTP or equal.
 - b. Video Receiver
 - 1. Video Support: DVI UXGA
 - 2. Resolution: 1600 x 1200 @ 60 Hz & HD modes
 - 3. Distance: 500 ft.
 - 4. Receiver shall be Magenta Infinea DVI Rx UTP or equal.
- D. HTTP Server
 - 1. A HTTP server shall be provided to handle XML Posts and Requests from Airline Host feeds that support XML.

2. Contractor shall create XML Web Services as required to interface each airline host feed.
 3. HTTP Server shall be located behind a firewall in a DMZ.
 4. HTTP Server shall be hosted on a non standard port in the range of 1024-9999 unless standard port is required by airline feed.
 5. Coordinate with network scope.
 6. HTTP Server shall run Apache Server 2.2 or Microsoft IIS 5.1 HTTP Services.
 7. The HTTP server shall be Windows XP-certified.
The minimum HTTP Server specifications are as follows:
 - a. Intel Pentium Dual Core E2180 2.0 GHz, 1MB, 800 FSB
 - b. 1GB DDR2 Non-ECC SDRAM, 677MHz
 - c. 80GB SATA 3.0Gb/s, 8MB Cache hard drive
 - d. 10/100/1000 Ethernet network interface
 - e. 48X CD-ROM drive, SATA
 - f. Integrated Video Graphics
 - g. 4 USB 2.0 Ports
 - h. Rackmount Shelf
 - i. DDC shall be Dell Optiplex 755 Desktop or equal.
 - j. Connect HTTP Server to KVM.
- E. Network Hardware
1. See Network Scope on sheet E6-04.
- F. KVM (Keyboard, Video Mouse)
1. Contractor shall connect to 17" LCD w/ KVM in the MDF rack as indicated on E5-02.
- G. Gate Departure Control System
1. The gate departure control system shall display gate-specific flight departure information. The system shall be controlled from the MUFIDS server. A micro-terminal shall allow podium personnel to modify and update flight information.
 2. The system shall utilize a display device, numeric-key input micro-terminal, and a DDC. Provide display devices as shown on the drawings.
 3. The display device shall display the following information: airline logo (full graphics), flight number, airline designator, departure time, status, and remarks. The DDC shall have sufficient memory capacity to store a minimum of 250 logos and images.
 4. The display devices shall operate automatically, displaying the correct data from the MUFIDS server.
 5. There shall be one display device, DDC, and micro-terminal provided at each podium position as indicated on the drawings.
- Selective inputs made at the gate micro-terminals shall change the MUFIDS database and all other displays on the airport system. The gate micro-terminals shall be capable of changing flight status fields, actual times and / or gate remarks.

2.6 DISPLAY DEVICES

- A. LCD Flat Panel Displays. The flat panel LCD displays shall be as manufactured by NEC, Mitsubishi, Samsung, LG, Philips or approved equal. The units shall not

cause any permanent image burn-in. The displays shall have multi-screen capabilities and full motion video. Contractor shall present various multiscreen options to "DLH" for approval. The screen layout configurations shown on the drawings are for example only. "DLH" will select final configuration after the presentation.

- B. See plans for model numbers.
- C. Provide supports and mounting brackets for all monitors as indicated on the drawings.

2.7 SPARE PARTS:

- A. Provide the following spare parts.
 - 1. One (1) DDC controllers.
 - 2. One (1) LCD Monitor of each size used.
 - 3. Two (2) Video Extender kits.

PART 3 - EXECUTION

3.1 PLANNING

- A. Prior to beginning of the work detailed planning and lay-out shall be performed to meet schedule and ensure proper installation of MUFID system.
- B. The MUFIDS Contractor shall plan conduit layout, power requirements, exact termination of the conduit and wiring to provide clean installation. No surface mounted conduit shall be installed without prior approval of Architect / Engineer.

3.2 COORDINATION

- A. The Contractor shall coordinate all work efforts with the Owner, A/E and other trades. The phasing-in schedule for the new system shall be submitted within 30 days of the contract award for approval.
- B. Conduit pathways and cable identification shall be coordinated with other contractors and A/E.

3.3 EQUIPMENT INSTALLATION

- A. The contractor shall provide all supports and installation hardware for the equipment furnished under the contract. The installation shall be in neat and workmanlike manner. The exact monitor location, height and other items shall be field coordinated with the A/E and owner.
- B. Locations of all cutting and patching shall be approved by the Architect / Engineer and Owner. All repairs must match the surrounding surfaces.
- C. Install all equipment in accordance with the manufacturer's written instructions.
- D. Install a complete and operational MUFID System.

3.4 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Division 16 Section "Electrical Identification."
- B. Provide 'as-built' record of wiring pathways and cable identification in dwf or dwg CAD format on CD.

3.5 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing. Field tests shall be witnessed by Design Engineer or designated alternate.
- B. Visual Inspection: Conduct visual inspection prior to testing.

3.6 FINAL TESTS AND DEMONSTRATION

- A. Final tests and inspection shall be held in the presence of Architect/Engineers and Owner's representatives and to their satisfaction. The Contractor shall supply personnel and required auxiliary equipment for this test without additional cost.
- B. Conduct reliability test for two months to indicate compliance with 99.5 percent system reliability requirements. The reliability shall be determined as follows:
Reliability Test
 - 1. The Contractor shall demonstrate a continuous operation of the MUFIDS at the site over a period of 1,440 hours (60 days) with an availability of 99.5 percent or more to include all supplied hardware and software. This shall be demonstrated after the Acceptance Test of the MUFIDS.
 - 2. Availability shall be calculated as follows:

$$\text{Availability} = \text{Percent } \frac{(\text{TDT} - \text{AOT}) \times 100}{\text{TDT}}$$
 - a. Test Duration Time (TDT) is the total elapsed time from start of the test to completion of the test. This time shall be a minimum of 1,440 hours.
 - b. Downtime shall be calculated according to the following rules:
 - 3. The duration of any outage shall be calculated from the time that a functional deficiency is first recognized to the time the deficiency has been corrected to the satisfaction of "DLH".
 - 4. If an intermittent failure (those which occur and then disappear 3 or more times) occurs, the problem shall be isolated and repaired. The system shall be considered unavailable while corrective maintenance is being performed.
 - 5. Central processor failure not specifically attributed to system hardware malfunctions shall be considered a system failure and downtime shall be accumulated when it occurs at any rate greater than once per week.
 - 6. No minimum time shall be charged against any occurrence.
 - 7. All time shall be recorded to the nearest minute.
 - 8. In the event of the failure of existing equipment, site conditions and / or accidental operator damage to the equipment caused by actions of "DLH", its agents or employees, the effect of which is to render the

equipment unavailable as described above, the testing shall cease. Upon return to normal operation, the testing shall resume again. No downtime shall be accumulated during this outage.

- C. Test Report: A copy of the test report shall be submitted documenting the test procedure and detail results, indicating proper functioning of system, and conformance to the specifications. System shall be left in operating condition.

3.7 TRAINING

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain MUFID system.
- B. The MUFIDS contractor shall provide 2 day(s) of on-site training for the airport staff on each operating shift. Each class shall contain both lecture discussions and hands-on experience and shall last approximately three to four hours. Each class shall be no larger than ten (10) students
- C. Provide one 12 hour training for airport personnel. The training shall be video recorded for future use and shall include the following.
 - 1. MUFIDS operation.
 - 2. Review the documentation and software submitted to test and manage the system.
 - 3. Operation of network equipment.
 - 4. Review maintenance procedures, labeling orientation, communication closets and equipment rooms.
 - 5. Trouble shooting of signal and power cabling.
 - 6. The training shall be conducted by qualified personnel. Submit qualification of the trainer for approval by Architect / Engineer.
- D. Send a letter to the Owner, for Owner's signature, acknowledging that instruction in system operation has been received. One copy to be retained by Owner and one copy sent to Contractor.

END OF SECTION 13742

**NEW PASSENGER TERMINAL
DULUTH INTERNATIONAL AIRPORT
DULUTH, MINNESOTA**

**SECTION 13915 - FIRE PROTECTION
SUPPRESSION PIPING**

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes general requirements for valves, piping and appurtenances for the following water based fire suppression systems:
 - 1. Standpipe, sprinkler and combined risers and cross mains.
 - 2. Sprinkler main and branch piping downstream of the floor control valve.
 - 3. Automatic, semi-automatic, and manual water based suppression systems including wet-pipe, dry-pipe and pre-action systems.

1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Related Sections include the following:
 - 1. Division 2 Section 02510 "Water Distribution".
 - 2. Division 7 Section 07270 "Firestopping".
 - 3. Division 9 Section 09910 "Painting".
 - 4. Division 13 Section 13050 "General Requirements".
 - 5. Division 13 Section 13060 "Fire Protection Hangers and Supports".
 - 6. Division 13 Section 13075 "Fire Protection Identification".
 - 7. Division 13 Section 13520 "Fire-Protection Cabinets".
 - 8. Division 13 Section 13921 "Electric-Drive, Horizontal Fire Pumps".
 - 9. Division 13 Section 13926 "Vertical-Turbine Fire Pumps".
 - 10. Division 16 Section "Fire Alarm Systems" for alarm devices not in this Section.

1.3 DEFINITIONS

- A. Hose Connection: Valve with threaded outlet matching fire hose coupling thread for attaching fire hose.
- B. Hose Station: Hose connection, fire hose rack, and fire hose.
- C. Working Plans: Documents, including drawings, calculations, and material specifications prepared according to NFPA 13 and NFPA 14 for obtaining approval from authorities having jurisdiction.

D. The following are industry abbreviations for plastic materials:

1. ABS: Acrylonitrile-butadiene-styrene plastic.
2. CPVC: Chlorinated polyvinyl chloride plastic.
3. PE: Polyethylene plastic.
4. PVC: Polyvinyl chloride plastic.

E. The following are industry abbreviations for rubber materials:

1. EPDM: Ethylene-propylene-diene terpolymer rubber.
2. NBR: Acrylonitrile-butadiene rubber.

1.4 SYSTEM PERFORMANCE REQUIREMENTS

- A. Design standpipes piping according to Section 13975 "Standpipes and Hoses".
- B. Design sprinkler piping according to Section 13916 "Fire-Suppression Sprinklers".
- C. Components and Installation: Capable of producing piping systems with **175-psig (1200-kPa)** minimum working-pressure rating, unless otherwise indicated, or as required by Local Code.

1.5 SUBMITTALS

A. Product Data: For the following:

1. Pipe and fitting materials and methods of joining for standpipe piping.
2. Valves, including specialty valves, accessories, and devices.
3. Alarm devices. Include electrical data.
4. Air compressors. Include electrical data.
5. Fire department connections. Include type; number, size, and arrangement of inlets; caps and chains; size and direction of outlet; escutcheon and marking; and finish.
6. Hose connections. Include size, type, and finish.
7. Hose stations. Include size, type, and finish of hose connections; type and length of fire hoses; finish of fire hose couplings; type, material, and finish of nozzles; and finish of rack.
8. Transition fittings.
9. Dielectric fittings.
10. Mechanical sleeve seals.
11. Escutcheons.

B. Welding certificates.

C. Fire-Hydrant Flow Test Report: As specified in Section 13050, "General Requirements".

- D. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13 and NFPA 14. Include "Contractor's Material and Test Certificate for Aboveground Piping" and "Contractor's Material and Test Certificate for Underground Piping."

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has designed and installed fire-suppression piping similar to that indicated for this Project and obtained design approval and inspection approval from authorities having jurisdiction.
- B. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code–Steel."
- C. Manufacturer Qualifications: Firms whose equipment, specialties, and accessories are listed by product name and manufacturer in UL's "Fire Protection Equipment Directory" and FM's "Fire Protection Approval Guide" and that comply with other requirements indicated.
- D. Standpipe and Sprinkler Components: Listing/approval stamp, label, or other marking by a testing agency acceptable to authorities having jurisdiction.
- E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.
- F. NFPA Standards: Equipment, specialties, accessories, installation, and testing complying with the following, in addition to local code and other applicable sections of Division 13:
 - 1. NFPA 13, "Installation of Sprinkler Systems."
- G. Applicator: Company specializing in piping installation with seven years minimum experience.
- H. Systems, installation, equipment and materials shall conform to requirements of the local Building Code, Owners Insurance Underwriters, Factory Mutual, Industrial Risk Insurers, local Fire Department, NFPA, ANSI/ASME B31.9 "Building Service Piping" and all authorities having jurisdiction. Equipment and materials Underwriters listed, labeled and approved as required.

1.7 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.
 - 2. Substitutions will not be permitted unless approved by the engineer.

2.2 PIPE, TUBE, AND FITTINGS

- A. Refer to individual Division 13 Specialty Sections 13915 "Suppression Piping" for pipe, tube, and fitting materials and joining methods.
- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.3 JOINING MATERIALS

- A. Refer to individual Division 13 Specialty Sections for special joining materials not listed below.
- B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
 - 1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch (3.2-mm) maximum thickness unless thickness or specific material is indicated.
 - a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
 - 2. AWWA C110, rubber, flat face, 1/8 inch (3.2 mm) thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.
- C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- D. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- E. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.
- F. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.4 TRANSITION FITTINGS

- A. AWWA Transition Couplings: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.
 - 1. Manufacturers:
 - a. Cascade Waterworks Mfg. Co.
 - b. Dresser Industries, Inc.; DMD Div.
 - c. Ford Meter Box Company, Incorporated (The); Pipe Products Div.
 - d. JCM Industries.
 - e. Smith-Blair, Inc.
 - f. Viking Johnson.
 - 2. Underground Piping **NPS 2 (DN 50)** and Larger: AWWA C219, metal sleeve-type coupling.
 - 3. Aboveground Pressure Piping: Pipe fitting.

2.5 DIELECTRIC FITTINGS

- A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.
- B. Insulating Material: Suitable for system fluid, pressure, and temperature.
- C. Dielectric Unions: Factory-fabricated, union assembly, for **250-psig (1725-kPa)** minimum working pressure at **180 deg F (82 deg C)**.
 - 1. Manufacturers:
 - a. Capitol Manufacturing Co.
 - b. Central Plastics Company.
 - c. Eclipse, Inc.
 - d. Epco Sales, Inc.
 - e. Hart Industries, International, Inc.
 - f. Watts Industries, Inc.; Water Products Div.
 - g. Zurn Industries, Inc.; Wilkins Div.
- D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 300-psig **(2070-kPa)** minimum working pressure as required to suit system pressures.
 - 1. Manufacturers:
 - a. Capitol Manufacturing Co.
 - b. Central Plastics Company.
 - c. Epco Sales, Inc.
 - d. Watts Industries, Inc.; Water Products Div.

- E. Dielectric-Flange Kits: Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.
 - 1. Manufacturers:
 - a. Advance Products & Systems, Inc.
 - b. Calpico, Inc.
 - c. Central Plastics Company.
 - d. Pipeline Seal and Insulator, Inc.
 - 2. Separate companion flanges and steel bolts and nuts shall have 300-psig (2070-kPa) minimum working pressure where required to suit system pressures.

2.6 SLEEVES AND MECHANICAL SEALS

- A. Refer to Division 13 Section 13053 "General Materials and Methods".

2.7 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Specialty Valves and Devices:
 - a. Badger Fire Protection, Inc.
 - b. Firematic Sprinkler Devices, Inc.
 - c. Reliable Automatic Sprinkler Co., Inc.
 - d. Tyco Sprinkler Corp.
 - e. Viking Corp.
 - f. Victaulic Co. of America.
 - 2. Water-Flow Indicators and Supervisory Switches:
 - a. Potter Electric Signal Co.
 - b. Reliable Automatic Sprinkler Co., Inc.
 - c. Viking Corp.
 - d. System Sensor Div. Pittaway Corp.
 - e. Victaulic Co. of America.
 - 3. Sprinkler, Drain and Alarm Test Fittings:
 - a. Tyco Sprinkler Corp.
 - b. Croker Corp.
 - c. Grinnell Corp.
 - d. Victaulic Co. of America.
 - 4. Sprinkler, Branch-Line Test Fittings:
 - a. Elkhart Brass Mfg. Co., Inc.
 - b. Fire-End and Croker Corp.
 - c. Smith Industries, Inc.; Potter-Roemer Div.
 - d. Potter Roemer.

- e. Tyco Sprinkler Corp.
 - f. Victaulic Co. of America.
5. Sprinkler, Inspector's Test Fittings:
- a. Croker Corp.
 - b. AFG Manufacturing, Inc.
 - c. Tyco Sprinkler Corp.
 - d. Victaulic
6. Fire Department Connections:
- a. Elkhart Brass Mfg. Co., Inc.
 - b. Croker Corp.
 - c. Reliable Automatic Sprinkler Co., Inc.
 - d. Potter Roemer.
7. Hose Connections and Hose Stations:
- a. Elkhart Brass Mfg. Co., Inc.
 - b. Croker Corp.
 - c. Guardian Fire Equipment, Inc.
 - d. Potter Roemer.
8. Roof Hose Cabinets:
- a. Croker Corp.
 - b. Metal Cabinet Co.
 - c. Potter Roemer.
9. Indicator Posts and Indicator-Post, Gate Valves:
- a. American Cast Iron Pipe Co.; Waterous Co.
 - b. Grinnell Corp.
 - c. Clow Valve Co. Div.
 - d. Kennedy Valve Div.
 - e. Nibco, Inc.
 - f. Stockham Valves & Fittings, Inc.
 - g. Potter Roemer.
10. Indicator Valves:
- a. Tyco Fire, Inc.
 - b. Grinnell Corp.
 - c. Kennedy Valve Div.
 - d. Milwaukee Valve Co., Inc.
 - e. Nibco, Inc.
 - f. Victaulic Co. of America.
 - g. Potter Roemer.
11. Fire-Protection-Service Valves:
- a. Tyco Fire, Inc.
 - b. Grinnell Corp.
 - c. Kennedy Valve Div.
 - d. Nibco, Inc.
 - e. Stockham Valves & Fittings, Inc.
 - f. Victaulic Co. of America.

12. Keyed Couplings for Steel Piping:
 - a. Grinnell Corp.
 - b. Victaulic Co. of America.
13. Keyed Couplings for Ductile-Iron Piping:
 - a. Victaulic Co. of America.
14. Keyed Couplings for Copper Tubing:
 - a. Grinnell Corp.
 - b. Victaulic Co. of America.
15. Press-Seal Fittings for Steel Piping:
 - a. Victaulic Co. of America.

2.8 PIPING MATERIALS

- A. Provide the following pipe materials in accordance with the piping material schedule on drawing and as required in other Division 13 Sections.
- B. Materials indicated are subject to approval of local governing authorities. All piping and fittings shall be metal, and plastic.
- C. Each pipe length shall have the manufacturer's name cast, stamped or rolled on.
- D. Each fitting shall have the manufacturer's symbol and pressure rating cast, stamped or rolled on, and shall be pressure rated and suitable for the system it is being used for.
- E. Steel pipe (Stl.): Welded or seamless, with maker's name stamped or rolled into each length. Pipe shall be black steel ANSI B125.1 and B125.2.
- F. Copper tubing seamless drawn or extruded tubing Type "L" or Type "K" as scheduled hard temper in accordance with ASTM Specification B-88, with brazed end fittings.

2.9 PIPES AND TUBES

- A. Ductile-Iron Pipe: Comply with UL 213 and AWWA C606 for ductile iron pipe dimension. AWWA C115 or C151, with cement-mortar lining and seal coat according to AWWA C104.
 1. Push-on-joint type; Include rubber gasket according to AWWA C111.
 2. Mechanical-joint type: Include gland, rubber gasket, and bolts and nuts according to AWWA C111.
 3. Factory or field radius-cut grooved according to AWWA C606.
- B. Steel Pipe: Comply with UL 213 and AWWA C606 for steel pipe dimensions.
 1. Standard-Weight: Comply with ASTM A 53, ASTM A 135, or ASTM A 795; Schedule 40 in **NPS 6 (DN150)** and smaller, and Schedule 30 in **NPS 8 (DN200)** and larger.

2. Schedule 30 Thinwall: For wall thickness less than Schedule 40 and greater than Schedule 10. Comply with ASTM A 135 or ASTM A 795.
 3. Schedule 10: For Schedule 10 in **NPS 5 (DN125)** and smaller and NFPA 13 specified wall thickness in **NPS 6 to NPS 10 (DN150 to DN250)**. Comply with ASTM A 135 or ASTM A 795,
- C. Copper Tube: Comply with ASTM B 88 (**ASTM B 88M**), Type K or Type L water tube, drawn temper. Tube ends may be factory or field expanded to steel-pipe OD.

2.10 PIPE JOINTS AND FITTINGS:

- A. Use the following pipe joints and fittings in accordance with the Pipe Material Schedule shown on the drawings and referenced in other Sections of Division 13.
- B. Joints between lengths of steel pipes: Screwed, flanged or victaulic approved type only. Make screwed joints without the use of lampwick or filler, except "utility compound" or Permacel teflon tape applied to make threads only.
- C. Flanged fittings: Cast iron, ductile iron, bronze or cast steel, of required working pressure, as scheduled.
- D. Mechanical victaulic type joint
 1. For steel pipe victaulic type 77, 75, 72 and zero flex are the only approved coupling to be used with grooved piping. Couplings shall be galvanized when used with galvanized piping. All grooves on piping that is galvanized shall be properly cleaned and provided with zinc chromate primer. See pipe material schedule.
- E. Brazed joints for copper tubing make with Handy and Harmon Jil-Fos, silver solder or approved and oxyacetylene flame. Brazing temperature 1300°F. Make the installation as per manufacturers recommendation.
- F. Ductile-Iron Fittings: Comply with UL 213 and AWWA C606 for ductile-iron pipe dimensions.
 1. Push-on-joint: AWWA C110 or ductile-iron or cast-iron; or AWWA C153, ductile-iron, compact type. Include cement-mortar lining and seal coat according to AWWA C104 and rubber gaskets according to AWWA C111.
 2. Mechanical-Joint: AWWA C110, ductile-iron or cast-iron type; or AWWA C153, ductile-iron, compact type. Include cement-mortar lining and seal coat according to AWWA C104 and glands, rubber gaskets, and bolts and nuts according to AWWA C111.
 3. Groove End: **ASTM A 47 (ASTM A 47M)**, malleable-iron or ASTM A 536, ductile-iron casting complying with AWWA pipe size; with ends factory grooved according to AWWA C606. Include cement-mortar lining and seal coat according to AWWA C104 or epoxy, interior coating according to AWWA C550.
 4. Keyed Couplings: Include ASTM A 536, ductile-iron housing, rubber gaskets, and steel bolts and nuts.
 5. Flanged Joints: AWWA C115, ductile-iron or gray-iron pipe flanges, rubber gaskets, and steel bolts and nuts.

- G. Cast-Iron:
 - 1. Threaded Flanges: ASME B16.1.
 - 2. Threaded Fittings: ASME B16.4.
- H. Malleable-Iron Threaded Fittings: ASME B16.3.
- I. Steel: Comply with UL 213 and AWWA C606, for Steel-Pipe Dimensions.
 - 1. Threaded Couplings: ASTM A 865.
 - 2. Welding Fittings: ASTM A 234/A 234M, ASME B16.9, or ASME B16.11.
 - 3. Flanges and Flanged Fittings: ASME B16.5.
 - 4. Grooved-End Fittings: UL-listed and FM-approved, **ASTM A 47 (ASTM A 47M)**, malleable iron or ASTM A 536, ductile iron; with dimensions matching steel pipe and ends factory grooved according to AWWA C606.
 - 5. Steel, Keyed Couplings: Include ASTM A 536, ductile-iron housing, rubber gaskets, and steel bolts and nuts. Include listing for dry-pipe service for couplings for dry piping.
 - 6. Press-Seal Fittings: UL 213 and FM-approved for use with Schedule 5, plain-end, steel pip, **175-psig (1200-kPa)** pressure rating; with steel housing, butylene O-rings, and pipe stop. Include UL 45-listed fitting manufacturer's pressure-sealing tools.
- J. Cast-Copper:
 - 1. Cast Alloy Fittings: ASME B16.18.
 - 2. Wrought-Copper Fittings: ASME B16.22.
 - 3. Cast-Bronze Flanges: ASME B16.24.
 - 4. Copper, Grooved-End Fittings: **ASTM B 75 (ASTM B 75M)**, copper tube or ASTM B 584, bronze castings. Fittings may be copper tube with ends factory or field expanded to steel-pipe OD.
 - 5. Copper, Keyed Couplings: UL 213 and equivalent to AWWA C606, for copper-tube dimensions. Include **ASTM A 47 (ASTM A 47M)**, malleable-iron or ASTM A 536, ductile-iron housing with copper-colored enamel finish, rubber gaskets, and steel bolts and nuts.
- K. Transition Couplings: AWWA C219, sleeve type, or other manufactured fitting the same size as, with pressure rating at least equal to, and with ends compatible with piping to be joined.

2.11 JOINING MATERIALS

- A. Refer to Division 13 Section 13053 "Fire Protection General Materials and Methods" for pipe-flange gasket materials and welding filler metals.
- B. Brazing Filler Metals: AWS A5.8, Classification BCuP-3 or BCuP-4.

2.12 POLYETHYLENE ENCASEMENT

- A. Polyethylene Encasement for Ductile-Iron Piping: ASTM A 674 or AWWA C105, film, **0.008-inch (0.20-mm)** minimum thickness, tube or sheet.

2.13 GENERAL DUTY VALVES

- A. Refer to Division 13 Section 13053 "Fire Protection General Materials and Methods" for gate, ball, butterfly, globe, and check valves not required to be UL listed and FM approved.

2.14 FIRE PROTECTION SERVICE VALVES

- A. General Requirements:
 - 1. Listings: UL Listed and FM Approved.
 - 2. Working Pressure: As required for intended service but not less than 175-psig (1200 kpa) non-shock rating.
 - 3. Valves for ground-end piping may be furnished with grooved ends instead of type of ends specified.
- B. Gate Valves:
 - 1. NPS 2 (DN50) and Smaller: UL 262; cast-bronze, threaded ends; solid wedge; OS&Y; and rising stem.
 - 2. NPS 2-1/2 (DN65) and Larger: UL 262, iron body, bronze mounted, taper wedge, OS&Y, and rising stem. Include replaceable, bronze, wedge facing rings and flanged ends.
- C. Indicating Valves:
 - 1. NPS 2-1/2 (DN65) and Smaller: UL 1091; butterfly or ball-type, bronze body with threaded ends; and integral indicating device. Indicator: Visual with electrical 115-V ac, prewired, two-circuit, supervisory switch.
- D. Indicator-Post:
 - 1. Gate Valves: UL 262, iron body, bronze mounted, solid-wedge disc, and nonrising stem with operating nut and flanged ends.
 - 2. Indicator Posts: UL 789, horizontal, wall type, cast-iron body, with windows for target plates that indicate valve position, extension rod and coupling, locking device, and red enamel finish. Provide operating wrench or handwheel.
- E. Swing Check Valves
 - 1. NPS 2 (DN50) and Smaller: UL 312 or MSS SP-80, Class 150; bronze body with bronze disc and threaded ends.
 - 2. NPS 2-1/2 (DN65) and Larger: UL 312, cast-iron body and bolted cap, with bronze disc or cast-iron disc with bronze-disc ring and flanged ends.
- F. Check Valves Split-Clapper NPS 4 (DN100) and Larger: UL 312, cast-iron body with rubber seal, bronze-alloy discs, and stainless-steel spring and hinge pin.

2.15 SPECIALTY VALVES

- A. Dry-Pipe Valves: UL 260; differential type; 175-psig (1200-kPa) working pressure; with cast-iron flanged inlet and outlet, bronze seat with O-ring seals, and single-hinge pin and latch design. Include UL 1486, quick-opening devices, trim sets for air supply, drain,

priming level, alarm connections, ball drip valves, pressure gages, priming chamber attachment, and fill-line attachment.

1. Option: Grooved-end connections for use with keyed couplings.
 2. Air-Pressure Maintenance Devices: Automatic device to maintain correct air pressure in piping. Include shutoff valves to permit servicing without shutting down sprinkler piping, bypass valve for quick filling, pressure regulator or switch to maintain pressure, strainer, pressure ratings with 14- to 60-psig (95- to 410-kPa) adjustable range, and 175-psig (1200-kPa) maximum inlet pressure.
 3. Air Compressor: Fractional horsepower, 120-V ac, 60 Hz, single phase.
- B. Ball Drip Valves: UL 1726, automatic drain valve, NPS 3/4 (DN20), ball check device with threaded ends.

2.16 HOSE CONNECTIONS

- A. Description: UL 668, 300-psig (2070-kPa) minimum pressure rating, brass, hose valve for connecting fire hose. Include 90-degree angle pattern design; female NPS inlet and male hose outlet; and lugged cap, gasket, and chain. Include NPS 2-1/2 (DN40 or DN65) as indicated, and hose valve threads according to NFPA 1963 and matching local fire department threads.
1. Valve Operation: Nonadjustable type.
 2. Finish: Rough brass.
 3. Finish: Rough chrome-plated.

2.17 FIRE DEPARTMENT CONNECTIONS

- A. Wall, Fire Department Connections: UL 405; cast-brass body with brass, wall, escutcheon plate; brass, lugged caps with gaskets and brass chains; and brass, lugged swivel connections. Include inlets with threads according to NFPA 1963 and matching local fire department sizes and threads, outlet with pipe threads, extension pipe nipples, check devices or clappers for inlets, and escutcheon plate with marking "AUTO SPKR & STANDPIPE."
1. Type: Flush mounting.
 2. Type: Exposed, projecting mounting.
 3. Escutcheon Plate: Round.
 4. Escutcheon Plate: Square.
 5. Escutcheon Plate: Rectangular.
 6. Finish: Polished chrome-plated.
 7. Finish: Rough chrome-plated.
 8. Finish: Polished brass.

2.18 ALARM DEVICES

- A. General: Types matching piping and equipment connections.

- B. Water-Flow Indicators: UL 346; electrical-supervision, vane-type water-flow detector; with 250-psig (1725-kPa) pressure rating; and designed for horizontal or vertical installation. Include two single-pole, double-throw, circuit switches for isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal if removed.
- C. Pressure Switches: UL 753; electrical-supervision-type, water-flow switch with retard feature. Include single-pole, double-throw, normally closed contacts and design that operates on rising pressure and signals water flow.
- D. Valve Supervisory Switches: UL 753; electrical; single-pole, double throw; with normally closed contacts. Include design that signals controlled valve is in other than fully open position.
- E. Indicator-Post Supervisory Switches: UL 753; electrical; single-pole, double throw; with normally closed contacts. Include design that signals controlled indicator-post valve is in other than fully open position.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Refer to Division 13 Section 13050 "Fire Protection General Requirements".

3.2 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. Install piping according to the following requirements and Division 13 Sections specifying piping systems. See Section 13053 "Fire Protection General Materials".
- B. No pipes, valves or other apparatus shall be installed so as to interfere in any way with the full swing of the doors.
- C. Where so shown, or required, piping shall be installed concealed in building construction.
- D. All screwed pipe throughout the job shall be reamed smooth before being installed. Pipe shall not be split, bent, flattened nor otherwise injured either before or during the installation.
- E. Where piping is required to be hung from other than stone concrete slabs, such as pre-cast or metal decking, submit proposed method of support to the structural engineer for approval prior to installation. See Division 13 Section 13060 "Fire Protection Hangers and Supports" for additional requirements.
- F. Piping may be hung from structural steel by means of beam attachments. All auxiliary steel required for support shall be provided by this trade. See Division 13 Section 13060 "Fire Protection Hangers and Supports" for additional requirements.

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- G. Do not hang piping from ductwork, except a 1" drop branch to a maximum of two heads.
- H. The Contractor may coordinate with other contractors to use common means of support. Submit for approval all pertinent design data relating to the support as well as verification of the responsibility for the support. See Division 13 Section 13060 "Fire Protection Hangers and Supports" for additional requirements.
- I. Install fittings for changes in direction and branch connections.
- J. Install piping to allow application of insulation as required.
- K. Select system components with pressure rating equal to or greater than system operating pressure.

3.3 PIPING APPLICATIONS

- A. Do not use welded joints with galvanized steel pipe.
- B. Flanges, unions, and transition and special fittings with pressure ratings the same as or higher than system's pressure rating may be used in aboveground applications, unless otherwise indicated.
- C. Piping between Fire Department Connections and Check Valves: Use galvanized, standard-weight steel pipe with threaded ends; cast- or malleable-iron threaded fittings; and threaded joints.
- D. Piping between Fire Department Connections and Check Valves: Use galvanized, standard-weight steel pipe with grooved ends; steel, grooved-end fittings; steel, keyed couplings; and grooved joints.
- E. Underground Service-Entrance Piping: Use ductile-iron, push-on-joint pipe and fittings and restrained joints.
- F. Underground Service-Entrance Piping: Use ductile-iron, mechanical-joint pipe and fittings and restrained joints.
- G. Underground Service-Entrance Piping: Use ductile-iron, grooved-end pipe and fittings; ductile-iron, keyed couplings; and grooved joints.
- H. Standpipes: See Division 13 Section 13975 "Fire Protection Standpipes and Hoses".
- I. Sprinkler Piping shall be per Section 13916 "Fire Suppression Sprinklers".

3.4 VALVE APPLICATIONS

- A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Fire-Protection-Service Valves: UL listed and FM approved for applications where required by NFPA 13 and NFPA 14.
 - a. Shutoff Duty: Use gate valves.
2. General-Duty Valves: For applications where UL-listed and FM-approved valves are not required by NFPA 13 and NFPA 14.
 - a. Shutoff Duty: Use gate, ball, or butterfly valves.
 - b. Throttling Duty: Use globe, ball, or butterfly valves.

3.5 PIPING JOINT CONSTRUCTION

- A. Refer to Division 15 Section 13053 "Fire Protection General Materials and Methods" for basic piping joint construction.
- B. Join pipe and fittings according to the following requirements and Division 21 Sections specifying piping systems.
- C. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- D. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- E. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
- F. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.
- G. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.21.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- H. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
- I. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

- J. Ductile-Iron-Piping, Grooved Joints: Use ductile-iron pipe with radius-cut-grooved ends; ductile-iron, grooved-end fittings; and ductile-iron, keyed couplings. Assemble joints with couplings, gaskets, lubricant, and bolts according to coupling manufacturer's written instructions.
- K. Steel-Piping, Grooved Joints: Use Schedule 40 steel pipe with cut or roll-grooved ends and Schedule 30 or thinner steel pipe with roll-grooved ends; steel, grooved-end fittings; and steel, keyed couplings. Assemble joints with couplings, gaskets, lubricant, and bolts according to coupling manufacturer's written instructions. Use gaskets listed for dry-pipe service for dry piping.
- L. Copper-Tubing, Grooved Joints: Use copper tube with roll-grooved ends; copper, grooved-end fittings; and copper, keyed couplings. Assemble joints with couplings, gaskets, lubricant, and bolts according to coupling manufacturer's written instructions. Use gaskets listed for dry-pipe service for dry piping.
- M. Brazed Joints: Use AWS A5.8, BCuP-3 or BCuP-4 filler metals.
- N. Press-Seal-Fitting Joints: Use UL-listed tool and procedure and follow fitting manufacturer's written instructions. Include use of specific equipment, pressure-sealing tool, and accessories.
- O. Locking-Lug-Fitting, Twist-Locked Joints: Follow fitting manufacturer's written instructions.
- P. Dissimilar-Piping-Material Joints: Construct joints using adapters or couplings compatible with both piping materials. Use dielectric fittings if both piping materials are metal. Refer to Division 13 Section 13053 "Fire Protection General Materials and Methods" for dielectric fittings.

3.6 SERVICE-ENTRANCE PIPING

- A. Connect fire suppression piping (standpipe and sprinkler) to water-service piping of size and in location indicated for service entrance to building. Refer to Division 2 Section "Water Distribution" for exterior piping.
- B. Install shutoff valve, backflow preventer, pressure gage, drain, and other accessories indicated at connection to water-service piping. Refer to Division 13 Section 13122 "Fire Protection Meters and Gages" for backflow preventers.
- C. Install shutoff valve, check valve, pressure gage, drain, and other accessories at connection to water service.

3.7 WATER-SUPPLY CONNECTION

- A. Connect fire suppression piping (standpipe and sprinkler) to building interior water distribution piping. Refer to Division 15 Section "Water Distribution Piping" for interior piping.

- B. Install shutoff valve, backflow preventer, pressure gage, drain, and other accessories indicated at connection to water distribution piping. Refer to Division 15 Section "Plumbing Specialties" AND Section 13916 Fire Suppression Sprinklers and Section 13975 Standpipe and Hoses for backflow preventers.
- C. Install shutoff valve, check valve, pressure gage, drain, and other accessories at connection to water service.

3.8 PIPING INSTALLATION

- A. Refer to Division 13 Section 13053 "Fire Protection General Materials and Methods" for basic piping installation.
- B. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated, as far as practical.
 - 1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.
- C. Install underground service-entrance piping according to Local Code and NFPA 24 and with restrained joints.
- D. Use approved fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.
- E. Make connections according to the following, unless otherwise indicated:
 - 1. Install unions, in piping NPS 2 (DN 50) and smaller, adjacent to each valve and at final connection to each piece of equipment.
 - 2. Install flanges, in piping NPS 2-1/2 (DN 65) and larger, adjacent to flanged valves and at final connection to each piece of equipment.
 - 3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
 - 4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.
- F. Install piping with drains for complete system drainage.
- G. Install ball drip valves to drain piping between fire department connections and check valves. Drain to floor drain or outside building.
- H. Install alarm devices in piping systems. As required by Local Codes, NFPA 13, 14, 20 and as called for in other sections of Division 13.
- I. Hangers and Supports: See Section 13060 "Fire Protection Hangers and Supports".
- J. Install piping with grooved joints according to manufacturer's written instructions. Construct rigid piping joints, unless otherwise indicated.

- K. Install pressure gages on riser or feed main, at each sprinkler test connection, and at top of each standpipe as called for in other sections of Division 13. Include pressure gages with connection not less than **NPS 1/4 (DN8)** and with soft metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they will not be subject to freezing.

3.9 VALVE INSTALLATION

- A. Refer to Division 13 Section 13053 "Fire Protection General Materials and Methods" for installing general-duty valves. Install fire-protection specialty valves, trim, fittings, controls, and specialties according to Local Code Requirements, NFPA 13 and NFPA 14, manufacturer's written instructions, and authorities having jurisdiction.
- B. Gate Valves: Install fire-protection-service valves supervised-open, located to control sources of water supply except from fire department connections. Provide permanent identification signs indicating portion of system controlled by each valve.
- C. Valves for Wall Fire Hydrants: Install gate valve with nonrising stem in supply pipe.
- D. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water supply sources.
- E. Pre-Action and Dry-Pipe Valves: Install deluge valve and trim sets for air supply, drain, priming level, alarm connections, ball drip valves, pressure gages, priming chamber attachment, and fill-line attachment. See other sections of Division 13 for additional information.

3.10 LABELING AND IDENTIFICATION

- A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13 and NFPA 14 and in Division 13 Section 13075 "Fire Protection Identification".

3.11 FIELD QUALITY CONTROL

- A. Flush, test, and inspect all piping according to Division 13 Section 13050 "Fire Protection General Requirements".
- B. Replace piping system components that do not pass test procedures and retest to demonstrate compliance. Repeat procedure until satisfactory results are obtained.
- C. Report test results promptly and in writing to Architect and authorities having jurisdiction.

3.12 PROTECTION AND CLEANING

- A. Clean dirt and debris from piping.
- B. See Section 13050 "Fire Protection General Requirements".

3.13 COMMISSIONING

- A. Verify that specialty valves, trim, fittings, controls, and accessories are installed and operate correctly.
- B. Verify that specified tests of piping are complete.
- C. Verify that potable-water supplies have correct types of backflow preventers.
- D. Drain dry system piping.
- E. Verify that hose connections and fire department connections have threads compatible with local fire department equipment.
- F. Fill wet-pipe systems with water. Contractor shall restrict the fill rate to avoid water hammer within the fire suppression systems.

END OF SECTION 13915

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**SECTION 13916 - FIRE SUPPRESSION
SPRINKLERS**

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes fire-suppression sprinklers, piping, and equipment for the following building systems:
 - 1. Wet and dry, fire-suppression sprinklers, including piping, valves, specialties, automatic sprinklers, air compressor, and accessories.
- B. Work Included:
 - 1. The system shall include all fire department connections, roof manifolds, hose stations, fire department outlets, fire, jockey pumps & controllers valves, wet sprinklers, dry sprinklers, etc. sprinkler heads, piping drain risers, cabinets, alarms as required for a complete system. Building or area will be fully sprinkled (exception only as per local code).
 - 2. All areas will be supplied from a combination standpipe or sprinkler riser system.
 - 3. Areas exposed to freezing will have a dry type sprinkler system.
 - 4. Before any work is commenced, shop drawings shall be carefully prepared and submitted for approval. It is required that the sprinkler systems be sized hydraulically in accordance with NFPA standards. Submit hydraulic calculation of each system with shop drawings showing balanced system delivery, and balanced supply and demand for the appropriate hazard class as defined in NFPA 13, latest edition accepted by local authority having jurisdiction. Such drawings and calculations must be reviewed and approved by all governing authorities, Fire Department, Owners Insurance Underwriters, Factory Mutual and/or Industrial Risk Insurers before any work is commenced at the jobsite.

1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Related Sections include the following:
 - 1. Division 13 Section 13053 "Fire Protection General Materials and Methods."
 - 2. Division 13 Section 13060 "Fire Protection Hangers and Supports."
 - 3. Division 13 Section 13071 "Fire Protection Vibration and Seismic Control."
 - 4. Division 13 Section 13075 "Fire Protection Identification."
 - 5. Division 13 Section 13083 "Fire Protection Piping Insulation."
 - 6. Division 13 Section 13921 "Fire Protection Electric-Drive, Horizontal Fire Pumps."
 - 7. Division 13 Section 13926 "Fire Protection Vertical-Turbine Fire Pumps."

8. Division 16 Section "Fire Alarm Protective Systems" for alarm devices not in this Section

1.3 DEFINITIONS

- A. CPVC: Chlorinated polyvinyl chloride plastic.
- B. Working Plans: Documents, including drawings, calculations, and material specifications prepared according to NFPA 13 for obtaining approval from authorities having jurisdiction.
- C. Automatic: As applied to fire protection devices, is a device or system providing an emergency function without the necessity for human intervention and activated as a result of a predetermined temperature rise, rate of temperature rise, or combustion products.
- D. Automatic Sprinkler System: A sprinkler system, for fire protection purposes, is an integrated system of underground and overhead piping designed in accordance with fire protection engineering standards. The system includes a suitable water supply. The portion of the system above the ground is a network of specially sized or hydraulically designed piping installed in a structure or area, generally overhead, and to which automatic sprinklers are connected in a systematic pattern. The system is usually activated by heat from a fire and discharges water over the fire area.
- E. Deluge System: A sprinkler system employing open sprinklers attached to a piping system connected to a water supply through a valve that is opened by the operation of a detection system installed in the same areas as the sprinklers. When this valve opens, water flows into the piping system and discharges from all sprinklers attached thereto.
- F. Detector, Heat: A fire detector that senses heat produced by burning substances. Heat is the energy produced by combustion that causes substances to rise in temperature.
- G. Fire Protection System: Approved devices, equipment and systems or combinations of systems used to detect a fire, activate an alarm, extinguish or control a fire, control or manage smoke and products of a fire or any combination thereof.
- H. Initiating Device: A system component that originates transmission of a change-of-state condition, such as in a smoke detector, manual fire alarm box, or supervisory switch.
- I. Listed: Equipment, materials or services included in a list published by an organization acceptable to the code enforcement official and concerned with evaluation of products or services that maintains periodic inspection of production of listed equipment or materials or periodic evaluation of services and whose listing states either that the equipment, material or service meets identified standards or has been tested and found suitable for a specified purpose
- J. Record Drawings: Drawings ("as built") that document the location of all devices, appliances, wiring, sequences, wiring methods, and connections of the components of a fire alarm system as installed.

- K. Smoke-proof Enclosure: An exit stairway designed and constructed so that the movement of the products of combustion produced by a fire occur ring in any part of the building into the enclosure is limited.

1.4 SYSTEM PERFORMANCE REQUIREMENTS

- A. Design sprinkler piping according to Local Code and to the following and obtain approval from authorities having jurisdiction:
1. Include 10 percent margin of safety for available water flow and pressure.
 2. Include losses through water-service piping, valves, and backflow preventers.
 3. Sprinkler Occupancy Hazard Classifications: Shall be per Local Code, NFPA, and Requirements of the Authority having Jurisdiction. In the absence of more restrictive requirements, the following classifications shall apply:
 - a. Building Service Areas: Ordinary Hazard, Group 1.
 - b. Electrical Equipment Rooms: Ordinary Hazard, Group 1.
 - c. General Storage Areas (Not over 12 ft.): Ordinary Hazard, Group 1.
 - d. General Storage Areas (Over 12 ft.): Ordinary Hazard, Group 2 or per NFPA 13.
 - e. Mechanical Equipment Rooms: Ordinary Hazard, Group 2.
 - f. Office and Public Areas: Light Hazard.
 - g. Passenger areas: Ordinary Hazard, Group 1.
 - h. Baggage Handling: Ordinary Hazard, Group 2.
 4. Minimum Density for Automatic Wet-Pipe Sprinkler Design: Shall be as follows:
 - a. Light-Hazard Occupancy: 0.10 gpm over 1500-sq. ft. (6.3 mL/s over 139-sq. m) area.
 - b. Ordinary-Hazard, Group 1 Occupancy: 0.15 gpm over 1500- sq. ft. (9.5 mL/s over 139-sq. m) area.
 - c. Ordinary-Hazard, Group 2 Occupancy: 0.20 gpm over 1500- sq. ft. (12.6 mL/s over 139-sq. m) area.
 5. Minimum density for dry pipe sprinkler systems shall be per wet-pipe sprinkler density with 30% larger area of application.
 6. Minimum Density for Deluge-Sprinkler Piping Design: As follows:
 - a. Ordinary-Hazard, Group 2 Occupancy: 0.20 gpm (12.6 mL/s) over entire area.
 7. Maximum Protection Area per Sprinkler: Shall be in accordance with the sprinkler heads listing or as follows:
 - a. Office Space: 225 sq. ft. (20.9 sq. m).
 - b. Storage Areas: 130 sq. ft. (12.1 sq. m) or as required by Local Code and NFPA.
 - c. Mechanical Equipment Rooms: 130 sq. ft. (12.1 sq. m).

FIRE SUPPRESSION SPRINKLERS

Bid Package 2A - Issue for Bid

- d. Electrical Equipment Rooms: 130 sq. ft. (12.1 sq. m).
- B. Components and Installation: Capable of producing piping systems with 175-psig (1200-kPa) minimum working-pressure rating, unless otherwise indicated.
- C. The sprinkler heads in all areas are to be installed in the center of the tile or centered with lights, diffusers or similar elements as indicated on the architectural reflected ceiling drawings. Sprinkler heads must also be installed on a true axis line in both directions with a maximum deviation from the axis line of ½" plus or minus. At the completion of the installation, if any heads are found to exceed the above mentioned tolerance, same shall be removed and reinstalled by this Contractor at no additional cost to the Owner.
- D. Provide all sprinkler heads and work in strict conformance with approved shop drawings. The Architect and/or Design Engineer reserves the right to reject any and all work not in accordance with the approved shop drawing.
- E. Whether or not the system shown on the Contract Drawings meets the requirements of the National Fire Protection Association, these specifications require the furnishing and installation of sprinkler systems complete in all details and in accordance with the standards of the National Fire Protection Association.
- F. Perform the following in areas where painting occurs or when sprinkler piping is painted. As soon as sprinkler heads are in place and the Contractor shall cover each head with a small bag of an Underwriter's approved type, which shall be removed only after all painting is complete. After the bag is removed, all heads shall be cleaned and polished.
- G. Hydraulic Calculations: Submit hydraulic calculations as part of the shop drawings. Prepare hydraulic calculations in accordance with NFPA 13 and the design criteria indicated on the drawings with the following exceptions:
1. Minimum operating pressure of any sprinkler head shall be according to NFPA 13 and UL listed or/FM approved.
 2. Pipe friction losses may be calculated by using the nearest foot for all piping over one foot in length. Horizontal lengths less than one foot may be neglected. Vertical length less than one foot shall be included for elevation purposes only.
 3. Flows shall be calculated to the nearest whole gallon.
 4. Velocity pressures may be neglected.
 5. Velocities in all piping shall not exceed 30 feet per second. Velocities in standpipes must be calculated based on the sprinkler flow and hose flow.
 6. The sprinkler/standpipe risers shall accommodate the sprinkler and standpipe hose stream flows. Each riser shall accommodate 250 gallons per minute flow for standpipe hose stream.
 7. Provide a minimum 20 psi differential (when applicable) between the available water supply and total system demand of the calculated sprinkler flow plus hose demand at residential pressure required for system.
 8. Refer to sprinkler design criteria on drawings for additional information.

1.5 SUBMITTALS

- A. Product Data: In addition to the requirements of Section 13050 "Fire Protection General Requirements" provide the following:

1. Pipe and fitting materials and methods of joining for sprinkler piping.
 2. Pipe hangers, supports and restraints.
 3. Valves, including specialty valves, accessories, and devices.
 4. Alarm devices. Include electrical data.
 5. Air compressors. Include electrical data.
 6. Fire department connections. Include type; number, size, and arrangement of inlets; caps and chains; size and direction of outlet; escutcheon and marking; and finish.
 7. Sprinklers, escutcheons, and guards. Include sprinkler flow characteristics, mounting, finish, and other pertinent data.
- B. Fire-Hydrant Flow Test Report: See Section 13050 "Fire Protection General Requirements" for additional information.
- C. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction. Include hydraulic calculations, for all applicable systems.
- D. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include "Contractor's Material and Test Certificate for Aboveground Piping" and "Contractor's Material and Test Certificate for Underground Piping."
- E. Product Requirement Data: For each type of sprinkler specialty to include in maintenance manuals specified in Division 1 Section 01600 and Division 13 Section 13050.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has designed and installed fire-suppression piping similar to that indicated for this Project and obtained design approval and inspection approval from authorities having jurisdiction.
- B. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified professional engineer. Base calculations on results of fire-hydrant flow test.
- C. 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 fire-suppression piping that are similar to those indicated for this Project in material, design, and extent.
- D. Manufacturer Qualifications: Firms whose equipment, specialties, and accessories are listed by product name and manufacturer in UL's "Fire Protection Equipment Directory" and FM's "Fire Protection Approval Guide" and that comply with other requirements indicated.

- E. Sprinkler Components: Listing/approval stamp, label, or other marking by a testing agency acceptable to authorities having jurisdiction. All components shall be domestically produced by reputable manufacturer with all certificates in place. Components of questionable quality or origin shall not be used.
- F. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.
- G. NFPA Standards: In addition to Local Code Requirements, all Equipment, specialties, accessories, installation, and testing complying with the following:
 - 1. NFPA 13, "Installation of Sprinkler Systems."
 - 2. NFPA 10 Extinguishers
 - 3. NFPA 14 Stand Pipes
 - 4. NFPA 20 Fire Pumps
 - 5. NFPA 415 "Air Port Terminals"

1.7 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Sprinkler Cabinets: Finished, wall-mounting steel cabinet and hinged cover, with space for a minimum of six spare sprinklers plus sprinkler wrench. Include the number of sprinklers required by NFPA 13 and wrench for sprinklers. Include separate cabinet with sprinklers and wrench for each type of sprinkler on Project. Unless otherwise noted the cabinet shall be located in the fire pump or incoming fire service valve room.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- 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:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Specialty Valves and Devices:
 - a. Globe Fire Sprinkler Corp.
 - b. Grinnell Corp.
 - c. Reliable Automatic Sprinkler Co., Inc.
 - d. Tyco Sprinkler Corp.
 - e. Viking Corp.

2. Water-Flow Indicators and Supervisory Switches:

- a. Gamewell Co.
- b. Grinnell Corp.
- c. Pittway Corp.; System Sensor Div.
- d. Potter Electric Signal Co.
- e. Reliable Automatic Sprinkler Co., Inc.
- f. System Sensor Div. Pittaway Corp.
- g. Viking Corp.
- h. Watts Industries, Inc.; Water Products Div.

3. Sprinkler, Drain and Alarm Test Fittings:

- a. Central Sprinkler Corp.
- b. Fire-End and Croker Corp.
- c. Grinnell Corp.
- d. Victaulic Co. of America.

4. Sprinkler, Branch-Line Test Fittings:

- a. AFG Manufacturing, Inc.
- b. Elkhart Brass Mfg. Co., Inc.
- c. Fire-End and Croker Corp.
- d. Potter Roemer.

5. Sprinkler, Inspector's Test Fittings:

- a. Croker Corp.
- b. Victaulic Co. of America.

6. Sprinklers:

- a. Globe Fire Sprinkler Corp.
- b. Reliable Automatic Sprinkler Co., Inc.
- c. Viking Corp.
- d. Victaulic
- e. Tyco, Inc.

2.2 PIPING MATERIALS

- A. Refer to Division 13 Section 13915 for applications of pipe, tube, fitting, and joining materials.
- B. Piping, sprinkler heads and hangers within an MRI room shall be non-ferrous material.

2.3 PIPES AND TUBES

- A. Refer to Division 13 Section 13915 "Fire Protection Suppression Piping".

2.4 PIPE AND TUBE FITTINGS

- A. Refer to Division 13 Section 13915 "Fire Protection Suppression Piping".

2.5 JOINING MATERIALS

- A. Refer to Division 13 Section 13915 "Fire Protection Suppression Piping".

2.6 GENERAL-DUTY VALVES

- A. Refer to Division 13 Section 13053 "Fire Protection General Materials and Methods" for gate, ball, butterfly, globe, and check valves not required to be UL listed and FM approved.

2.7 FIRE-PROTECTION-SERVICE VALVES

- A. General: UL listed and FM approved, with minimum 175-psig (1200-kPa) nonshock working-pressure rating. Valves for grooved-end piping may be furnished with grooved ends instead of type of ends specified.
- B. Refer to Division 13 Section 13915 "Fire Protection Suppression Piping".
- C. Provide Supervisory Tamper switches on all control valves.
- D. See schedule on drawings for models and types of valves. All valves shall be listed for Fire Protection service.
- E. Control valves of O.S. & Y. pattern gate valves with equalizing bypass for valves 6" and larger in size.
- F. Provide on all control and sectional valves, 120 volt closed circuit supervisory tamper switches, shop mounted in accordance with Underwriters IRI, and F.M. standards. Wiring to alarm panel is under other sections of the work.
- G. Pressure Reducing Valves for Fire Hose Valves
 - 1. Provide adjustable pressure reducing valve on each hose valve where required by Code and local fire department. Refer to riser diagram for locations.
 - 2. Where hydrostatic pressure exceeds 100 psi, adjust to 100 psi discharge pressure.

2.8 DRY PIPE VALVES:

- A. Provide Reliable Automatic Sprinkler Co., Model D, Central, Viking or other approved. Dry pipe valves and standard trimmings, including priming chamber, Reliable Model B Accelerator, priming water level test facilities, alarm testing by-pass, alarm switch to actuate electric alarm gongs and provide alarm signal at alarm panel and necessary test and drain piping and fitting to make a complete installation.

2.9 DRY PIPE AIR COMPRESSORS:

- A. Provide sprinkler type air compressors of sufficient capacity to meet the demands of the dry pipe sprinkler system. Air compressors shall be specifically listed for Fire Protection services. Coordinate with electrical trade for available electrical service.
- B. Provide manual starter and automatic start-stop pressure switch control in accordance with N.F.P.A. standards.
- C. Compressor shall include suction muffler filter, MVD with cooling fan, flywheel and centrifugal unloader, inter-cylinder manifold with single inlet connection, NEMA open drip-proof motor, motor slide rails all assembled on steel base and mounted on housekeeping pad. Provide automatic air maintenance device with required trim.
- D. Provide in compressed air piping a low pressure alarm switch wired to alarm panel by Electrical Trade.
- E. Provide compressed air piping system with type "L" copper tubing, valves and all required accessories.

2.10 WATER-FLOW INDICATOR:

- A. Provide where indicated, Potter Electric Switch Company, or other approved Type VSR-D Detector with flexible vane and retarding device to prevent false alarms from line surges.
- B. Wiring to Central Control & Surveillance System will be provided by the Electrical Trade.

2.11 SPRINKLER CONTROL RIG:

- A. See detail on drawings.
- B. Sprinkler control rigs shall contain all controls, test alarms, and drain apparatus at sprinkler tap points, at the combination riser.

2.12 SPRINKLER DRAINS AND TEST CONNECTION:

- A. Provide all necessary drain valves, drain risers, capped nipples, auxiliary piping, etc., as required to drain the system risers and mains and all trapped portions of the system. Drain valves which are not connected to drain pipes leading to floor drains shall be hose end type.
- B. Main drains and test connections shall be piped to waste, or as shown on drawings.
- C. Provide all piping required to spill the drains and test connections to the floor, funnel or other drainage connections provided under the Plumbing Contract, or arrange with the Plumbing Trade to provide additional drainage facilities, in which case pay all charges related to the additional Plumbing Construction work.

- D. Provide Inspectors Test connections at end of systems in accordance with Section 3082 of N.F.P.A. Pamphlet No. 13, and as required by Local Fire Department or authorities having jurisdiction. Pipe to waste and include sight connection as necessary.

2.13 SPRINKLER HEADS:

- A. Provide approved automatic spray sprinkler heads of Reliable Automatic Sprinkler Co., or other approved manufacturer.
- B. Head locations, type and finish as scheduled on the drawings.
- C. Dry pendant type heads shall be listed and provided with 1" vertical pipe to horizontal branch, in all area's subject to freezing with hung ceilings or soffits on dry pipe systems.
- D. All heads shall be of the proper temperature rating for the locations in which they are installed.
- E. Provide sprinkler guards where sprinkler heads are located 7'-0" AFF or where heads are subject to damage.
- F. Provide stock of extra sprinkler heads, sprinkler wrenches in accordance with Article 3660 of N.F.P.A. Pamphlet No. 13. Cabinets shall be Reliable or other approved.

2.14 ALARM GONGS:

- A. Provide ACME or other approved, WSVB electric, weatherproof, underdome vibration alarm gongs.

2.15 LADDERS:

- A. Steel ladders to all valves located 7 ft. or as required by local authorities above finished floor will be provided by others.
- B. This Trade shall furnish a location list of all required ladders to the installing trade.

2.16 SPRINKLERS

- A. Sprinkler Types and Categories: Nominal **1/2-inch (12.7-mm)** orifice for "Ordinary" temperature classification rating, unless otherwise indicated or required by application.
- B. Sprinkler types, features, and options include the following:
 1. Concealed ceiling sprinklers, including cover plate.
 2. Flush ceiling sprinklers, including escutcheon.
 3. Institution sprinklers, made with small, breakaway projection.
 4. Pendent sprinklers.
 5. Pendent, dry-type sprinklers.

- 6. Quick-response sprinklers.
- 7. Recessed sprinklers, including escutcheon.
- 8. Upright sprinklers.

- C. Sprinkler Finishes: Chrome-plated, bronze, or factory painted as directed by the Architect.
- D. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications, unless alternate finish is specified by architect. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.
 - 1. Ceiling Mounting: Chrome-plated steel, one piece, flat.
 - 2. Ceiling Mounting: Chrome-plated steel, two piece, with 1-inch (25-mm) vertical adjustment.
 - 3. Ceiling Mounting: Plastic, white finish, one piece, flat.
- E. Sprinkler Guards: Wire-cage type, including fastening device for attaching to sprinkler.

2.17 SPECIALTY SPRINKLER FITTINGS

- A. Specialty Fittings: UL listed and FM approved; made of steel, ductile iron, or other materials compatible with piping.
- B. Dry-Pipe-System Fittings: Corrosion Resistant, UL listed for dry-pipe service.
- C. Locking-Lug Fittings: UL 213, ductile-iron body with locking-lug ends.
- D. Mechanical-T Fittings: UL 213, ductile-iron housing with pressure-responsive gasket, bolts, and threaded or locking-lug outlet.
- E. Mechanical-Cross Fittings: UL 213, ductile-iron housing with pressure-responsive gaskets, bolts, and threaded or locking-lug outlets.
- F. Drop-Nipple Fittings: UL 1474, with threaded inlet, threaded outlet, and seals; adjustable.
- G. Sprinkler, Drain and Alarm Test Fittings: UL-listed, cast- or ductile-iron body; with threaded inlet and outlet, test valve, and orifice and sight glass.
- H. Sprinkler, Branch-Line Test Fittings: UL-listed, brass body; with threaded inlet and capped drain outlet and threaded outlet for sprinkler.
- I. Sprinkler, Inspector's Test Fittings: UL-listed, cast- or ductile-iron housing; with threaded inlet and drain outlet and sight glass.

2.18 FIRE DEPARTMENT CONNECTIONS

- A. Refer to Division 13 Section 13915 "Fire Protection Suppression Piping".

2.19 ALARM DEVICES

- A. General: Provide types matching piping and equipment connections.
- B. Refer to Division 13 Section 13915 "Fire Protection Suppression Piping".
- C. Water-Flow Indicators: UL 346; electrical-supervision, vane-type water-flow detector; with 250-psig (1725-kPa) pressure rating; and designed for horizontal or vertical installation. Include two single-pole, double-throw, circuit switches for isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal if removed.
- D. Pressure Switches: UL 753; electrical-supervision-type, water-flow switch with retard feature. Include single-pole, double-throw, normally closed contacts and design that operates on rising pressure and signals water flow.
- E. Valve Supervisory Switches: UL 753; electrical; single-pole, double throw; with normally closed contacts. Include design that signals controlled valve is in other than fully open position.
- F. Indicator-Post Supervisory Switches: UL 753; electrical; single-pole, double throw, with normally closed contacts. Include design that signals controlled indicator-post valve is in other than fully open position.

2.20 PRESSURE GAGES

- A. Pressure Gages: UL 393, 3-1/2- to 4-1/2-inch- (90- to 115-mm-) diameter dial with dial range of 0 to 250 psig (0 to 1725 kPa), or to two times (2x) the working pressure.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Perform fire-hydrant flow test according to NFPA 13, 415 and NFPA 291. Use results for system design calculations required in "Quality Assurance" Article in Part 1 of this Section.
- B. Report test results promptly and in writing.

3.2 EARTHWORK

- A. Refer to Division 2 Section 02300 "Earthwork" for excavating, trenching, and backfilling.

3.3 PIPING APPLICATIONS

- A. Do not use welded joints with galvanized steel pipe.

- B. Flanges, unions, and transition and special fittings with pressure ratings the same as or higher than system's pressure rating may be used in aboveground applications, unless otherwise indicated.
- C. Piping between Fire Department Connections and Check Valves:
 - 1. Use galvanized, standard-weight steel pipe with threaded ends; cast- or malleable-iron threaded fittings; and threaded joints.
 - 2. Use galvanized, standard-weight steel pipe with grooved ends; steel, grooved-end fittings; steel, keyed couplings; and grooved joints.
- D. Underground Service-Entrance Piping:
 - 1. Use ductile-iron, push-on-joint pipe and fittings and restrained joints.
 - 2. Use ductile-iron, mechanical-joint pipe and fittings and restrained joints.
- E. Sprinkler Feed Mains and Risers: Use the following:
 - 1. **NPS 4 (DN100)** and Smaller:
 - a. Standard-weight steel pipe with threaded ends, cast- or malleable-iron threaded fittings, and threaded joints.
 - b. Standard-weight steel pipe with grooved ends; steel, grooved-end fittings; steel, keyed couplings; and grooved joints.
 - c. Standard-weight steel pipe with plain ends, steel welding fittings, and welded joints.
 - d. Galvanized, standard-weight steel pipe with threaded ends; cast- or malleable-iron threaded fittings; and threaded joints.
 - e. Galvanized, standard-weight steel pipe with grooved ends; steel, grooved-end fittings; steel, keyed couplings; and grooved joints.
 - f. Schedule 30 steel pipe with threaded ends, cast- or malleable-iron threaded fittings, and threaded joints.
 - g. Schedule 30 steel pipe with roll-grooved ends; steel, grooved-end fittings; steel, keyed couplings; and grooved joints.
 - h. Schedule 30 steel pipe with plain ends, steel welding fittings, and welded joints.
 - i. Schedule 10 steel pipe with roll-grooved ends; steel, grooved-end fittings; and grooved joints.
 - j. Schedule 10 steel pipe with plain ends, steel welding fittings, and welded joints.
 - 2. **NPS 5 and NPS 6 (DN125 and DN150):**
 - a. Standard-weight steel pipe with threaded ends, cast- or malleable-iron threaded fittings, and threaded joints.
 - b. Standard-weight steel pipe with grooved ends; steel, grooved-end fittings; steel, keyed couplings; and grooved joints.
 - c. Standard-weight steel pipe with plain ends, steel welding fittings, and welded joints.
 - d. Galvanized, standard-weight steel pipe with threaded ends; cast- or malleable-iron threaded fittings; and threaded joints.
 - e. Galvanized, standard-weight steel pipe with grooved ends; steel, grooved-end fittings; steel, keyed couplings; and grooved joints.
 - f. Schedule 10 steel pipe with roll-grooved ends; steel, grooved-end fittings; and grooved joints.

- g. Schedule 10 steel pipe with plain ends, steel welding fittings, and welded joints.

F. Sprinkler Branch Piping Wet-Pipe Systems: Use the following: (EDIT)

1. Sprinkler-Piping Option: For **NPS 2 (DN50)** and smaller, mechanical-T bolted-branch-outlet fittings, may be used downstream from sprinkler zone valves.
2. Sprinkler-Piping Option: For **NPS 2 (DN50)** and smaller, specialty sprinkler fittings, including mechanical-T fittings, may be used downstream from sprinkler zone valves.
3. **NPS 1-1/2 (DN40)** and Smaller:
 - a. Standard-weight steel pipe with threaded ends, cast- or malleable-iron threaded fittings, and threaded joints.
 - b. Standard-weight steel pipe with plain ends, locking-lug fittings, and twist-locked joints.
 - c. Standard-weight steel pipe with plain ends, steel welding fittings, and welded joints.
 - d. Galvanized, standard-weight steel pipe with threaded ends; cast- or malleable-iron threaded fittings; and threaded joints.
 - e. Galvanized, standard-weight steel pipe with plain ends; locking-lug fittings; and twist-locked joints.
 - f. Schedule 30 steel pipe with threaded ends, cast- or malleable-iron threaded fittings, and threaded joints.
 - g. Schedule 30 steel pipe with plain ends, locking-lug fittings, and twist-locked joints.
 - h. Schedule 30 steel pipe with plain ends, steel welding fittings, and welded joints.
 - i. Schedule 10 steel pipe with plain ends, steel welding fittings, and welded joints.
 - j. **NPS 1-1/2 (DN40)** and Smaller: Schedule 5 steel pipe with plain ends; steel, press-seal fittings; and press-sealed joints.
4. **NPS 2 (DN50)**:
 - a. Standard-weight steel pipe with threaded ends, cast- or malleable-iron threaded fittings, and threaded joints.
 - b. Standard-weight steel pipe with plain ends, locking-lug fittings, and twist-locked joints.
 - c. Standard-weight steel pipe with grooved ends; steel, grooved-end fittings; steel, keyed couplings; and grooved joints.
 - d. Standard-weight steel pipe with plain ends, steel welding fittings, and welded joints.
 - e. Galvanized, standard-weight steel pipe with threaded ends; cast- or malleable-iron threaded fittings; and threaded joints.
 - f. Galvanized, standard-weight steel pipe with plain ends; locking-lug fittings; and twist-locked joints.
 - g. Galvanized, standard-weight steel pipe with grooved ends; steel, grooved-end fittings; steel, keyed couplings; and grooved joints.
 - h. Schedule 30 steel pipe with threaded ends, cast- or malleable-iron threaded fittings, and threaded joints.

- i. Schedule 30 steel pipe with plain ends, locking-lug fittings, and twist-locked joints.
- j. Schedule 30 steel pipe with grooved ends; steel, grooved-end fittings; steel, keyed couplings; and grooved joints.
- k. Schedule 30 steel pipe with plain ends, steel welding fittings, and welded joints.
- l. Schedule 10 steel pipe with roll-grooved ends; steel, grooved-end fittings; steel, keyed couplings; and grooved joints.
- m. Schedule 10 steel pipe with plain ends, steel welding fittings, and welded joints.

5. **NPS 2-1/2 to NPS 3-1/2 (DN65 to DN90):**

- a. Standard-weight steel pipe with threaded ends, cast- or malleable-iron threaded fittings, and threaded joints.
- b. Standard-weight steel pipe with grooved ends; steel, grooved-end fittings; steel, keyed couplings; and grooved joints.
- c. Standard-weight steel pipe with plain ends, steel welding fittings, and welded joints.
- d. Galvanized, standard-weight steel pipe with threaded ends; cast- or malleable-iron threaded fittings; and threaded joints.
- e. Galvanized, standard-weight steel pipe with grooved ends; steel, grooved-end fittings; steel, keyed couplings; and grooved joints.
- f. Schedule 30 steel pipe with threaded ends, cast- or malleable-iron threaded fittings, and threaded joints.
- g. Schedule 30 steel pipe with roll-grooved ends; steel, grooved-end fittings; steel, keyed couplings; and grooved joints.
- h. Schedule 30 steel pipe with plain ends, steel welding fittings, and welded joints.
- i. Schedule 10 steel pipe with roll-grooved ends; steel, grooved-end fittings; and grooved joints.
- j. Schedule 10 steel pipe with plain ends, steel welding fittings, and welded joints.

6. **NPS 4 (DN100) and Larger:**

- a. Standard-weight steel pipe with threaded ends, cast- or malleable-iron threaded fittings, and threaded joints.
- b. Standard-weight steel pipe with grooved ends; steel, grooved-end fittings; steel, keyed couplings; and grooved joints.
- c. Standard-weight steel pipe with plain ends, steel welding fittings, and welded joints.
- d. Galvanized, standard-weight steel pipe with threaded ends; cast- or malleable-iron threaded fittings; and threaded joints.
- e. Galvanized, standard-weight steel pipe with grooved ends; steel, grooved-end fittings; steel, keyed couplings; and grooved joints.
- f. Schedule 30 steel pipe with threaded ends, cast- or malleable-iron threaded fittings, and threaded joints.
- g. Schedule 30 steel pipe with roll-grooved ends; steel, grooved-end fittings; steel, keyed couplings; and grooved joints.
- h. Schedule 30 steel pipe with plain ends, steel welding fittings, and welded joints.
- i. Schedule 10 steel pipe with roll-grooved ends; steel, grooved-end fittings; and grooved joints.

- j. Schedule 10 steel pipe with plain ends, steel welding fittings, and welded joints.

G. Dry-Pipe Sprinklers: Use the following:

1. Sprinkler-Piping Option: For NPS 2 (DN50) and smaller, Mechanical-T bolted-branch-outlet fittings, may be used downstream from sprinkler zone valves.
2. Sprinkler-Piping Option: For NPS 2 (DN50) and smaller, Specialty sprinkler fittings, including mechanical-T fittings, may be used downstream from sprinkler zone valves.
3. NPS 1-1/2 (DN40) and Smaller:
 - a. Galvanized, standard-weight steel pipe with threaded ends; cast- or malleable-iron threaded fittings; and threaded joints.
 - b. Galvanized, standard-weight steel pipe with plain ends; locking-lug fittings; and twist-locked joints.
4. NPS 2 (DN50):
 - a. Galvanized, standard-weight steel pipe with threaded ends; cast- or malleable-iron threaded fittings; and threaded joints.
 - b. Galvanized, standard-weight steel pipe with plain ends; locking-lug fittings; and twist-locked joints.
 - c. Galvanized, standard-weight steel pipe with grooved ends; steel, grooved-end fittings; steel, keyed couplings; and grooved joints.
5. NPS 2-1/2 and Larger:
 - a. Galvanized, standard-weight steel pipe with threaded ends; cast- or malleable-iron threaded fittings; and threaded joints.
 - b. Galvanized, standard-weight steel pipe with grooved ends; steel, grooved-end fittings; steel, keyed couplings; and grooved joints.

3.4 VALVE APPLICATIONS

- A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
1. Fire-Protection-Service Valves: UL listed and FM approved for applications where required by NFPA 13.
 - a. Shutoff Duty: Use gate valves.
 2. General-Duty Valves: For applications where UL-listed and FM-approved valves are not required by NFPA 13.
 - a. Shutoff Duty: Use gate, ball, or butterfly valves.
 - b. Throttling Duty: Use globe, ball, or butterfly valves.
- B. Refer to Division 13 Section 13915 "Fire Protection Suppression Piping".

3.5 JOINT CONSTRUCTION

- A. Refer to Division 13 Section 13053 "Fire Protection General Materials and Methods" for basic piping joint construction.
- B. Refer to Division 13 Section 13915 "Fire Protection Suppression Piping".
- C. Use gaskets listed for dry-pipe service for dry piping.
- D. Dissimilar-Piping-Material Joints: Construct joints using adapters or couplings compatible with both piping materials. Use dielectric fittings if both piping materials are metal. Refer to Division 13 Section 13053 "Fire Protection General Materials and Methods" for dielectric fittings.

3.6 SERVICE-ENTRANCE PIPING

- A. Connect sprinkler piping to water-service piping of size and in location indicated for service entrance to building. Refer to Division 2 Section "Water Distribution" for exterior piping.
- B. Install shutoff valve, backflow preventer, pressure gage, drain, and other accessories indicated at connection to water-service piping. Refer to Division 2 Section "Water Distribution" for backflow preventers.
- C. Install shutoff valve, check valve, pressure gage, drain, and other accessories at connection to water service.

3.7 WATER-SUPPLY CONNECTION

- A. Connect sprinkler piping to building interior water distribution piping. Refer to Division 15 Section "Water Distribution Piping" for interior piping.
- B. Install shutoff valve, backflow preventer, pressure gage, drain, and other accessories indicated at connection to water distribution piping. Refer to Division 15 Section "Plumbing Specialties" for backflow preventers.
- C. Install shutoff valve, check valve, pressure gage, drain, and other accessories at connection to water service.

3.8 PIPING INSTALLATION

- A. Refer to Division 13 Section "Fire Protection General Materials and Methods" for basic piping installation.
- B. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated, as far as practical.

1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.
- C. Install underground service-entrance piping according to Local Code and NFPA 24 and with restrained joints.
- D. Use approved fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.
- E. Install "Inspector's Test Connections" in sprinkler piping, complete with shutoff valve, sized and located according to NFPA 13.
- F. Install sprinkler piping with drains for complete system drainage.
- G. Install sprinkler zone control valves, test assemblies, and drain risers adjacent to sprinkler risers when sprinkler branch piping is connected to sprinkler risers.
- H. Install ball drip valves to drain piping between fire department connections and check valves. Drain to floor drain or outside building.
- I. Install alarm devices in piping systems.
- J. Hangers and Supports: Comply with Section 13060 "Fire Protection Hangers and Supports" and NFPA 13 for hanger materials and installation.
- K. Install piping with grooved joints according to manufacturer's written instructions. Construct rigid piping joints, unless otherwise indicated.
- L. Install pressure gages on riser or feed main and at each sprinkler test connection. Include pressure gages with connection not less than **NPS 1/4 (DN8)** and with soft metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they will not be subject to freezing.

3.9 SPECIALTY SPRINKLER FITTING INSTALLATION

- A. Install specialty sprinkler fittings according to Section 13915 "Fire Protection Suppression Piping".

3.10 VALVE INSTALLATION

- A. For installing general-duty valves. Install fire-protection specialty valves, trim, fittings, controls, and specialties according to NFPA 13, manufacturer's written instructions, and authorities having jurisdiction.
- B. Service Control Valves: Install fire-protection-service valves supervised-open, located to control sources of water supply except from fire department connections. Provide permanent identification signs indicating portion of system controlled by each valve.
- C. Valves for Wall Fire Hydrants: Install gate valve with nonrising stem in supply pipe.

- D. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water supply sources.
- E. Alarm Check Valves: Install valves in vertical position for proper direction of flow, including bypass check valve and retard chamber drain-line connection.
- F. Dry-Pipe Valves: Install trim sets for air supply, drain, priming level, alarm connections, ball drip valves, pressure gages, priming chamber attachment, and fill-line attachment.
 - 1. Air-Pressure Maintenance Devices for Dry-Pipe Systems: Install shutoff valves to permit servicing without shutting down sprinkler system; bypass valve for quick system filling; pressure regulator or switch to maintain system pressure; strainer; pressure ratings with 14- to 60-psig (95- to 410-kPa) adjustable range; and 175-psig (1200-kPa) maximum inlet pressure.
 - 2. Install air compressor and compressed-air supply piping.

3.11 SPRINKLER APPLICATIONS

- A. General: Use sprinklers according to the following applications, or as directed by the Architect.
 - 1. Rooms without Ceilings: Upright or pendent sprinklers, as indicated.
 - 2. Rooms with Suspended Ceilings: Pendent, recessed, flush, or concealed sprinklers, as indicated.
 - 3. Spaces Subject to Freezing: Upright; pendent, dry-type; dry-type sprinklers.
 - 4. Sprinkler Finishes: Use sprinklers with the following finishes or as directed by the Architect.
 - a. Upright, Pendent, and Sidewall Sprinklers: Chrome-plated in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view; wax coated where exposed to acids, chemicals, or other corrosive fumes.
 - b. Concealed Sprinklers: Rough brass, with factory-painted white cover plate; Color by Architect.
 - c. Flush Sprinklers: White with painted white escutcheon; Color by Architect.
 - d. Recessed Sprinklers: White with bright chrome escutcheon; Color by Architect.

3.12 SPRINKLER INSTALLATION

- A. Sprinkler Heads: Space, locate, and position sprinkler heads in accordance with the reflected ceiling plans and the design criteria.
 - 1. The sprinkler heads in all areas are to be installed on a true axis line in both directions with a maximum deviation from the axis line of ½" plus or minus from architects reflected ceiling plans. At the completion of the installation, if any heads are found to exceed the above mentioned tolerance, same shall be removed and reinstalled by this Contractor.
 - 2. Install sprinklers in center of tiles.
 - 3. Provide all sprinkler heads and work in strict conformance with approved shop drawings. The Architect reserves the right to reject any and all work not in accordance with the approved shop drawing.

4. Perform the following in areas where painting occurs or when sprinkler piping is painted. As soon as sprinkler heads are in place, the Contractor shall cover each head with a small bag of an Underwriter's approved type, which shall be removed only after all painting is complete. After the bag is removed, all heads shall be cleaned and polished.
5. Do not install pendant wet-type sprinklers in areas subject to freezing. Use dry type sprinklers. Locate water supply within heated space.

3.13 CONNECTIONS

- A. Connect water-supply piping and sprinklers to fire pumps. Include backflow preventers.
- B. Connect water supplies to sprinklers. Include backflow preventers.
- C. Install ball drip valves at each check valve for fire department connection. Drain to floor drain or outside building.
- D. Connect piping to specialty valves, specialties, fire department connections, and accessories.
- E. Electrical Connections: Power wiring is specified in Division 16.
- F. Connect alarm devices to fire alarm.
- G. Connect compressed-air supply to dry-pipe sprinkler piping.
- H. Connect air compressor to the following piping and wiring:
 1. Pressure gages and controls.
 2. Electrical power system.
 3. Fire alarm system devices, including low-pressure alarm.

3.14 LABELING AND IDENTIFICATION

- A. Install labeling and pipe markers on equipment and piping according to requirements of the Authority having Jurisdiction, NFPA 13 and Division 13 Section 13050 "Fire Protection General Materials and Methods."
- B. Install labeling and pipe markers on equipment and piping according to requirements as required by the Authority having Jurisdiction, NFPA 13 and Division 13 Section 13075 "Fire Protection Identification."

3.15 FIELD QUALITY CONTROL

- A. Flush, test, and inspect sprinkler piping according to the Authority having Jurisdiction, NFPA 13, Section 13050 "Fire Protection General Requirements", "System Acceptance" Chapter.
- B. Replace piping system components that do not pass test procedures and retest to demonstrate compliance. Repeat procedure until satisfactory results are obtained.

- C. Report test results promptly and in writing to Architect and authorities having jurisdiction.

3.16 CLEANING

- A. Clean dirt and debris from sprinklers.
- B. Remove and replace sprinklers having paint other than factory finish.

3.17 PROTECTION

- A. Protect sprinklers from damage until Substantial Completion.

3.18 COMMISSIONING

- A. Verify that specialty valves, trim, fittings, controls, and accessories are installed and operate correctly.
- B. Verify that air compressors and their accessories are installed and operate correctly.
- C. Verify that specified tests of piping are complete.
- D. Verify that damaged sprinklers and sprinklers with paint or coating not specified are replaced with new, correct type.
- E. Verify that sprinklers are correct types, have correct finishes and temperature ratings, and have guards as required for each application.
- F. Verify that potable-water supplies have correct types of backflow preventers.
- G. Drain dry-pipe sprinkler piping.
- H. Pressurize and check dry-pipe sprinkler piping air-pressure maintenance devices and air compressors.
- I. Verify that fire department connections have threads compatible with local fire department equipment.
- J. Fill wet-pipe sprinkler piping with water.
- K. Energize circuits to electrical equipment and devices.
- L. Start and run jockey pumps.
- M. Start and run air compressors.
- N. Adjust operating controls and pressure settings.
- O. Coordinate with fire alarm tests. Operate as required.

- P. Coordinate with fire-pump tests. Operate as required.

3.19 DEMONSTRATION

- A. Demonstrate equipment, specialties, and accessories. Review operating and maintenance information.
- B. Schedule demonstration with Owner with at least seven days' advance notice.

END OF SECTION 13916

**NEW PASSENGER TERMINAL
DULUTH INTERNATIONAL AIRPORT
DULUTH, MINNESOTA**

**SECTION 13921 - ELECTRIC-DRIVEN
HORIZONTAL FIRE PUMPS**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes electric-drive, horizontal fire pumps for building fire-suppression systems and the following:
1. Split-case fire pumps.
 2. Pressure-maintenance pumps.
 3. Full-service, fire-pump controllers.
 4. Automatic transfer switches.
 5. Pressure-maintenance-pump controllers.
 6. Fire-pump specialties and accessories.
 7. Pressure-maintenance-pump specialties and accessories.
 8. Alarm panels.
 9. Flow-measuring systems.
- B. Related Sections include the following:
1. Division 13 Section 13915 "Fire-Suppression Piping" for feed-main, fire-suppression piping at fire pumps.
 2. Division 13 Section 13916 "Fire-Suppression Sprinklers" for feed-main, fire-suppression piping at fire pumps.
 3. Division 13 Section 13975 "Standpipes and Hoses" for feed-main, fire-suppression piping at fire pumps.
 4. Division 16 Section "Fire Alarm Systems" for connection to alarm panel.
 5. Division 16 Sections for power and connections to fire-pump and pressure-maintenance-pump controllers.

1.3 DEFINITIONS

- A. End-Suction Fire Pump: Radially split-case, horizontal fire pump with suction nozzle on side of casing opposite stuffing box and flange of discharge nozzle perpendicular to longitudinal axis of shaft.
- B. Fire Pump: Horizontal-type fire pump used to supply water at rated capacity and total head required for fire-suppression service.

- C. Fire-Pump Unit: Assembly with fire pump, driver, controller, and related accessories.
- D. In-Line Fire Pump: Radially split-case, horizontal fire pump with drive unit supported by pump, suction and discharge flanges on same centerline, and pump shaft in vertical position.
- E. Pressure-Maintenance Pump: Electric-drive pump used to maintain water pressure in fire-suppression piping system.
- F. Pressure-Maintenance-Pump Unit: Assembly with pressure-maintenance pump, driver, controller, and related accessories.
- G. Residential Fire-Pump Unit: Packaged assembly with fire pump, driver, controller, piping, and related accessories.
- H. Split-Case Fire Pump: Axially split-case, horizontal fire pump with its housing split parallel to shaft.

1.4 SYSTEM PERFORMANCE REQUIREMENTS

- A. Fire-Pump Systems: Fire-pump and pressure-maintenance-pump units that comply with performance requirements specified and are compatible with building fire-suppression systems.
- B. Pump, Equipment, Accessory, and Piping Pressure Rating: **175-psig (1200-kPa)** minimum working-pressure rating, unless higher rating is indicated.

1.5 SUBMITTALS

- A. Product Data: Include rated capacities; certified pump performance curves with each selection point indicated; shipping, installed, and operating weights; furnished specialties; and accessories for each fire-pump and pressure-maintenance-pump unit and flow-measuring system.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, methods of field assembly, components, and location and size of each field connection for each fire-pump and pressure-maintenance-pump unit.
 - 1. Wiring Diagrams: Detail wiring for power, signal, and control systems and differentiate between manufacturer-installed and field-installed wiring.
 - 2. Shop Drawings may be incorporated into other Division 13 Section 13915 "Fire-Suppression Piping System" Shop Drawings.
- C. Product Certificates: Signed by manufacturers of fire pumps and fire-pump controllers certifying that products furnished comply with requirements.
- D. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

- E. Maintenance Data: For each fire-pump and pressure-maintenance-pump unit to include in maintenance manuals specified in Division 1.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Firms whose fire pumps, pressure-maintenance pumps, drivers, controllers, and accessories are listed by product name and manufacturer in UL's "Fire Protection Equipment Directory" and FM's "Fire Protection Approval Guide" and that comply with requirements indicated. The following are exceptions and are not required:
 - 1. UL listing and FM approval of pressure-maintenance pumps.
 - 2. FM approval of residential fire pumps and controllers.
 - 3. FM approval of pressure-maintenance-pump controllers.
 - 4. UL listing of flow-measuring systems.
 - 5. Either UL listing or FM approval, but not both, if product otherwise complies with specifications.
- B. Source Limitations: Obtain fire-pump and pressure-maintenance-pump units through one source with responsibility and accountability to respond to and resolve problems regarding compatibility, installation, performance, and acceptance of units.
- C. Product Options: Drawings indicate size, profiles, connections, and dimensional requirements of fire-pump and pressure-maintenance-pump units and are based on specific models indicated. Other manufacturers' pump units with equal performance characteristics may be considered. Refer to Division 1 Section "Substitutions."
- D. Provide listing/approval stamp, label, or other marking on equipment made to specified standards.
- E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.
- F. Comply with standards of authorities having jurisdiction pertaining to materials, hose threads, and installation.
- G. Comply with NFPA 20, "Centrifugal Fire Pumps," for fire pumps, drivers, controllers, accessories, and installation.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Preparation for Shipping: After assembling and testing fire pumps and pressure-maintenance pumps, protect flanges and exposed machined metal surfaces, pipe openings, and nozzles.
- B. Retain shipping flange protective covers and protective coatings during storage.
- C. Protect bearings and couplings against damage from sand, grit, or other foreign matter.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- 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:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Single-Stage, Horizontally Mounted, Split-Case Fire Pumps:
 - a. Armstrong Darling, Inc.
 - b. Fairbanks Morse Pump Corp.
 - c. General Signal Pump Group; Aurora Pump Unit.
 - d. ITT Fluid Technology Corp.; ITT A-C Pump Unit.
 - e. Paco Pumps, Inc.
 - f. Patterson Pump Co.
 - g. Peerless Pump Co.
 - h. Reddy-Buffaloes Pump, Inc.
 - 2. Multistage, Pressure-Maintenance Pumps:
 - a. Grundfos Pumps Corp.
 - b. Jacuzzi Brothers.
 - c. Paco Pumps, Inc.
 - d. Peerless Pump Co.
 - e. Taco, Inc.
 - 3. Fire-Pump Controllers:
 - a. Firetrol, Inc.
 - b. Hubbell Industrial Controls, Inc.
 - c. Joslyn Clark Controls, Inc.
 - d. Master Control Systems, Inc.
 - e. Metron, Inc.
 - 4. Pressure-Maintenance-Pump Controllers:
 - a. Firetrol, Inc.
 - b. Hubbell Industrial Controls, Inc.
 - c. Joslyn Clark Controls, Inc.
 - d. Master Control Systems, Inc.
 - e. Metron, Inc.
 - 5. Alarm Panels:
 - a. Firetrol, Inc.
 - b. Hubbell Industrial Controls, Inc.
 - c. Joslyn Clark Controls, Inc.
 - d. Master Control Systems, Inc.
 - e. Metron, Inc.

6. Flow-Measuring Systems:
 - a. Dieterich Standard Corp.
 - b. Gerand Engineering Co.
 - c. Hyspan Precision Products, Inc.
 - d. Preso Industries, Ltd.
 - e. Reddy-Buffaloes Pump, Inc.
 - f. Scott Fetzer Co.; Meriam Instrument Div.
 - g. Victaulic Company of America.

2.2 GENERAL

- A. Fire Pumps: Provide factory tested pumps thoroughly cleaned and painted with machinery enamel prior to shipment.
- B. The pumps shall be hydrostatically tested to twice the working pressure, but in no case less than 250 psig. Prior to shipment, the pump, motor and controller shall be thoroughly shop tested by the manufacturer. A characteristic curve of pump performance from the test results shall be drawn and furnished to the Architect and Engineer.
- C. Provide fire pump systems that include fire pump units, pressure-maintenance pump units, accessories, and piping that comply with performance requirements specified and are compatible with building fire protection systems. Refer to schedule on drawings for pump capacities and characteristics.

2.3 SPLIT-CASE FIRE PUMPS

- A. Single-Stage, Horizontally Mounted, Split-Case Fire Pumps: UL 448, factory-assembled and -tested, electric-drive, double-suction, horizontal type. Include pump and driver mounted on same base and connected with coupling.

2.4 PRESSURE-MAINTENANCE PUMPS (JOCKEY PUMP)

- A. Description: Factory-assembled and -tested, electric-drive pumps with cast-iron or stainless-steel casing and bronze or stainless-steel impellers and mechanical seals. Include flanged suction and discharge flanges machined to ASME B16.1, Class 125 dimensions, unless Class 250 flanges are indicated and except that connections may be threaded in sizes where flanges are not available.
 1. Multistage, Pressure-Maintenance Pumps: Multiple-impeller type complying with HI 1.1-1.5 requirements for multistage centrifugal pumps. Include base.

2.5 PUMP DRIVERS

- A. Description: NEMA MG 1, open-dripproof, squirrel-cage, induction motor. Include construction complying with NFPA 20 and NFPA 70, and include wiring compatible with controller used.
 - 1. Finish: Manufacturer's standard red paint applied to factory-assembled and -tested unit before shipping.
 - 2. Nameplate: Complete with motor horsepower, characteristics, and other pertinent data.

2.6 PUMP CONTROLLERS, GENERAL

- A. Description: Combined automatic and nonautomatic operation; factory assembled and wired; factory tested for capacities and electrical characteristics; and with the following features:
 - 1. Enclosure: UL 50, Type 2, dripproof, indoor, unless special-purpose enclosure is indicated.
 - 2. Controls, devices, alarms, functions, and operations listed in NFPA 20 as required for drivers and controller types used, and specific items listed for each controller type.
 - 3. Nameplate: Complete with capacity, characteristics, approvals and listings, and other pertinent data.
 - 4. Controller Sensing Pipes: Fabricate pipe and fittings according to NFPA 20 with nonferrous-metal sensing piping, **NPS 1/2 (DN15)**, with globe valves for testing controller mechanism from system to pump controller as indicated. Include bronze check valve with **3/32-inch (2.4-mm)** orifice in clapper or ground-face union with noncorrosive diaphragm having **3/32-inch (2.4-mm)** orifice.

2.7 FULL-SERVICE, FIRE-PUMP CONTROLLERS

- A. Description: UL 218 and NFPA 20; listed for electric-drive, fire-pump service and service entrance.
- B. The motor control equipment shall be completely assembled, wired and tested at the factory. The controller shall be the manual wound rotor speed regulating type built according to NFPA Pamphlet 20 standards.
 - 1. Type Starting: Wye-delta, closed transition.
- C. Rate controllers for scheduled horsepower. Include short-circuit withstand rating at least equal to short-circuit current available at controller location. Take into account cable size and distance from substation or supply transformers.
- D. Automatic Transfer Switches: UL 218 and UL 1008 and requirements for and attached to fire-pump controllers. Include enclosure complying with UL 50, Type 2, with automatic transfer switch with rating at least equal to fire-pump driver-motor horsepower. Include ampere rating not less than 115 percent of motor full-load current and suitable for switching motor-locked rotor current. (i.e. - 600% of motor full load current).

E. Controllers: As follows:

1. Isolating means and circuit breaker.
2. "Power on" pilot lamp.
3. Fire alarm system connections for indicating motor running condition, loss-of-line power, and line-power phase reversal.
4. Automatic and manual operation, and minimum run-time relay to prevent short cycling.
5. Water-pressure-actuated switch with independent high and low calibrated adjustments responsive to water pressure in fire-suppression system.
6. Automatic and manual shutdown.
7. System pressure recorder, electric ac driven with spring backup.
8. Mounting: Wall type for field electrical connections.
9. Enclosure Finish: Manufacturer's standard red paint applied to factory-assembled and -tested unit before shipping.
10. Circuit breakers shall have minimum interrupting capacities as follows:
 - a. For pump motors up to 50 HP
 - 1) 30,000 amps symmetrical at 460 (480) volts
 - 2) 42,000 amps symmetrical at 200 (208) volts
 - b. For pump motors over 50 HP
 - 1) 150,000 amps symmetrical at all voltages.

2.8 PRESSURE-MAINTENANCE-PUMP CONTROLLERS

- A. Description: UL 508; factory-assembled, -wired, and -tested across-the-line type for combined automatic and nonautomatic operation.
1. Enclosure: UL 508 and NEMA 250, Type 2, wall-mounting type for field electrical wiring. Rate controller for scheduled horsepower (KW) and include the following:
 2. Fusible disconnect switch.
 3. Pressure switch. (adjustable high and low pressure)
 4. Hand-off-auto selector switch.
 5. Pilot light.
 6. Running period timer.
 7. Enclosure Finish: Manufacturer's standard color paint applied to factory-assembled and -tested unit before shipping.

2.9 FIRE-PUMP SPECIALTIES AND ACCESSORIES

- A. Match fire-pump suction and discharge ratings as required for fire-pump capacity rating. Include the following:
1. Automatic air-release valve.
 2. Circulation relief valve.
 3. Suction and discharge pressure gages.

4. Eccentric-tapered reducer at suction inlet.
5. Concentric-tapered reducer at discharge outlet.
6. Test-Header Manifold: Ductile-iron or brass body for hose valves. Include nozzle outlets arranged in single line; horizontal, flush-wall mounting attachment; and rectangular, brass escutcheon plate with lettering equivalent to "PUMP TEST CONNECTION."
 - a. Escutcheon Plate Finish: Polished chrome-plated.
 - b. Escutcheon Plate Finish: Rough brass.
7. Test-Header Manifold: Ferrous for hose valves. Manufacturer's standard finish. Include bronze or cast-iron, exposed-type valve header with nozzle outlets; and round, brass escutcheon plate with lettering equivalent to "PUMP TEST CONNECTION."
8. Hose Valves: UL 668, straightway pattern, bronze with cap and chain. Include NFPA 1963 hose thread that complies with local fire department standards and finish same as for test-header-manifold escutcheon plate.
9. Ball Drip Valve: UL 1726.
10. Main Relief Valve: UL 1478, pilot operated.
11. Main Relief Valve: UL 1478, spring loaded.
12. Discharge Cone: Closed.
13. Discharge Cone: Open.
14. Hose valves with caps and chains.
15. Coupling guard.
16. Finish: Manufacturer's standard factory-applied red paint, unless brass or other finish is specified.

2.10 PRESSURE-MAINTENANCE-PUMP SPECIALTIES AND ACCESSORIES

- A. Match pressure-maintenance-pump suction and discharge ratings as required for pump capacity rating. Include the following:
 1. Circulation relief valve.
 2. Suction and discharge pressure gages.

2.11 ALARM PANELS

- A. Description: Factory-assembled and -wired remote panel complying with UL 508 and requirements in NFPA 20. Include audible and visible alarms matching controller type.
 1. Enclosure: NEMA 250, Type 2, remote wall-mounting type.
 2. Enclosure Finish: Manufacturer's standard red paint applied to factory-assembled and -tested unit before shipping.
- B. Features: Include manufacturer's standard features and the following:
 1. Motor-operating condition.
 2. Loss-of-line power.
 3. Phase reversal.
 4. Low-water alarm.

2.12 FLOW-MEASURING SYSTEMS

- A. Description: FM-approved, fire-pump, flow-measuring systems that indicate flow to not less than 175 percent of fire-pump rated capacity. Include sensor of size to match pipe, tubing, flow meter, and fittings.
 - 1. Pressure Rating: 175 psig (1200 kPa) minimum.
 - 2. Sensor: Venturi, annular probe, or orifice plate, unless otherwise indicated.
 - 3. Flow Meter: Compatible with flow sensor with dial not less than 4-1/2 inches (115 mm) in diameter or manufacturer's equivalent size.
 - 4. Permanently Mounted: Flow meter suitable for wall mounting with copper tubing to connect to flow sensor.
 - 5. Portable: Flow meter, with two 12-foot (4-m) hoses, in carrying case with handle.
 - 6. Include complete operating instructions.

2.13 SOURCE QUALITY CONTROL

- A. Factory Tests: Hydrostatically test and test run fire pumps before shipping. Test at 150 percent of shutoff head plus suction head, but not less than 250 psig (1725 kPa). Produce certified test curves showing head capacity and brake horsepower of each pump.

2.14 GROUT

- A. Description: ASTM C 1107, Grade B, factory-mixed and -packaged nonshrink and nonmetallic grout; suitable for interior and exterior applications.
- B. Characteristics: Post-hardening, volume-adjusting, dry, hydraulic-cement grout.
- C. Properties: Nonstaining, noncorrosive, and nongaseous.
- D. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas, equipment foundations, and conditions, with Installer present, for compliance with requirements for installation and other conditions affecting fire-pump performance.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.
- B. Examine roughing-in of fire-suppression piping systems. Verify actual locations of piping connections before pump installation.

3.2 CONCRETE BASES

- A. Install concrete bases of dimensions indicated for fire pumps, pressure-maintenance pumps, and controllers. Refer to Division 3 Section "Cast-in-Place Concrete" and Division 15 Section "Basic Mechanical Materials and Methods."

3.3 INSTALLATION

- A. Comply with fire-pump, pressure-maintenance-pump, and controller manufacturers' written installation and alignment instructions, and with NFPA 20.
- B. Install pumps and controllers to provide access for periodic maintenance, including removal of motors, impellers, couplings, and accessories.
- C. Set base-mounting-type pumps on concrete bases. Disconnect coupling halves before setting. Do not reconnect couplings until alignment operations have been completed.
 - 1. Support pump baseplate on rectangular metal blocks and shims or on metal wedges having small taper, at points near foundation bolts to provide **3/4- to 1-1/2-inch (19- to 38-mm)** gap between pump base and foundation for grouting.
 - 2. Adjust metal supports or wedges until pump and driver shafts are level. Check coupling faces and pump suction and discharge flanges to verify that they are level and plumb.
- D. Install suction and discharge piping equal to or greater than diameter of fire-pump nozzles.
- E. Install valves that are the same size as piping connecting fire pumps, bypasses, test headers, and other piping systems.
- F. Install pressure gages on fire-pump suction and discharge at pressure-gage tapings.
- G. Support pumps and piping separately so weight of piping does not rest on pumps.
- H. Install piping accessories, hangers and supports, anchors, valves, meters and gages, and equipment supports.
- I. Install flow meters and sensors where indicated. Install flow-measuring-system components and make connections according to manufacturer's written instructions.
- J. Electrical Wiring: Install electrical devices furnished by equipment manufacturers but not specified to be factory mounted. Furnish copies of manufacturers' wiring diagram Submittals to electrical Installer.
 - 1. Verify that electrical wiring is installed according to manufacturers' submittal and installation requirements in Division 16 Sections. Proceed with equipment startup only after wiring installation is satisfactory.

3.4 ALIGNMENT

- A. Align fire-pump and driver shafts after complete unit has been leveled on foundation, grout has set, and foundation bolts have been tightened.
- B. After alignment is correct, tighten foundation bolts evenly but not too firmly. Fill baseplate completely with grout, with metal blocks and shims or wedges in place. Tighten foundation bolts after grout has hardened. Check alignment and make required corrections.
- C. Make piping connections, check alignment, and make required corrections.
 - 1. Adjust alignment of pump and driver shafts for angular and parallel alignment by one method in HI 1.1-1.5, Section 1.4, "Installation, Operation and Maintenance."
 - 2. Alignment Tolerances: Comply with manufacturer's written instructions.
- D. Align vertically mounted, split-case pump and driver shafts after complete unit has been made plumb on foundation, grout has set, and foundation bolts have been tightened. Follow pump manufacturer's written instructions.

3.5 CONNECTIONS

- A. Piping installation requirements are specified in other Division 13 Sections. Drawings indicate general arrangement of piping and specialties. The following are specific connection requirements:
 - 1. Install piping adjacent to fire and pressure-maintenance pumps to allow service and maintenance.
 - 2. Connect water supply to fire and pressure-maintenance pumps.
 - 3. Connect fire-pump and pressure-maintenance-pump discharge piping to building fire-suppression piping.
 - 4. Connect relief-valve discharge to point of disposal.
- B. Connect flow-measuring-system meters and sensors according to manufacturer's written instructions.
- C. Connect fire-pump controllers to building fire alarm system. Refer to Division 16 Section "Fire Alarm Systems."
- D. Connect controllers to pumps.
- E. Electrical wiring and connections are specified in Division 16 Sections.
- F. Ground equipment.
 - 1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.6 FIELD QUALITY CONTROL

A. Automatic Sequence of Operation:

1. Pump unit shall start automatically by pressure drop in fire protection system. Jockey pump shall automatically maintain pressure on system. Make necessary adjustments during test.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including fire-pump and pressure-maintenance-pump units, piping and electrical connections. Report results in writing.

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Check suction line connections for tightness so no air gets into pumps.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation. Remove malfunctioning units, replace with new units, and retest.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
5. Furnish fire hoses in number, size, and length required to reach storm drain or other acceptable location to dispose of fire-pump test water. Fire hoses are for field-acceptance tests only and are not property of Owner.
6. Final Checks before Startup: Perform the following preventive-maintenance operations and checks:
 - a. Lubricate oil-lubrication-type bearings.
 - b. Remove grease-lubrication-type bearing covers, flush bearings with kerosene, and clean thoroughly. Fill with new lubricant according to manufacturer's written instructions.
 - c. Disconnect coupling and check electric motor for proper rotation. Rotation shall match direction of rotation marked on pump casing.
 - d. Verify that pump is free to rotate by hand. If pump is bound or if it drags even slightly, do not operate until cause of trouble is determined and corrected.
7. Starting procedure for pumps is as follows:
 - a. Prime pump by opening suction valve and closing drains, and prepare pump for operation.
 - b. Open sealing liquid supply valves if pump is so fitted.
 - c. Start motor.
 - d. Open discharge valve slowly.
 - e. Observe leakage from stuffing boxes and adjust sealing liquid valve for proper flow to ensure lubrication of packing. Do not tighten gland immediately but let packing run in before reducing leakage through stuffing boxes.
 - f. Check general mechanical operation of pump and motor.
8. The pumps shall be hydrostatically tested to twice the working pressure, but in no case to less than 250 PSIG. Prior to shipment, the pump and motor and control

panel shall be thoroughly shop tested by the manufacturer. A characteristics curve of pump performance from the test results shall be drawn and furnished to the Architect and Engineer.

- C. Perform field tests for each fire-pump unit and system piping when installation is complete. Comply with operating instructions and procedures in NFPA 20 to demonstrate compliance with requirements. Where possible, field correct malfunctioning equipment, then retest to demonstrate compliance. Replace equipment that cannot be satisfactorily corrected or that does not perform as indicated, then retest to demonstrate compliance. Verify that each fire-pump unit performs as indicated. Report test results in writing.

3.7 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain units as specified below:
 - 1. Train Owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining units for a period of not less than one 8-hour working day.
 - 2. Review data in maintenance manuals. Refer to Division 1 Section "Closeout Procedure."
 - 3. Review data in maintenance manuals. Refer to Division 1 Section 01700 "Execution Requirements".
 - 4. Schedule training with Owner with at least seven days' advance notice.

END OF SECTION 13921

**NEW PASSENGER TERMINAL
DULUTH INTERNATIONAL AIRPORT
DULUTH, MINNESOTA**

**SECTION 13967 - CLEAN-AGENT
EXTINGUISHING SYSTEMS**

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes clean-agent extinguishing systems and the following:
 - 1. Piping and piping specialties.
 - 2. Extinguishing-agent containers.
 - 3. Extinguishing agent.
 - 4. Detection and alarm devices.
 - 5. Control and alarm panels.
 - 6. Accessories.
 - 7. Connection devices for and wiring between system components.
 - 8. Connection devices for power and integration into building's fire alarm system.

1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Related sections include the following:
 - 1. Division 13 Section 13050 "Fire Protection General Requirements".

1.3 DEFINITIONS

- A. FM-200: Trade name for HFC 227ea fire-extinguishing clean agent.

1.4 SYSTEM DESCRIPTION

- A. Description: Engineered system for discharge and total flooding of hazard areas with "FM-200".

1.5 PERFORMANCE REQUIREMENTS

- A. Performance Requirements: Discharge FM-200 within 10 seconds and maintain 7.1 percent concentration by volume at 70 deg F (21 deg C) for 10-minute holding time in hazard areas.
 - 1. FM-200 concentration in hazard areas greater than 9.0 percent immediately after discharge or less than 5.8 percent throughout holding time will not be accepted without written authorization from Owner and authorities having jurisdiction.
 - 2. System Capabilities: Minimum 620-psig (4278-kPa) calculated working pressure and 360-psig (2484-kPa) initial charging pressure.
- B. Cross-Zoned Detection: Include devices located in two separate zones. Sound alarm on activating single-detection device, and discharge extinguishing agent on actuating single-detection device in other zone. (Note: Cross-zoned detection subject to approval by local authorities having jurisdiction).
- C. System Operating Sequence: As follows:
 - 1. Actuating First Detector: Give visual indication on annunciator panel, energize audible alarm, shut down air-conditioning and ventilating systems serving protected area, release and close doors in protected area, and send signal to fire alarm system.
 - 2. Actuating Second Detector: Give visual indication on annunciator panel, energize audible alarm, shut down power to protected equipment, actuate time delay for extinguishing-agent discharge for 30 seconds, and release extinguishing agent.
 - 3. Extinguishing-agent discharge will operate audible alarms and strobe lights.
- D. Operating manual-release stations will discharge extinguishing agent when activated.
- E. Operating abort switches will delay extinguishing-agent discharge while being activated, and switches must be reset to prevent agent discharge. Release of switch will discharge agent.

1.6 SUBMITTALS

- A. Product Data: For the following:
 - 1. Extinguishing-agent containers.
 - 2. Extinguishing agent.
 - 3. Discharge nozzles.
 - 4. Control panels.
 - 5. Detection devices.
 - 6. Manual-release stations.
 - 7. Switches.

8. Alarm devices.
- B. Shop Drawings: Signed and sealed by a qualified professional engineer. Include design calculations. Include the following for hazard-area enclosure, drawn to scale:
1. Plans, elevations, sections, details, and attachments to other Work. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 2. Wiring Diagrams: Detail wiring for power, signal, and control systems and differentiate between manufacturer-installed and field-installed wiring.
 3. Design Calculations: For weight, volume, and concentration of extinguishing agent required for each hazard area.
 4. Reflected Ceiling Plans: Show ceiling penetrations, ceiling-mounted items, and the following:
 - a. Extinguishing-agent containers, piping, discharge nozzles, detectors, and accessories.
 - b. Method of attaching hangers to building structure.
 - c. Other ceiling-mounted items including light fixtures, diffusers, grilles, speakers, sprinklers, and access panels.
 5. Occupied Work Area Plans: Show the following:
 - a. Controls and alarms.
 - b. Extinguishing-agent containers, piping and discharge nozzles if mounted in space, detectors, and accessories.
 - c. Equipment and furnishings.
 6. Access Floor Space Plans: Show the following:
 - a. Extinguishing-agent containers, piping, discharge nozzles, detectors, and accessories.
 - b. Method of supporting piping.
- C. Permit Approved Drawings: Working plans, prepared according to NFPA 2001, that have been approved by authorities having jurisdiction. Include design calculations.
- D. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.
- E. Maintenance Data: For components to include in maintenance manuals specified in Division 1.

1.7 QUALITY ASSURANCE

- A. 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 clean-agent extinguishing systems that are similar to those indicated for this Project in material, design, and extent.
- B. Source Limitations: Obtain extinguishing agent and equipment through one source.
- C. Product Options: Drawings indicate size, profiles, and dimensional requirements of clean-agent extinguishing systems and are based on the specific system indicated. Other manufacturers' systems with equal performance characteristics may be considered. Refer to Division 1 Section 01330 "Submittal Procedures."
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- E. ASME Compliance: Fabricate piping to comply with ASME B31.1, "Power Piping."
- F. FM Compliance: Provide components that are FM approved and are listed in FM's "Fire Protection Approval Guide."
- G. NFPA Compliance: Fabricate and label clean-agent extinguishing systems to comply with NFPA 2001, "Clean Agent Extinguishing Systems."
- H. UL Compliance: Provide equipment components complying with UL 1058, "Halogenated Agent Extinguishing System Units," and are UL listed for clean-agent extinguishing system units in UL's "Fire Protection Equipment Directory."

1.8 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents. Deliver extra materials to Owner.
 - 1. Detection Devices: Not less than 20 percent of amount of each type installed.
 - 2. Container Valves: Not less than 10 percent of amount of each size and type installed.
 - 3. Nozzles: Not less than 20 percent of amount of each type installed.
 - 4. Extinguishing Agent: Not less than 100 percent of amount installed in largest hazard area. Include pressure-rated containers with valves.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Clean-Agent Extinguishing Systems:
 - a. Cerberus Pyrotronics.
 - b. Chemetron Fire Systems.
 - c. Fike Corp.; Fire Protection Systems Div.
 - d. Kidde-Fenwal, Inc.
 - e. Modular Protection Corp.
 - f. Ansul, Inc.

2.2 PIPING MATERIALS

- A. Refer to Part 3 piping applications Article retained for applications of pipe, tube, fitting, and joining materials.
- B. Piping, Valves, and Discharge Nozzles: Comply with types and standards listed in NFPA 2001, Section "Distribution," and Appendix A, for charging pressure of system.

2.3 PIPES AND TUBES

- A. Black Steel Pipe: ASTM A 53, Type S, Grade A or ASTM A 106, Grade A; Schedule 40, unless Schedule 80 is indicated.
- B. Galvanized Steel Pipe: ASTM A 53, Type S, Grade A, Schedule 40, unless Schedule 80 is indicated.

2.4 PIPE AND TUBE FITTINGS

- A. Malleable-Iron, Threaded Fittings: ASME B16.3, Class 300.
- B. Steel Flanges and Flanged Fittings: ASME B16.5, Class 300, unless Class 600 is indicated.
- C. Forged-Steel Welding Fittings: ASME B16.11, Class 3000, socket pattern.
- D. Steel, Grooved-End Fittings: FM approved and UL listed, **ASTM A 47** (**ASTM A 47M**) malleable iron or ASTM A 536 ductile iron, with dimensions matching steel pipe and ends factory grooved according to AWWA C606.

2.5 JOINING MATERIALS

- A. Refer to Division 13 Section 13053 "Fire Protection General Materials and Methods" for basic joining materials.

- B. Steel, Keyed Couplings: UL 213, AWWA C606, approved or listed for halon or clean-agent service, and matching steel-pipe dimensions. Include ASTM A 536, ductile-iron housing, rubber gasket, and steel bolts and nuts.

2.6 VALVES

- A. General: Brass; suitable for intended operation.
- B. Container Valves: With rupture disc or solenoid, capable of immediate and total agent discharge and suitable for intended flow capacity.
- C. Valves in Sections of Closed Piping and Manifolds: Fabricate to prevent entrapment of liquid, or install valve and separate pressure-relief device.
- D. Valves in Manifolds: Check valve; installed to prevent loss of extinguishing agent when container is removed from manifold.

2.7 EXTINGUISHING-AGENT CONTAINERS

- A. Description: Steel tanks complying with ASME Boiler and Pressure Vessel Code: Section VIII, for unfired pressure vessels. Include minimum working-pressure rating that matches system charging pressure, valve, pressure switch, and pressure gage.
 - 1. Finish: Red, enamel or epoxy paint.
 - 2. Manifold: Fabricate with valves, pressure switches, and connections for multiple storage containers, as indicated.
 - 3. Storage-Tank Brackets: Factory- or field-fabricated retaining brackets consisting of steel straps and channels; suitable for container support, maintenance, and tank refilling or replacement.

2.8 FIRE-EXTINGUISHING CLEAN AGENT

- A. Clean Agent: FM-200; HFC 227ea, heptafluoropropane.

2.9 DISCHARGE NOZZLES

- A. Equipment manufacturer's standard one-piece brass or aluminum alloy of type, discharge pattern, and capacity required for application.

2.10 ORIFICE UNIONS

- A. Description: UL-listed device with minimum 2000-psig (13.8-MPa) pressure rating, to control flow and reduce pressure of INERGEN gas in piping.

1. **NPS 2 (DN50)** and Smaller: Piping assembly with orifice, sized for system design requirements.
2. **NPS 2-1/2 (DN65)** and Larger: Piping assembly with nipple, sized for system design requirements.

2.11 CONTROL PANELS

- A. Description: FM approved or UL listed, including equipment and features required for testing, supervising, and operating fire-extinguishing system.
- B. Power Requirements: 120/240-V ac; with electrical contacts for connection to system components and fire alarm system, and transformer or rectifier as needed to produce power at voltage required for accessories and alarm devices.
- C. Enclosure: NEMA ICS 6, Type 1, enameled-steel cabinet.
 1. Mounting: Surface.
- D. Supervised Circuits: Separate circuits for each independent hazard area.
 1. Provide the following crossed-zoned-detection applications:
 - a. Zone 1 detection circuit.
 - b. Zone 2 detection circuit.
 - c. Manual pull-station circuit.
 - d. Alarm circuit.
 - e. Release circuit.
 2. Provide the following control-panel features:
 - a. Electrical contacts for shutting down fans, activating dampers, and operating system electrical devices.
 - b. Automatic switchover to standby power at loss of primary power.
 - c. Storage container, low-pressure indicator.
 3. Annunciator Panel: Graphic type showing protected, hazard-area plans and locations of detectors and manual-release stations. Include lamps to indicate device-initiating alarm, electrical contacts for connection to control panel, and stainless-steel or aluminum enclosure.
 4. Standby Power: Lead-acid or nickel-cadmium batteries with capacity to operate system for 72 hours and alarm for minimum of 15 minutes. Include automatic battery charger, with varying charging rate between trickle and high depending on battery voltage, that is capable of maintaining batteries fully charged. Include manual voltage control, dc voltmeter, dc ammeter, electrical contacts for connection to control panel, and suitable enclosure.

2.12 DETECTION DEVICES

- A. Description: Comply with NFPA 2001 and NFPA 72, and include the following types:
1. Ionization Detectors: UL 268, dual-chamber type, having sampling and referencing chambers, with smoke-sensing element.
 2. Photoelectric Detectors: UL 268, consisting of LED light source and silicon photodiode receiving element.
 3. Other Detectors: Contractor's option, complying with NFPA 2001 and NFPA 72.

2.13 MANUAL-RELEASE STATIONS

- A. Description: FM approved or UL listed, with "PULL STATION" caption, 120-V ac or low voltage compatible with controls, and red finish. Include contacts for connection to control panel. Unit can manually discharge extinguishing agent with operating device that remains engaged until unlocked.
1. Mounting: Surface.

2.14 SWITCHES

- A. Description: FM approved or UL listed, where available, 120-V ac or low voltage compatible with controls. Include contacts for connection to control panel.
1. Pressure Switches: Pneumatic operation.
 2. Transfer Switches: Key-operation selector, for transfer of release circuit signal from main supply to reserve supply.
 3. Abort Switches: Dead-man type, requiring constant pressure, for delay of system discharge.
 4. Door Closers: Magnetic retaining and release device.

2.15 ALARM DEVICES

- A. Description: FM approved or UL listed, low voltage, and surface mounting, unless otherwise indicated.
- B. Bells: Minimum 6-inch (150-mm) diameter.
- C. Horns: 90 to 94 dBA.
- D. Strobe Lights: Translucent lens, with "FIRE" or similar caption.

2.16 ELECTRICAL POWER AND WIRING

- A. Electrical power, wiring, and devices are specified in Division 16 Sections.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with hazard-area leakage requirements, installation tolerances, and other conditions affecting work performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PIPING APPLICATIONS FOR 360-PSIG (2484-kPa) CHARGING PRESSURE

- A. Flanged pipe and fittings and flanged joints may be used to connect to specialties and accessories and where required for maintenance.
- B. Fittings Working Pressure: 620 psig (4278 kPa) minimum.
- C. Flanged Joints: Class 300 minimum.
- D. NPS 3 (DN80) and Smaller:
 - 1. Copper tube; copper, solder-joint fittings; and brazed joints.
 - 2. Black steel pipe, malleable-iron threaded fittings, and threaded joints.
 - 3. Galvanized steel pipe, malleable-iron threaded fittings, and threaded joints.
- E. NPS 2½" (DN65) and Larger:
 - 1. Black steel pipe; steel, grooved-end fittings; steel, keyed couplings; and grooved joints.
 - 2. Galvanized steel pipe; steel, grooved-end fittings; steel, keyed couplings; and grooved joints.
- F. NPS 4 (DN100) and Larger: Black steel pipe, forged-steel welding fittings, and welded joints.

3.3 CLEAN-AGENT EXTINGUISHING PIPING INSTALLATION

- A. Install clean-agent extinguishing piping and other components level and plumb and according to manufacturers' written instructions.
- B. Refer to Division 13 Section "Basic Fire Protection Materials and Methods" for basic pipe installation and joint construction.
- C. Grooved Piping Joints: Groove pipe ends according to AWWA C606 dimensions. Assemble grooved-end steel pipe and steel, grooved-end fittings with steel, keyed couplings and lubricant according to manufacturer's written instructions.
- D. Install extinguishing-agent containers anchored to substrate.

- E. Install pipe and fittings, valves, and discharge nozzles according to requirements listed in NFPA 2001, Section "Distribution," and related Appendix A paragraphs; and ASME B31.1.
 - 1. Install valves designed to prevent entrapment of liquid or install pressure-relief devices in valved sections of piping systems.
 - 2. Support piping using supports and methods according to NFPA 13 and Division 15 Section "Hangers and Supports."
 - 3. Install seismic restraints for extinguishing-agent containers and piping systems.
 - 4. Install control panels, detection system components, alarms, and accessories, complying with requirements of NFPA 2001, Section "Detection, Actuation, and Control Systems," as required for supervised system application.

3.4 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties. The following are specific connection requirements:
- B. Install piping adjacent to extinguishing-agent containers to allow service and maintenance.
- C. Connect electrical devices to control panel and to building's fire alarm system. Electrical power, wiring, and devices are specified in Division 13 Section "Fire Alarm."
- D. Ground electrical components.
 - 1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.5 LABELING

- A. Install labeling on piping, extinguishing-agent containers, other equipment, and panels according to NFPA 2001.

3.6 FIELD QUALITY CONTROL

- A. Professional Engineer: Inspect installed clean-agent extinguishing systems, prepare installation report, and certify that installation complies with the Contract Documents and calculations, and comments of authorities having jurisdiction.
- B. Perform field-acceptance tests of each clean-agent extinguishing system when installation is complete. Perform system testing only after hazard-area enclosure construction has been completed and openings sealed. Comply with operating instructions and procedures of NFPA Section 2001, "Approval of Installations." Include the following inspections and tests to demonstrate compliance with requirements:

1. Check mechanical items.
 2. Inspect extinguishing-agent containers and extinguishing agent, and check mountings for adequate anchoring to substrate.
 3. Check electrical systems.
 4. Check enclosure integrity. Comply with NFPA Section 2001, "Enclosure Inspection," and Appendix B, "Enclosure Integrity Procedure."
 5. Perform functional predischage test.
 6. Perform system functional operational test.
 7. Check remote monitoring operations.
 8. Check control-panel primary power source.
 9. Perform "puff" test on piping system, using nitrogen.
- C. Correct malfunctioning equipment, then retest to demonstrate compliance. Replace equipment that cannot be corrected or does not perform as specified and indicated, then retest to demonstrate compliance. Repeat procedure until satisfactory results are obtained.
1. Report test results promptly and in writing to Architect and authorities having jurisdiction.
- D. Perform the following field quality-control testing:
1. After installing clean-agent extinguishing piping system and after electrical circuitry has been energized, test for compliance with requirements.
 2. Perform each visual and mechanical inspection and electrical test stated in NETA ATS, Section 7, "Inspection and Test Procedures," and Section 8, "System Function Tests." Certify compliance with test parameters.
- E. Repair or replace malfunctioning units. Retest as specified above after repairs or replacements are made.
- F. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including piping and electrical connections. Report results in writing.
1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation. Remove malfunctioning units, replace with new units, and retest.
 3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.7 COMMISSIONING

- A. Engage a factory-authorized service representative to perform startup service.
- B. Verify that extinguishing system is installed and connected according to the Contract Documents.

- C. Verify that electrical wiring installation complies with the Contract Documents.
- D. Complete installation and startup checks according to manufacturer's written instructions and do the following:
 - 1. Verify that tests of piping system are complete.
 - 2. Check for complete enclosure integrity.
 - 3. Check operation of ventilation and exhaust systems.
- E. Startup Procedures: Follow manufacturer's written procedures. If no procedures are prescribed by manufacturer, proceed as follows:
 - 1. Fill extinguishing-agent containers with extinguishing agent and pressurize to indicated charging pressure.
 - 2. Install filled extinguishing-agent containers.
 - 3. Energize circuits.
 - 4. Adjust operating controls.

3.8 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain system.
 - 1. Train Owner's maintenance personnel on procedures and schedules for troubleshooting, servicing, and maintaining equipment and schedules.
 - 2. Review data in maintenance manuals. Refer to Division 1 Section "Contract Closeout."
 - 3. Review data in maintenance manuals. Refer to Division 1 Section "Operation and Maintenance Data."
 - 4. Schedule training with Owner, through Architect, with at least seven days' advance notice.

END OF SECTION 13967

**NEW PASSENGER TERMINAL
DULUTH INTERNATIONAL AIRPORT
DULUTH, MINNESOTA**

**SECTION 13970 - PRE-ACTION
SPRINKLER SYSTEM**

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes pre-action sprinkler systems and the following:
1. Piping and piping specialties.
 2. Detection and alarming devices.
 3. Controls and alarm devices.
 4. Accessories
 5. Connection devices between system components.
 6. Connection devices for power and integration into building fire alarm system.

1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Related Sections include the following:
1. Division 13 Section 13851 "Fire Alarm."
 2. Division 13 Section 13915 "Fire Suppression Piping".

1.3 DEFINITIONS

- A. The following definitions are based on NFPA 13 - Standard for Installation of Sprinkler Systems.
1. Preaction Sprinkler System - Preaction sprinkler system are categorized into three following types:
 - a. Non-Interlock System. A non-interlock system admits water to sprinkler piping upon operation of detection devices or automatic sprinklers.
 - b. Single Interlock System. A single interlock system admits water to sprinkler piping upon operation any single fire detection device. Operation of an automatic sprinkler and subsequent loss of air pressure will sound supervisory alarm, but will not charge the sprinkler pipes with water. Heat detectors, shall be temperature rise-of-rise type, to avoid nuisance charging of the sprinkler pipes with water.
 - c. Double Interlock System. A double interlock system admits water to sprinkler piping upon operation of both the fire detection devices and automatic sprinklers.

2. A manual electrical pull station is required within the protected space for each of the above systems. In addition, each of the above systems must also be equipped with a local manual control (hydraulic operation) for sprinkler activation. This station is generally located at the location of the sprinkler control valve.
3. Deluge Sprinkler System. A sprinkler system equipped with open sprinklers that are attached to a piping system that is connected to a water supply controlled by a valve that is opened by the operation of a detection system installed in the same areas as the sprinklers. When this valve opens, water flows into the piping system and discharges from all sprinklers simultaneously. (Explanatory note: Deluge sprinkler nozzles are always open. The detectors are usually the heat detectors.)
4. Dry Type System. A system with automatic sprinklers that are attached to a piping system containing air or nitrogen under pressure, the release of which (as from the opening of a sprinkler) permits the water pressure to open a valve known as a dry pipe valve, and the water then flows into the piping system and out the opened sprinklers. (Smoke or heat detectors are not utilized).
5. Cross-Zoning. This term refers to actuation of at least two (2) fire detection devices wired on separate wiring circuit zones. If the fire detectors are individually addressable type, then the operation of any two detectors would result in the same function. (In New York City the cross zoning of fire detectors for pre-action system operation is not permitted. Time delays and abort switched are also not permitted in sprinkler systems).

1.4 PRE-ACTION SPRINKLER SYSTEMS:

- A. Single interlock preaction systems are used to protect areas where there is danger of serious water damage that might result from damaged automatic sprinklers or piping. Typically such areas include computer rooms, storage areas for valuable artifacts, libraries and archives. Also, preaction systems are effectively used to protect properties where a prealarm of a possible fire condition may allow time for fire extinguishment by alternate suppression means, prior to sprinkler discharge. In the event the fire cannot otherwise be extinguished preaction sprinkler system will then perform as the primary fire protection system. Single interlock preaction systems employ automatic sprinklers attached to a piping system containing 10 psi (0,7 bar) supervisory pressure, with a supplemental electric fire detection system installed in the same area as the sprinklers. Preaction systems with 10 psi (0, 7 bar) supervisory pressure may also be activated by either wet or dry pilot sprinklers instead of electric detectors. Actuation of the fire detection system from a fire opens the deluge valve, allowing water to flow into the sprinkler piping system and to be discharged only from those sprinklers that have been operated by heat over the fire. Loss of supervisory pressure from the system piping as a result of damaged sprinklers or broken piping will activate a trouble alarm to indicate impairment of the system. The deluge system valve will not open due to loss of supervisory pressure.

- B. Double interlock preaction systems are designed for applications such as refrigerated areas that require the maximum degree of protection against an inadvertent operation that could result in unnecessary flooding of the sprinkler system piping. The double interlock system consists of a deluge valve and swing check valve with releasing trim featuring both a solenoid valve and a dry pilot actuator in a series configuration. The swing check valve isolates the body of the deluge valve from the system air or nitrogen pressure that holds the dry pilot actuator closed. The solenoid valve remains closed until it is electrically energized by a deluge releasing panel that responds to the operation of a fire detection device. In order to actuate the double interlock preaction system, two independent events, caused by a fire condition, must occur. The sprinkler system piping must lose air or nitrogen pressure due to the operation of one or more sprinklers, and the deluge releasing panel must energize and open the solenoid valve upon the operation of a fire detection device. The double interlock system will operate only when both the dry pilot actuator and the solenoid valve are open at the same time. Opening of the dry pilot actuator only (for example: a forklift truck accidentally dislodges a sprinkler) or of the solenoid valve only (for example: accidental operation of an electric manual pull station) will cause an alarm, and will not trip the system or flood the sprinkler system piping.
- C. Pre-action system components and basic operation as follows:
1. Check valve on discharge side of deluge valve to retain supervisory air pressure.
 2. Deluge valve to withhold release of water in system.
 3. External reset provision to facilitate testing of deluge valve.
 4. Electric releases to retain or release clapper in deluge valve.
 5. Release control panel to supervise and control release mechanism.
 6. End-line resistors to regulate supervisory current in detector units.
 7. Trouble signal and bell to signal circuit faults.
 8. Power supply panels to provide primary power supply to release mechanism.
 9. Storage battery units to provide secondary source of power supply.
 10. Tamper switches to supervise O.S.&Y. control valves, control valves to control water supply to deluge valve.
 11. Detector heads to initiate operation of release mechanisms through release control panels.
 12. Emergency manual pull stations to act as manual provisions for operating the release mechanism.
 13. Electric alarm switches to operate electric alarms upon water flow.
 14. Supervisory air supply, self-contained, with air compressor panel, air compressor, check valve, pressure gage, tubing, audible and visual alarm, silence switch, O.S.& Y. monitor switch.
 15. Air maintenance device w/valve, filter, regulator, low pressure alarm, pressure gage, check valve.

D. Work Included

1. Provide approved type automatic supervised preaction sprinkler system, consisting of closed sprinkler heads properly spaced to cover the areas protected, a system of properly spaced electric smoke detector heads including electrically operated deluge valves and manual break glass releases. All wiring of system, including detectors, shall be provided. The electric smoke detector system must actuate, and a sprinkler head must fuse (lowers air pressure in pipe system) before water will enter system thru deluge valve. Activation of one switch, i.e., (alarm condition) or opened (fused) sprinkler head (i.e., trouble alarm) will sound alarm only. Primary electric power source shall be 220 volt A.C. current with transformation and rectification to 24 volt D.C. for system operation. Provide all electric work from 220 volt power source. Secondary power source by means of 24 volt storage batteries and battery charger. Low air pressure switch and automatically maintained low air pressure source. Wiring of air compressor motor by electrical contractor. System shall be in full accordance with the requirements of the Local Fire Protection Publications and shall be approved by the local authorities having jurisdiction.

E. Quality Assurance

1. Applicator: Company specializing in sprinkler installation with seven years minimum experience.
2. Submit manufacturer's installation instructions in accordance with specifications.

F. Pre-Action Sprinkler Systems Utilizing Deluge Valve and Electric Solenoid Valve

1. Refer to drawing for detail of pre-action sprinkler system utilizing an electric solenoid valve.

G. The pre-action system shall consist of the detection system with combination fixed temperature and rate-of-rise heat and smoke detectors, and the sprinkler distribution piping with closed type sprinkler heads.

H. The detection system shall include manual release stations, which shall be able to override detectors network. The detection system shall be a single zone system. (i.e., not cross-zoned).

I. The sprinkler distribution piping of the pre-action system shall be supervised by compressed air provided by system's air compressor.

J. The system shall include external reset provisions to facilitate testing of a deluge valve.

K. Primary electric power source shall be 120 volt A.C. current with transformation and rectification to 24 volt D.C. for system operation. Provide all electric work from 120 volt power source. Secondary power source by means of 24 volt storage batteries and battery charger.

L. The single interlock pre-action system utilizes a deluge valve which is tripped by the actuation of a solenoid valve from the operation of the detection system. This puts water in the system piping prior to fusing of the sprinklers, thereby permitting a more rapid fire attack.

M. An activation of first detector will initiate an alarm signal.

- N. An activation of a second detector or manual pull station shall open solenoid valve releasing water into piping system and sounding an alarm at building Fire Alarm system panel.
- O. The system piping is pressurized with air for supervisory purposes. If the system piping or a sprinkler heads is broken, without activation of the detection system the pressure will be reduced and an alarm will sound but water will not discharge.
- P. Pre-action system water supply control valve is provided with a tamper switch to supervise the systems water supply.

1.5 GENERAL SYSTEM OPERATION

- A. Water pressure is maintained in the top chamber of deluge valve by passing through a small check valve and restricted orifice. System piping is pressured with air so alarm will sound if a sprinkler head opens or piping is damaged, but no water will flow. When detection system is activated, the solenoid valve in the magnetic bypass or release control unit vents the top chamber of deluge valve faster than water can be replaced through restricted orifice which causes it to open and operate alarm system. The damage of sprinkler piping or fuse of sprinkler head without activation of detection system shall cause a low pressure alarm due to the rapid drop of supervised compressed air in the system piping but shall not fill the system piping with water.
- B. When two detectors operate within the affected area and the system is armed with water, and the temperature at the sprinkler heads reaches their fusing point (normally 165°F) water will flow to suppress a fire.

1.6 SEQUENCE OF OPERATION

- A. Activation of any single detector shall:
 1. Illuminate detector zone on pre-action system control panel.
 2. Activate combination horn/light within the affected area to indicate fire situation.
 3. Initiate signal to the building fire alarm system to automatically notify local Fire Department. (Coordinate contact closure requirements).
 4. Activate circuits to operate fire safety system, opening of exist doors, etc.
 5. Transfer contacts to building Fire Alarm Panel within affected areas as designated by the tenant and his appointed personnel directly in charge and responsible for the area and equipment protected by the pre-action system.
 6. Activate output alarm contact.
 7. Activate solenoid release valve
- B. Activation of any additional detector shall perform the following actions in addition to the actions above:
 1. Activate solenoid release valve.
- C. Activation of pre-action manual pull station system located within the protected area shall:

1. Illuminate manual pull station zone on pre-action system control panel.
 2. Activate operations. See 1.5A and 1.5B.
- D. Activation of pre-action manual pull station system located at valve assembly (testing of pre-action system) shall:
1. Illuminate waterflow switch zone on pre-action system control panel.
 2. Activate operations. See 1.5A and 1.5B.
- E. Activation of a tamper switch shall:
1. Transfer common trouble contact to building Fire Alarm Panel.
- F. Low air pressure, caused by fused element or not, shall: The damage of sprinkler piping or fuse of sprinkler head without activation of detection system shall cause a low pressure alarm due to the rapid drop of supervised compressed air in the system piping but shall not fill the system piping with water.

1.7 PERFORMANCE REQUIREMENTS

- A. Piping and Piping Specialties: **175-psig (1200-kPa)** minimum working pressure, unless otherwise indicated.

1.8 SUBMITTALS

- A. Product Data: For the following:
1. Pipe and fitting materials and methods of joining for sprinkler piping.
 2. Pipe hangers and supports and restraints.
 3. Control panels.
 4. Valves with tamper switches.
 5. Deluge valve.
 6. Accessories.
 7. Discharge devices. Include flow characteristics.
 8. Detection and alarm devices. Include electrical data.
- B. Shop Drawings: Signed and sealed by a qualified professional engineer. Include design calculations. Include the following for each hazard area, drawn to scale:
1. Include plans, elevations, sections, details, and attachments to other Work. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 2. Wiring Diagrams: Power, signal, and control wiring. Differentiate between manufacturer-installed and field-installed wiring.
 3. Design Calculations: hydraulic calculations are required for each sprinkler zone.

4. Plans: Show the following:

- a. Pre-action valve assembly, details conforming to NFPA 13, piping, discharge devices, detector and alarm devices, and accessories.
 - b. Method of attaching hangers to building structure.
 - c. Fire alarm panel.
 - d. Electrical equipment requiring high and low voltage systems and furnishings.
 - e. A complete layout of flashing lights, horn, bells, manual pull stations and wiring for same, indicating horizontal and vertical locations.
 - f. A complete layout of detection system components indicating location of detectors and wiring for same.
 - g. A complete electrical system (one-line) drawing and details indicating all electrical components and equipment requiring high and low voltage electrical systems and alarm systems.
 - h. Additional dry contacts within control panel and/or additional pressure switches (number and identify) to operate all required alarms, bells, horns, lights, shutdown of equipment of other trades as required.
- C. Permit-Approved Drawings: Working plans, prepared according to NFPA 11, that have been approved by authorities having jurisdiction. Include design calculations.
- D. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.
- E. Maintenance Data: For components to include in maintenance manuals specified in Division 1.

1.9 QUALITY ASSURANCE

- A. 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 kind indicated. Engineering services are defined as those performed for installations of pre-action systems that are similar to those indicated for this Project in material, design, and extent.
- B. Source Limitations: Obtain pre-action valve and major accessories through one source.
- C. Product Options: Drawings indicate size, profiles, and dimensional requirements of pre-action systems and are based on the specific system indicated. Other manufacturers' pre-action systems complying with requirements may be considered. Refer to Division 1 Section 01330 "Submittal Procedures."
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- E. NFPA Compliance: Pre-action systems to comply with NFPA 13.
- F. ASME Compliance: Fabricate piping to comply with ASME B31.1. "Power Piping".

- G. FM Compliance: Provide components that are FM approved and that are listed in FM's "Fire Protection Approval Guide."
- H. UL Compliance: Provide pre-action and equipment complying with UL "Pre-Action Systems" and with systems that are listed in UL's "Fire Protection Equipment Directory."

1.10 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 1. Sprinkler Heads: Not less than 20 percent of amount of each type installed.
 2. Electrical Detector: Not less than 20 percent of amount installed.

1.11 PRE-ACTION SYSTEM BASIC OPERATION COMPONENTS

- A. Addressable control panels
 1. Notifier AFP-400 w/VGAS Custom Graphic Annunciation System.
 2. For each other system, Notifier AFP-200.
- B. O.S.&Y type control valve with tamper switch with monitor module (Notifier MMX-1) to supervise water supply to the pre-action system.
- C. Check valve on discharge side of deluge valve to retain supervisory air pressure.
- D. Electrically operated deluge valve to withhold release of water in system.
- E. External reset provision to facilitate testing of deluge valve.
- F. Electric releases to retain or release clapper in deluge valve.
- G. Release control panel to supervise and control release mechanism.
- H. End-line resistors to regulate supervisory current in detector units.
- I. Trouble signal and bell signal circuit faults.
- J. Power supply panels to provide primary and emergency power supply to release mechanism.
- K. Storage battery units to provide secondary source of power supply.
- L. Addressable analog thermal detector head (Notifier FDX-55IR) as required, to initiate operation of release control panels.

- M. Sprinkler heads, piping, hangers, drains, etc.,.
- N. Addressable Emergency break glass stations as manual provisions for operating of detection system. (Notifier BGX-101L)
- O. Electric alarm switches with monitor module (Notifier MMX-1) to operate electric alarms upon water flow.
- P. Supervisory air supply, self-contained, with air compressor panel, air compressor, check valve, pressure gauge, tubing, audible and visual alarm, silence switch, O.S.&Y. monitor switch.
- Q. Air maintenance device with valve, filter, regulator, low pressure alarm, pressure gauge, check valve.
- R. Bells with strobe units and horn units.
- S. Provisions for equipment shut-down with control module (Notifier CMX-2).
- T. All equipment shall perform as a part of a single system. All components shall be approved by the authorities having jurisdiction.
- U. Materials and equipment shall be standard products of a single manufacturer's latest design and suitable to perform the functions intended. Field fabricated equipment will not be accepted and will be grounds for system rejection.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- 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. All equipment shall perform as a part of a single system. All components shall be approved by authorities having jurisdiction.
 - 2. Materials and equipment shall be standard products of a single manufacturer's latest design, and suitable to perform the functions intended. Field fabricated equipment will not be accepted and will be grounds for system rejection. This specification covers the requirement for Automatic Pre-Action system using herein specified control panel, detectors, and related equipment. In order to insure system effectiveness and Owner satisfaction, the contractor shall supply all specified equipment and accessories for a complete, electrically supervised system as described. The contractor shall prepare plans which are to indicate, with lettering no smaller than 3.2mm (one-eighth inch), the location and marking of all system components and a description of all pipe routing.

3. Upon completion of the installation, a meeting shall be held at the site with contractor and Owners personnel present. The contractor shall familiarize the Owners personnel present with system components, system functions and recommended procedures. At this time, a functional test of the system will be demonstrated. The contractor shall provide the necessary personnel and instruments to conduct this test. A detection system acclimation period shall be utilized to insure stability of the overall system. The contractor will provide the Owner with two complete operational and maintenance manuals as well as a written summary of the conducted tests. The contractor will provide the Owner with a system checklist which the Owners Representative will sign as acceptance of the system.
4. Equipment and accessories furnished by the contractor shall be approved components of a single manufacturer.
5. Substitution of components shall be equal to those specified in the system design. Contractor shall provide a cover sheet list of all equipment item model numbers and the model number of specified item to be included.

B. Operating Requirements:

1. The pre-action control system shall include a detection sub-system and releasing sub-system.
2. The detection sub-system shall employ ionization detectors on separate circuits. These detectors shall be cross-zoned with the pre-action system low air pressure switch. A single detector activating will cause an alarm signal (bells) to be generated. The pre-action solenoid valve shall activate only when both the thermal detector has alarmed and the system has lost air pressure (due to fusing of sprinkler head).
3. Detectors shall comply with spacing standards as described in standard fire code, but shall in no case exceed one detector per every 37 square meters (400 sq.ft.).

C. System Components:

1. Provide and install an integrated system of automatic detection devices and related wiring. The devices shall be used to activate a control panel. Auxiliary outputs shall be available to shunt trip power, contact other agencies, or annunciate on remote devices. System shall have as standard equipment, battery standby power so as to provide a minimum of ninety (90) hours of battery power. In addition system is provided with building emergency power.
2. Wiring must be in 3/4" conduit. Use 18 AWG, 600 volt, 105°C, UL listed wire for all control wiring except for detection and release wiring where 16 AWG shall be used. Splices must be soldered; wire nuts are not acceptable. The 220 volt, 50 Hz single phase power input line must be separate conduit and connected to the main building line through a separate 15 amp breaker, dedicated to the pre-action system.
3. The control panel to be used for the automatic detection system shall be a two zone releasing control or approved equal.
4. A multi-zone control panel complete with all required relays and controls for each pre-action sprinkler system shall be listed and approved by the fire code.

- a. The housing shall be 18 gauge sheet steel and shall have a hinged removable door with a key lock. The finish shall be baked enamel. The unit shall be microprocessor based and the main circuit board module shall be removable without disconnecting the field wiring.
- b. A combination power supply/battery charger shall be provided as a part of the control. Adequate space shall be provided for standby batteries that are capable of operating the system for up to ninety (90) hours. All overcurrent protection devices shall be resettable type circuit breakers. All circuits powered for the control panel shall meet UL requirements for power limited circuits. Regulated 24 VDC rated at ½ ampere shall be available for the operating of four (4) wire detectors or other auxiliary devices.
- c. Two (2) supervised signal initiating device circuits, for ionization and/or thermal detectors, with a capacity of 25-100 uA., two (2) wire detectors shall be provided. Each circuit shall be switch selectable to be Style D (Class A).
- d. Two (2) supervised signal indicating device circuits shall be provided that reverse polarity when an alarm condition occurs. These circuits shall supply regulated 24 VDC rated at 1.0 amperes to the indicating devices.
- e. A separate, supervised FM approved Style A (Class A) supervisory circuit shall be provided for the connection of such items as valve, pressure, or temperature monitoring switches. Operation of this circuit shall result in a distinct supervisory indication.
- f. A supervised extinguishing agent releasing circuit shall be provided that reverses polarity when a releasing condition occurs. This circuit shall be rated at 24 VDC, 1.0 ampere continuous or 3 amperes momentary.
- g. The following visual indicators shall be visible with the door closed: AC On-Green LE, Alarm Red, System Trouble-Yellow LED, System Discharge-Red LED, and Supervisory Condition-Yellow LED. A thirty-two (32) character alpha-numeric liquid crystal display with backlight, shall also be provided to display in an English format, the condition, status, and circuit for all Alarm, Trouble and Supervisory signals. The time to discharge will be displayed whenever the pre-discharge timer is activated.
- h. The unit shall contain the following Control Switches: A common Silence Switch that silences the alarm indicating devices and Trouble Buzzer, a Reset Switch that must be held for three (3) seconds to prevent accidental resetting, a Test Switch that turns on all Alarm and Trouble indicators and outputs, a Zone Disable Switch for each zone, a Releasing Circuit Disable Switch, and an Auto-Reset Switch that disables the latching function making a "One Man Test" possible.
- i. The control panel must be arranged to provide three (3) distinctive signals:
 - 1) Alarm signal for manual station, fire detection (either smoke or heat), and sprinkler waterflow.
 - 2) Supervisory alarm for tamper switch and low air pressure.
 - 3) Trouble - Common trouble signal for control panel.
- j. Activation of a waterflow, smoke detector, heat detector, or manual station shall cause fan shutdown of those building systems serving the area. The shut-down of free-standing self-contained units within the protected area is operational.
- k. Time delays and abort switches are prohibited.
- l. Operation of preaction system (waterflow, smoke or heat detection or manual station) must report as an alarm condition in where Class E, J, or C fire alarm system is installed.

- m. Reporting to the building system of preaction low air pressure, tamper alarm or trouble.
- 5. Ionization Detector: The detector shall utilize solid state circuitry and be of the dual chamber configuration. One (1) chamber shall be open to sense the particles of combustion while the other will be used as a reference chamber for stability. The unit shall be designed so as to be unaffected by RF energy from 1kHz through 100 MHZ. The detectors shall also be unaffected by air velocity up to 1200 FPM. The detector shall be capable of having its calibration checked or adjusted in the field via the standard detector sensitivity monitor. The detector may have its sensitivity tested either in place as it is exposed to the environment, or in a calibrated smoke chamber to give a reading of sensitivity which can be referenced against other like detectors under know conditions. The detector shall be approved, ULC listed and UL listed to UL Standard 268. Configuration of unit shall be approved prior to purchasing.
- 6. Remote Control and Indicators: Alarm Signals - Will be provided by six inch 150 alarm bells with Xenon flashing strobe. Control panel shall include relay configuration to satisfy operational requirements as outlined in paragraph g.
- 7. Sequence of Operation:
 - a. Common Alarm - Activation of one (1) thermal detector, or ionization detector, the water flow switch, or manual pull station shall cause the following:
 - 1) Activate local alarm bell/strobe.
 - 2) Annunciate alarm condition to building system.
 - b. Discharge Release - Activation of one (1) thermal detector and loss of air pressure shall cause the following:
 - 1) Activate pre-action solenoid valve.
 - c. Common Abnormal Trouble - Abnormal condition on control panel or activation of tamper switch or low air pressure switch or loss of electrical power, shall cause the following:
 - 1) Annunciate panel trouble condition to building system.
- 8. All associated wiring for the tamper switch, high and low air pressure switch, water flow switch, and solenoid pre-action valve shall be provided by this contractor.
- 9. All associated wiring to building system, from system control panel (alarm, trouble, and release) shall be provided by the electrical contractor.
- D. Drawings and Manuals:
 - 1. As-built drawings complete with hydraulic calculations shall be furnished to the Owner. The contractor shall revise and provide all drawings to agree with the construction as actually accomplished and stamped "As-Built".
 - 2. Prior to final acceptance, the contractor shall provide complete operation and maintenance manuals (two (2) copies for each system) to the Owner.
- E. Check valve on discharge side of deluge valve to retain supervisory air pressure.

- F. Deluge valve to withhold release of water in system.
- G. Tamper switches to supervise fire system control valves, control valves to control water supply to deluge valve.
- H. Supervisory air supply, self-contained, with air compressor and tank, check valve, pressure gage, dehydrator, tubing, audible and visual alarm, silence switch, O.S.& Y. monitor switch.
- I. Air maintenance device w/valve, filter, regulator, low pressure alarm, power failure relay switch, pressure gage, check valve. Provide compressor support and fasteners.
- J. System shall be complete and tested in accordance with all authorities having jurisdiction.
- K. A **(single) (double)** inter locked preaction sprinkler valve manufactured by the Viking or Piping shall be as per specifications Reliable Sprinkler Company of the same design configuration and appurtenances is an acceptable alternate.
- L. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Pre-Action Valve (Deluge)
 - a. Tyco Protection Inc.
 - b. Globe Fire Sprinkler Corp.
 - c. Reliable Sprinkler Co., Inc.
 - d. Viking Corp.
 - 2. Detectors
 - a. Game Well Co.
 - b. Potter Electric Signal.
 - c. System Sensor Div Pittwa Corp.
 - d. Viking Corp.

2.2 PIPES AND FITTINGS

- A. Refer to Section 13915 "Fire Protection Suppression Piping".

2.3 JOINING MATERIALS

- A. Refer to Division 15 Section 13053 "Fire Protection General Materials and Methods" for basic joining materials.

2.4 VALVES

- A. Refer to Section 13915 "Fire Protection Suppression Piping".

- B. Deluge Valves: UL 260, cast-iron body, 175-psig (1200-kPa) working pressure; hydraulically operated, differential-pressure type. Include flanged inlet and outlet, bronze seat with O-ring seals, trim sets for bypass, drain, electric sprinkler alarm switch, pressure gages, drip cup assembly piped without valves and separate from main drain line, fill-line attachment with strainer, and push-rod chamber supply connection.
1. Air-Pressure Maintenance Devices: Automatic device to maintain correct air pressure in piping. Include shutoff valves to permit servicing without shutting down sprinkler piping, bypass valve for quick filling, pressure regulator or switch to maintain pressure, strainer, pressure ratings with 14- to 60-psig (95- to 410-kPa) adjustable range, and 175-psig (1200-kPa) maximum inlet pressure.
 2. Air Compressor: Fractional horsepower, 120-V ac, 60 Hz, single phase.
 3. Dry, Pilot-Line Trim Set: Include dry, pilot-line actuator; air- and water-pressure gages; low-air-pressure warning switch; air-relief valve; and actuation device. Dry, pilot-line actuator includes cast-iron, 175-psig (1200-kPa) working-pressure, air-operated, diaphragm-type valve with resilient facing plate, resilient diaphragm, and replaceable bronze seat. Valve includes threaded water and air inlets and water outlet. Loss of air pressure on dry, pilot-line side allows pilot-line actuator to open and causes deluge valve to open immediately.

2.5 PRESSURE GAGES

- A. Description: Comply with UL 393, with 3-1/2-inch- (90-mm-) minimum diameter dial, 0- to 300-psig (0- to 2500-kPa) dial range, and caption "WATER" on dial face.

2.6 DISCHARGE DEVICES

- A. Sprinklers: See Section 13916 "Fire Suppression Sprinklers" for requirements.

2.7 DETECTION DEVICES WATER

- A. Comply with NFPA 13 and NFPA 72.
1. Water-Flow Indicators: UL 346, electrical-supervision, vane-type water-flow detector, with 250-psig (1725-kPa) pressure rating; designed for horizontal or vertical installation. Include two single-pole, double-throw, circuit switches for isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal if removed.
 2. Valve Supervisory Switches: UL 753, electrical, single pole, double throw, with normally closed contacts. Include design that signals controlled valve is in other than fully open position.
 3. Other Detectors: Comply with NFPA 13 and NFPA 72.

2.8 ALARM DEVICES

- A. Description: UL listed or FM approved, low voltage, and surface mounting, unless otherwise indicated.
- B. Bells: 6-inch (150-mm) diameter, minimum.
- C. Horns: 90 to 94 dBA.
- D. Strobe Lights: Translucent lens, with "FIRE" or similar caption.

2.9 CONTROL PANELS

- A. Description: FM approved or UL listed, including equipment and features required for testing, supervising, and operating fire-extinguishing system.
- B. Power Requirements: 120/240-V ac; with electrical contacts for connection to system components and fire alarm system, and transformer or rectifier as needed to produce power at voltage required for accessories and alarm devices.
- C. Enclosure: NEMA ICS 6, Type 1, enameled-steel cabinet.
 - 1. Mounting: **[Recessed flush with surface] [Surface].**
- D. Supervised Circuits: Separate circuits for each independent hazard area.
 - 1. Provide the following crossed-zoned-detection applications:
 - a. Zone 1 detection circuit.
 - b. Zone 2 detection circuit.
 - c. Manual pull-station circuit.
 - d. Alarm circuit.
 - e. Release circuit.
 - 2. Provide the following verified-detection applications:
 - a. Detection circuit.
 - b. Manual pull-station circuit.
 - c. Alarm circuit.
 - d. Release circuit.
 - 3. Provide the following control-panel features:
 - a. Electrical contacts for shutting down fans, activating dampers, and operating system electrical devices.
 - b. Automatic switchover to standby power at loss of primary power.
 - c. Storage container, low-pressure indicator.

4. Annunciator Panel: Graphic type showing protected, hazard-area plans and locations of detectors and manual-release stations. Include lamps to indicate device-initiating alarm, electrical contacts for connection to control panel, and stainless-steel or aluminum enclosure.
5. Standby Power: Lead-acid or nickel-cadmium batteries with capacity to operate system for 72 hours and alarm for minimum of 15 minutes. Include automatic battery charger, with varying charging rate between trickle and high depending on battery voltage, that is capable of maintaining batteries fully charged. Include manual voltage control, dc voltmeter, dc ammeter, electrical contacts for connection to control panel, and suitable enclosure.

2.10 DETECTION DEVICES - ELECTRICAL

- A. Description: Comply with NFPA 2001 and NFPA 72, and include the following types:
 1. Ionization Detectors: UL 268, dual-chamber type, having sampling and referencing chambers, with smoke-sensing element.
 2. Photoelectric Detectors: UL 268, consisting of LED light source and silicon photodiode receiving element.
 3. Other Detectors: Contractor's option, complying with NFPA 13 and NFPA 72.

2.11 MANUAL-RELEASE STATIONS

- A. Description: FM approved or UL listed, with "PULL STATION" caption, 120-V ac or low voltage compatible with controls, and red finish. Include contacts for connection to control panel. Unit can manually discharge extinguishing agent with operating device that remains engaged until unlocked.
 1. Mounting: **[Surface] [Semirecessed]**.

2.12 SWITCHES

- A. Description: FM approved or UL listed, where available, 120-V ac or low voltage compatible with controls. Include contacts for connection to control panel.
 1. Pressure Switches: Pneumatic operation.
 2. Transfer Switches: Key-operation selector, for transfer of release circuit signal from main supply to reserve supply.
 3. Abort Switches: Dead-man type, requiring constant pressure, for delay of system discharge.
 4. Door Closers: Magnetic retaining and release device.

2.13 ELECTRICAL POWER AND WIRING

- A. Electrical power, wiring, and devices are specified in Division 16 Sections.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with hazard-area leakage requirements, installation tolerances, and other conditions affecting work performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PIPING APPLICATIONS

- A. Flanged pipe and fittings and flanged joints may be used to connect to specialties and accessories and where required for maintenance.
- B. Fittings Working Pressure: maximum 175 psig.
- C. Flanged Joints: Class 200 minimum.
- D. **NPS 2 (DN50)** and Smaller: Copper tube; copper, solder-joint fittings; and brazed joints.
- E. **NPS 2 (DN50)** and Smaller: Black steel pipe, malleable-iron threaded fittings, and threaded joints.
- F. **NPS 2 (DN50)** and Smaller: Galvanized steel pipe, malleable-iron threaded fittings, and threaded joints.
- G. **NPS 2-1/2 and NPS 3 (DN65 and DN80)**: Copper tube; copper, solder-joint fittings; and brazed joints.
- H. **NPS 2-1/2 and NPS 3 (DN65 and DN80)**: Black steel pipe, malleable-iron threaded fittings, and threaded joints.
- I. **NPS 2-1/2 and NPS 3 (DN65 and DN80)**: Galvanized steel pipe, malleable-iron threaded fittings, and threaded joints.
- J. **NPS 2-1/2 and NPS 3 (DN65 and DN80)**: Black steel pipe; steel, grooved-end fittings; steel, keyed couplings; and grooved joints.
- K. **NPS 2-1/2 and NPS 3 (DN65 and DN80)**: Galvanized steel pipe; steel, grooved-end fittings; steel, keyed couplings; and grooved joints.
- L. **NPS 4 (DN100)** and Larger: Black steel pipe; steel, grooved-end fittings; steel, keyed couplings; and grooved joints.
- M. **NPS 4 (DN80)** and Larger: Galvanized steel pipe; steel, grooved-end fittings; steel, keyed couplings; and grooved joints.

- N. **NPS 4 (DN100)** and Larger: Black steel pipe, forged-steel welding fittings, and welded joints.

3.3 PRE-ACTION PIPING INSTALLATION

- A. Install pre-action piping and other components level and plumb and according to manufacturers' written instructions.
- B. Refer to Division 13 Section 13050 "Basic Fire Protection Materials and Methods" for basic pipe installation and joint construction.
- C. Grooved Piping Joints: Groove pipe ends according to AWWA C606 dimensions. Assemble grooved-end steel pipe and steel, grooved-end fittings with steel, keyed couplings and lubricant according to manufacturer's written instructions.
- D. Install pipe and fittings, valves, and sprinkler according to requirements listed in NFPA 13, Section "Distribution," and related Appendix.
 - 1. Install valves designed to prevent entrapment of liquid or install pressure-relief devices in valved sections of piping systems.
 - 2. Support piping using supports and methods according to NFPA 13 and Division 13 Section 13060 "Fire Protection Hangers and Supports."
 - 3. Install seismic restraints for pre-action valve and piping systems.
 - 4. Install control panels, detection system components, alarms, and accessories, complying with requirements of NFPA 70, Section "Detection, Actuation, and Control Systems," as required for supervised system application.
- E. Deluge Valve: Install trim sets for air supply, drain, priming level, alarm connections, ball drip valves, pressure gages, priming chamber attachment, and fill-line attachment.
 - 1. Air-Pressure Maintenance Devices for Dry-Pipe Systems: Install shutoff valves to permit servicing without shutting down sprinkler system; bypass valve for quick system filling; pressure regulator or switch to maintain system pressure; strainer; pressure ratings with **14- to 60-psig (95- to 410-kPa)** adjustable range; and **175-psig (1200-kPa)** maximum inlet pressure.
 - 2. Install air compressor and compressed-air supply piping.
 - 3. Install compressed-air supply piping from building compressed-air piping system.

3.4 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties. The following are specific connection requirements:
- B. Install piping adjacent to extinguishing-agent containers to allow service and maintenance.
- C. Connect electrical devices to control panel and to building's fire alarm system. Electrical power, wiring, and devices are specified in Division 13 Section 13851 "Fire Alarm."
- D. Ground electrical components.

1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.5 FIELD QUALITY CONTROL

- A. Professional Engineer: Inspect installed pre-action systems, prepare installation report, and certify that installation complies with the Contract Documents and calculations, and comments of authorities having jurisdiction.
- B. Comply with operating instructions and procedures of NFPA 13. Include the following inspections and tests to demonstrate compliance with requirements:
 1. Check mechanical items.
 2. Inspect extinguishing-agent containers and extinguishing agent, and check mountings for adequate anchoring to substrate.
 3. Check electrical systems.
 4. Perform functional predischage test.
 5. Perform system functional operational test.
 6. Check remote monitoring operations.
 7. Check control-panel primary power source.
 8. Perform "puff" test on piping system, using nitrogen.
- C. Perform field-acceptance tests of each pre-action system when installation is complete. Perform system testing only after hazard-area enclosure construction has been completed and openings sealed. Comply with operating instructions and procedures of NFPA 13. Include the following to demonstrate compliance with requirements:
 1. Perform functional predischage test.
 2. Perform system functional operational test.
 3. Check remote monitoring operations.
 4. Check control-panel primary power source.
 5. Perform pressure test on piping system.
- D. Correct malfunctioning equipment, then retest to demonstrate compliance. Replace equipment that cannot be corrected or does not perform as specified and indicated, then retest to demonstrate compliance. Repeat procedure until satisfactory results are obtained.
 1. Report test results promptly and in writing to Architect and authorities having jurisdiction.
- E. Perform the following field quality-control testing:
 1. After installing pre-action piping system and after electrical circuitry has been energized, test for compliance with requirements.
 2. Perform each visual and mechanical inspection and electrical test stated in NETA ATS, Section 7, "Inspection and Test Procedures," and Section 8, "System Function Tests." Certify compliance with test parameters.

- F. Repair or replace malfunctioning units. Retest as specified above after repairs or replacements are made.
- G. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including piping and electrical connections. Report results in writing.
 - 1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - 2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation. Remove malfunctioning units, replace with new units, and retest.
 - 3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.6 CONCRETE BASES

- A. Install concrete bases of dimensions indicated. Refer to Division 3 Section "Cast-in-Place Concrete" and Division 13 Section 13050 "General Requirements."

3.7 LABELING

- A. Install labeling on piping, equipment, and panels according to NFPA 13 and Division 13 Section 13075 "Fire Protection Identification".

3.8 COMMISSIONING

- A. Engage a factory-authorized service representative to perform startup service.
- B. Verify that pre-action system is installed and connected according to the Contract Documents.
- C. Verify that electrical wiring installation complies with the Contract Documents.
- D. Complete installation and startup checks according to manufacturer's written instructions and do the following:
 - 1. Verify that tests of piping system are complete.
 - 2. Check for complete enclosure integrity.
- E. Startup Procedures: Follow manufacturer's written procedures. If no procedures are prescribed by manufacturer, proceed as follows:
 - 1. Fill system with water and pressurize to indicated pressure.
 - 2. Energize circuits.
 - 3. Adjust operating controls.

3.9 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain system.
 - 1. Train Owner's maintenance personnel on procedures and schedules for troubleshooting, servicing, and maintaining equipment and schedules for a period of not less than one 8-hour working day.
 - 2. Review data in maintenance manuals. Refer to Division 1 Section 01770 "Closeout Procedures."
 - 3. Review data in maintenance manuals. Refer to Division 1 Section 01700 "Execution Requirements."
 - 4. Schedule training with Owner, through Architect, with at least seven days' advance notice.

3.10 SYSTEM INSTALLATION

- A. Contractor shall provide and install the following sprinkler items:
 - 1. System control valve with tamper switch;
 - 2. Deluge control valve with all trimming;
 - 3. Check valve;
 - 4. Supervisory air supply with all necessary appurtenances;
 - 5. Heat detector.
 - 6. Control panel with batteries and battery charger;
 - 7. Air pressure supply;
 - 8. Piping and piping materials, hangers and supports;
 - 9. Sprinkler heads;
 - 10. Bell/strobe and horn/strobe units.
 - 11. Power and control wiring between control panel and detectors, air compressor, all audio and visual alarms, pull stations.
 - 12. Separate pressure switch (water flow) for the each pre- action sub-system with individual connection and read-out and alarm at the building Fire Alarm system command station.
 - 13. Separate manual pull stations as indicated on the drawings for the each protected area.
 - 14. Means of testing water flow switches for the each pre-action sub-system.
 - 15. Means of testing detectors for the each pre-action sub- system.
 - 16. Means of shutting down A/C unit supplying air to protected area and all equipment within the protected area, upon actuation of any device controlling the pre-action system.
 - 17. Label all spare wires in pre-action sub-system control panel.
 - 18. All pre-action system piping shall pitch back to valve assembly (for proper drainage) in accordance with NFPA #13.
- B. The Sprinkler contractor shall engage the electrical contractor to provide and install the following electrical items:
 - 1. Uninterrupted power supply to pre-action system control panel and air compressor;

2. Feed to panel to be 120 VAC, 60 HZ., single phase from line side of local floor panel with battery backup on constant trickle charge provided in control unit through an approved, lockable fuse cutout with a solid copper neutral.
 3. All control and alarm wiring between pre-action system control panel and building Fire Alarm panel. Interconnection to building Fire Alarm system shall be coordinated with building engineer and vendor of building system;
 4. Separate fuse cut-out box with solid removable copper bar for each pre-action system. Fuse cutout shall be painted Fire Department red and permanently and properly labeled;
 5. Separate #10 green ground wire from building main water pipe or building structural member for each Firecycle system control panel;
 6. Electrical contractor shall file his portion of the work with all local authority having jurisdiction.
 7. No conduit or wire may enter top of control panel.
 8. All wiring shall be type THWR or THWN in rigid threaded conduit in strict compliance with all codes of authorities having jurisdiction.
 9. All field device wiring shall be series parallel loop. No parallel branching (tee tapping) is permitted.
- C. The sprinkler contractor shall coordinate with the plumbing contractor for location and installation of funnel or floor drains for proper drainage and testing of pre-action valve assembly.

END OF SECTION 13970

**NEW PASSENGER TERMINAL
DULUTH INTERNATIONAL AIRPORT
DULUTH, MINNESOTA**

SECTION 13975 - STANDPIPES AND HOSES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes piping and equipment for the following building systems:
 - 1. Standpipes, combined (sprinkler and standpipe) risers and cross mains.

1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Related Sections include the following:
 - 1. Division 2 Section 02510 "Water Distribution".
 - 2. Division 7 Section 07270 "Firestopping".
 - 3. Division 9 Section 09910 "Painting".
 - 4. Division 13 Section 13050 "Fire Protection General Requirements".
 - 5. Division 13 Section 13060 "Fire Protection Hangers and Supports".
 - 6. Division 13 Section 13075 "Fire Protection Identification".
 - 7. Division 13 Section 13520 "Fire-Protection Cabinets".
 - 8. Division 13 Section 13915 "Fire Protection Suppression Piping".
 - 9. Division 13 Section 13921 "Fire Protection Horizontal Fire Pumps."
 - 10. Division 16 Section "Fire Alarm Systems" for alarm devices not in this Section.

1.3 DEFINITIONS

- A. Hose Connection: Valve with threaded outlet matching fire hose coupling thread for attaching fire hose.
- B. Hose Station: Hose connection, fire hose rack, and fire hose.
- C. Automatic: As applied to fire protection devices, is a device or system providing an emergency function without the necessity for human intervention and activated as a result of a predetermined temperature rise, rate of temperature rise, or combustion products.

- D. **Automatic Sprinkler System:** A sprinkler system, for fire protection purposes, is an integrated system of underground and overhead piping designed in accordance with fire protection engineering standards. The system includes a suitable water supply. The portion of the system above the ground is a network of specially sized or hydraulically designed piping installed in a structure or area, generally overhead, and to which automatic sprinklers are connected in a systematic pattern. The system is usually activated by heat from a fire and discharges water over the fire area.
- E. **Deluge System:** A sprinkler system employing open sprinklers attached to a piping system connected to a water supply through a valve that is opened by the operation of a detection system installed in the same areas as the sprinklers. When this valve opens, water flows into the piping system and discharges from all sprinklers attached thereto.
- F. **Detector, Heat:** A fire detector that senses heat produced by burning substances. Heat is the energy produced by combustion that causes substances to rise in temperature
- G. **Fire Protection System:** Approved devices, equipment and systems or combinations of systems used to detect a fire, activate an alarm, extinguish or control a fire, control or manage smoke and products of a fire or any combination thereof.
- H. **Initiating Device:** A system component that originates transmission of a change-of-state condition, such as in a smoke detector, manual fire alarm box, or supervisory switch.
- I. **Listed:** Equipment, materials or services included in a list published by an organization acceptable to the code enforcement official and concerned with evaluation of products or services that maintains periodic inspection of production of listed equipment or materials or periodic evaluation of services and whose listing states either that the equipment, material or service meets identified standards or has been tested and found suitable for a specified purpose
- J. **Record Drawings:** Drawings ("as built") that document the location of all devices, appliances, wiring, sequences, wiring methods, and connections of the components of a fire alarm system as installed.
- K. **Smokeproof Enclosure:** An exit stairway designed and constructed so that the movement of the products of combustion produced by a fire occurring in any part of the building into the enclosure is limited.
- L. **Standpipe System, Classes of:** Standpipe classes are as follows:
 - 1. **Class I system.** A system providing 2.5-inch (64 mm) hose connections to supply water for use by fire departments and those trained in handling heavy fire streams.
 - 2. **Class II system.** A system providing 1.5-inch (38 mm) hose stations to supply water for use primarily by the building occupants or by the fire department during initial response.
 - 3. **Class III system.** A system providing 1.5-inch (38 mm) hose stations to supply water for use by building occupants and 2.5-inch (64 mm) hose connections to supply a larger volume of water for use by fire departments and those trained in handling heavy fire streams.
- M. **Standpipe, Types of:** Standpipe types are as follows:

1. Automatic dry. A dry standpipe system, normally filled with pressurized air, that is arranged through the use of a device, such as a dry pipe valve, to admit water into the system piping automatically upon the opening of a hose valve. The water supply for an automatic dry standpipe system shall be capable of supplying the system demand.
2. Automatic wet. A wet standpipe system that has a water supply that is capable of supplying the system demand automatically.
3. Manual dry. A dry standpipe system that does not have a permanent water supply attached to the system. Manual dry standpipe systems require water from a fire department pumper to be pumped into the system through the fire department connection in order to supply the system demand.
4. Manual wet. A wet standpipe system connected to a water supply for the purpose of maintaining water within the system but which does not have a water supply capable of delivering the system demand attached to the system. Manual wet standpipe systems require water from a fire department pumper (or the like) to be pumped into the system in order to supply the system demand.
5. Semiautomatic dry. A dry standpipe system that is arranged through the use of a device, such as a deluge valve, to admit water into the system piping upon activation of a remote control device located at a hose connection. A remote control activation device shall be provided at each hose connection. The water supply for a semiautomatic dry standpipe system shall be capable of supplying the system demand.

- N. Working Plans: Documents, including drawings, calculations, and material specifications prepared according to Local Code and NFPA 14 for obtaining approval from authorities having jurisdiction.

1.4 SYSTEM PERFORMANCE REQUIREMENTS

- A. Design standpipes and obtain approval from authorities having jurisdiction. Include minimum residual pressures at hydraulically remote outlets according to the following:
1. NPS 2-1/2 (DN65) Hose Connections: 120 psig (704 kPa).
- B. Components and Installation: Capable of producing piping systems with 175-psig (1200-kPa) minimum working-pressure rating, unless otherwise indicated, or required by Local Code.

1.5 SUBMITTALS

- A. Product Data: In addition to the requirements of Division 13, Section 13050 "Fire Protection General Requirements", and other applicable sections, provide the following:
1. Pipe and fitting materials and methods of joining for standpipe piping.
 2. Pipe hangers, supports, and restraints. Include calculations and loading criteria.
 3. Valves, including specialty valves, accessories, and devices.
 4. Alarm devices. Include electrical data.
 5. Air compressors. Include electrical data.

6. Fire department connections. Include type; number, size, and arrangement of inlets; caps and chains; size and direction of outlet; escutcheon and marking; and finish.
 7. Hose connections. Include size, type, and finish.
 8. Hose stations. Include size, type, and finish of hose connections; type and length of fire hoses; finish of fire hose couplings; type, material, and finish of nozzles; and finish of rack.
- B. Fire-Hydrant Flow Test Report: As specified in Division 13 Section 13050 "Fire Protection General Requirements".
 - C. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 14. Include "Contractor's Material and Test Certificate for Aboveground Piping" and "Contractor's Material and Test Certificate for Underground Piping."
 - D. Product Requirement: For each type of standpipe specialty to include in maintenance manuals specified in Division 1 Section 01600 and Division 13 Section 13050.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has designed and installed fire-suppression piping similar to that indicated for this Project and obtained design approval and inspection approval from authorities having jurisdiction.
- B. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified professional engineer. Base calculations on results of fire-hydrant flow test.
- C. 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 fire-suppression piping that are similar to those indicated for this Project in material, design, and extent.
- D. Manufacturer Qualifications: Firms whose equipment, specialties, and accessories are listed by product name and manufacturer in UL's "Fire Protection Equipment Directory" and FM's "Fire Protection Approval Guide" and that comply with other requirements indicated.
- E. Standpipe Components: Listing/approval stamp, label, or other marking by a testing agency acceptable to authorities having jurisdiction.
- F. Electrical Components, Devices, and Accessories: Listed and labeled as required by Local Code and as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.
- G. NFPA Standard: Equipment, specialties, accessories, installation, and testing complying with NFPA 14, "Standpipe and Hose Systems."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Refer to Section 13915 "Fire Protection Suppression Piping".
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Backflow Preventors/Double Check Valves
 - a. Febco.
 - b. Watts Regulator Co.
 - c. Wilkins Regulator Div. Zurn Industries, Inc.
 - 2. Specialty Valves and Devices:
 - a. Badger Fire Protection, Inc.
 - b. Tyco Sprinkler Corp.
 - c. Firematic Sprinkler Devices, Inc.
 - d. Globe Fire Sprinkler Corp.
 - e. Grinnell Corp.
 - f. Reliable Automatic Sprinkler Co., Inc.
 - g. Viking Corp.

2.2 PIPING MATERIALS

- A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.

2.3 PIPES AND TUBES

- A. Refer to Section 13915 "Fire Protection Suppression Piping".

2.4 PIPE AND TUBE FITTINGS

- A. Refer to Section 13915 "Fire Protection Suppression Piping".

2.5 JOINING MATERIALS

- A. Refer to Section 13915 "Fire Protection Suppression Piping".

2.6 GENERAL-DUTY VALVES

- A. Refer to Division 13 Section Refer to Section 13053 “Fire Protection General Materials and Methods” for gate, ball, butterfly, globe, and check valves not required to be UL listed and FM approved.

2.7 FIRE-PROTECTION-SERVICE VALVES

- A. Refer to Section 13915 “Fire Protection Suppression Piping”.
- B. General: UL listed and FM approved, with minimum nonshock working-pressure rating of 175-psig (1200-kPa) or as required, by Local Code.
- C. Riser and Sectional Control Valves, NPS 2-1/2 (DN65) and Larger: UL 262, Type I [Class 175] [Class 300] [Class 500] iron body, OS&Y rising stem or other positive indicator. Provide tamper switch.
- D. Provide supervisory tamper switches on all control valves.

2.8 SPECIALTY VALVES

- A. Refer to Section 13915 “Fire Protection Suppression Piping”.
- B. Ball Drip Valves: UL 1726, automatic drain valve, NPS 3/4 (DN20), ball check device with threaded ends.
- C. Backflow Prevention: Provide in accordance with Section 13053 “Basic Fire Protection Materials and Methods”.

2.9 MANUAL CONTROL STATIONS

- A. Manual Control Stations: Hydraulic operation, with union, NPS 1/2 (DN15) pipe nipple, and bronze ball valve. Include metal enclosure labeled "MANUAL CONTROL STATION" with operating instructions and cover held closed by breakable strut to prevent accidental opening.

2.10 HOSE CONNECTIONS

- A. Description: UL 668, 300-psig (2070-kPa) minimum pressure rating, brass, hose valve for connection of fire hose. Include 90-degree angle pattern design; female NPS inlet and male hose outlet; and lugged cap, gasket, and chain. Include NPS 1-1/2 or NPS 2-1/2 (DN40 or DN65) as indicated, and hose valve threads according to NFPA 1963 and matching local fire department threads.
 1. Valve Operation: Nonadjustable type, or pressure-regulating type as indicated.
 2. Finish: Rough brass.

2.11 HOSE STATIONS

A. Description: UL 47, semiautomatic hose stations. Include brass, rack nipple; hose rack; and the following features:

1. Valves: UL 668, **300-psig (2070-kPa)** minimum pressure rating, 90-degree angle pattern hose valve with female NPS inlet and outlet, unless otherwise indicated.
 - a. Valve Operation: Nonadjustable type, or pressure-regulating type as indicated.
2. Threads and Gaskets: NFPA 1963 and matching local fire department threads.
3. Flow-Restricting Devices: **NPS 1-1/2 (DN40)** brass, adjustable for **NPS 1-1/2 (DN40)** fire hose inlet.
4. Fire Hose: NFPA 1961 and UL 219, lined fire hose with couplings, gaskets, and nozzle. Include the following fire hose materials:
 - a. Jacket: Natural, synthetic, or combination of natural and synthetic threads.
 - b. Lining: Rubber, plastic, or combination of rubber and plastic compounds.
 - c. Cover: Rubber, plastic, or combination of rubber and plastic compounds.
5. Nozzles: UL 401.
6. Drain Valves: UL 1726.
7. Mountings: Pipe clamp or wall bracket for freestanding units.
8. Mountings: Pipe escutcheon for cabinet-mounted units.

B. **NPS 2-1/2 by NPS 1-1/2 (DN65 by DN40)** Hose Stations: **NPS 2-1/2 (DN65)** hose valve; **NPS 2-1/2 by NPS 1-1/2 (DN65 by DN40)** reducer adapter; hose rack with water-retention device and pins for folded, **NPS 1-1/2 (DN40)** lined hose; **NPS 1-1/2 (DN40)** lined hose with swivel inlet coupling and nozzle; and reducer adapter spanner wrench.

1. Hose-Rack Finish: Red enamel.
2. Hose Valve and Trim Finish: Rough brass.
3. Fire Hose: Lined, **50-foot (15-m)** length.
4. Fire Hose: Lined, **75-foot (23-m)** length.
5. Fire Hose: Lined, **100-foot (30-m)** length.
6. Nozzle: Brass, adjustable from shutoff to fog spray or straight stream.
7. Nozzle: Polycarbonate plastic, plain type.
8. Nozzle: Brass, plain type.

C. **NPS 1-1/2 (DN40)** Hose Stations: **NPS 1-1/2 (DN40)** hose valve; hose rack with water-retention device and pins for folded, **NPS 1-1/2 (DN40)** lined hose; and **NPS 1-1/2 (DN40)** lined hose with swivel inlet coupling and nozzle.

1. Hose-Rack Finish: Red enamel.
2. Hose Valve and Trim Finish: Rough brass.
3. Fire Hose: Lined, **50-foot (15-m)** length.
4. Fire Hose: Lined, **75-foot (23-m)** length.
5. Fire Hose: Lined, **100-foot (30-m)** length.
6. Nozzle: Brass, adjustable from shutoff to fog spray or straight stream.
7. Nozzle: Polycarbonate plastic, plain type.

8. Nozzle: Brass, plain type.
9. Nozzle: Brass, adjustable fog; for use on electrical fires.

D. NPS 2-1/2 (DN65) Hose Station: NPS 2-1/2 (DN65) hose valve with male threaded outlet, cap, and chain.

1. Hose Valve and Trim Finish: Rough brass.

2.12 ROOF HOSE CABINETS

A. Description: FM-approved, low-profile-type, hose station for roof mounting. Include the following:

1. Housing: Sheet-steel construction with steel reinforcement and modified to hold not less than length of fire hose indicated.
2. Shutoff Valve: NPS 1-1/2 (DN40) gate valve with extended stem.
3. Hose Connection: NPS 1-1/2 (DN40) valve.
4. Fittings: Brass.
5. Hose: NPS 1-1/2 (DN40), lined and suitable for exterior service. Include two 75-foot (23-m) lengths coupled together.
6. Nozzle: NPS 1-1/2 (DN40) brass, adjustable from shutoff to fog spray or straight stream.
7. Nozzle: Brass, adjustable-fog type.
8. Drain Valve: NPS 1/2 (DN15) gate valve with extended stem.
9. Finish: Red enamel paint.
10. Roof Curb: Matching housing dimensions.
11. Mounting Materials: Structural steel and wood blocking as recommended in writing by manufacturer.

2.13 WALL FIRE HYDRANTS

A. Description: Cast-brass body with brass, wall, escutcheon plates; brass, lugged caps with gaskets and brass chains; and brass, lugged swivel connections. Include outlets with threads according to NFPA 1963 and matching local fire department sizes and threads, inlet with pipe threads, extension pipe nipple, and valve control.

1. Type: Flush mounting.
2. Type: Exposed, projecting mounting.
3. Escutcheon Plates: Round.
4. Escutcheon Plates: Square or rectangular.
5. Finish: Polished chrome-plated.
6. Finish: Rough chrome-plated.
7. Finish: Polished brass.
8. Hydrant, Escutcheon-Plate Marking: "HYDRANT."
9. Hydrant, Valve Control: Wall-mounting assembly with extension rod for manual control of valve inside building.
10. Hydrant, Valve Escutcheon Plate Marking: "HYDRANT VALVE CONTROL."

2.14 FIRE DEPARTMENT CONNECTIONS

- A. Wall, Fire Department Connections: UL 405; cast-brass body with brass, wall, escutcheon plate; brass, lugged caps with gaskets and brass chains; and brass, lugged swivel connections. Include inlets with threads according to NFPA 1963 and matching local fire department sizes and threads, outlet with pipe threads, extension pipe nipples, check devices or clappers for inlets, and escutcheon plate with marking "STANDPIPE AND/OR SPRINKLER/STANDPIPE."
 - 1. Type: Flush mounting.
 - 2. Type: Exposed, projecting mounting.
 - 3. Escutcheon Plate: Round.
 - 4. Escutcheon Plate: Square.
 - 5. Escutcheon Plate: Rectangular.
 - 6. Finish: Polished chrome-plated.
 - 7. Finish: Rough chrome-plated.
 - 8. Finish: Polished brass.
- B. Exposed, Freestanding, Fire Department Connections: UL 405, cast-brass body, inlets with threads according to NFPA 1963 and matching local fire department sizes and threads, and bottom outlet with pipe threads. Include brass, lugged caps, gaskets, and brass chains; brass, lugged swivel connection and drop clapper for each hose-connection inlet; 18-inch- (460-mm-) high brass sleeve; and round, floor, brass, escutcheon plate with marking "STANDPIPE AND/OR SPRINKLER."
 - 1. Finish Including Sleeve: Polished chrome-plated.
 - 2. Finish Including Sleeve: Rough chrome-plated.
 - 3. Finish Including Sleeve: Polished brass.

2.15 PRESSURE GAGES

- A. Pressure Gages: UL 393, 3-1/2- to 4-1/2-inch- (90- to 115-mm-) diameter dial with dial range of 0 to 250 psig (0 to 1725 kPa) or two time (2x) the operating pressure.

2.16 CONTROL PANELS

- A. Description: Single-area, two-area, or single-area cross-zoned type as indicated. Control panel includes NEMA ICS 6, Type 1 enclosure, detector, alarm, and solenoid-valve circuitry for operation of deluge valves. Panels contain power supply; battery charger; standby batteries; field-wiring terminal strip; electrically supervised solenoid valves and polarized fire alarm bell; lamp test facility; single-pole, double-throw auxiliary alarm contacts; and rectifier.
 - 1. Panels: UL listed and FM approved when used with thermal detectors and Class A detector circuit wiring. Electrical characteristics are 120-V ac, 60 Hz, with 24-V dc rechargeable batteries.

2. Manual Control Stations: Electric operation, metal enclosure, labeled "MANUAL CONTROL STATION" with operating instructions and a cover held closed by breakable strut.
3. Manual Control Stations: Hydraulic operation, with union, NPS 1/2 (DN15) pipe nipple, and bronze ball valve. Include metal enclosure labeled "MANUAL CONTROL STATION" with operating instructions and a cover held closed by breakable strut.

2.17 DRIP PANS

- A. Examine the drawings and in cooperation with the Electrical Trade confirm the final location of all electrical equipment to be installed in the vicinity of piping. Plan and arrange all overhead piping no closer than two feet from a vertical line to electric motors and controllers, switchboards, panelboards, or similar equipment.
- B. Where the installation of piping does not comply with the requirements of foregoing paragraph. Furnish gutters as follows:
 1. Provide and erect a gutter 18 gauge galvanized steel, under every pipe which is within 2'-0" from a vertical line to any motor, electrical controllers, switchboards, panelboards, or the like.
 2. Each gutter shall be reinforced, rimmed, soldered and made watertight, properly suspended and carefully pitched to a convenient point for draining. Provide a 3/4" drain, with valve as directed, to nearest floor drain or slop sink, as approved.
 3. In lieu of such separate gutters, a continuous protecting sheet of similar construction adequately supported and braced, properly rimmed, pitched and drained, may be provided over any such motor, and extending 2'-0" in all directions beyond the motor, over which such piping has to run.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Perform fire-hydrant flow test according to NFPA 291. Use results for system design calculations required in "Quality Assurance" Article in Part 1 of this Section.
- B. Report test results promptly and in writing.

3.2 EARTHWORK

- A. Refer to Division 2 Section 02300 "Earthwork" for excavating, trenching, and backfilling.

3.3 EXAMINATION

- A. Examine roughing-in for hose connections and stations to verify actual locations of piping connections before installation.
- B. Examine walls and partitions for suitable thickness, fire- and smoke-rated construction, framing for hose-station cabinets, and other conditions where hose connections and stations are to be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.4 PIPING APPLICATIONS

- A. Do not use welded joints with galvanized steel pipe.
- B. Flanges, unions, and transition and special fittings with pressure ratings the same as or higher than system's pressure rating may be used in aboveground applications, unless otherwise indicated.
- C. Piping between Fire Department Connections and Check Valves: Use galvanized, standard-weight steel pipe with threaded ends; cast- or malleable-iron threaded fittings; and threaded joints.
- D. Piping between Fire Department Connections and Check Valves: Use galvanized, standard-weight steel pipe with grooved ends; steel, grooved-end fittings; steel, keyed couplings; and grooved joints.
- E. Underground Service-Entrance Piping: Use ductile-iron, push-on-joint pipe and fittings and restrained joints.
- F. Underground Service-Entrance Piping: Use ductile-iron, mechanical-joint pipe and fittings and restrained joints.
- G. Underground Service-Entrance Piping: Use ductile-iron, grooved-end pipe and fittings; ductile-iron, keyed couplings; and grooved joints.
- H. Standpipes: For applications up to 350 psi: Non-Shock Working Pressure: Use the following:
 - 1. **NPS 12 (DN300)** and Smaller: Standard-weight steel pipe with
 - a. threaded ends, cast- or malleable-iron threaded fittings, and threaded joints.
 - b. grooved ends; steel, grooved-end fittings; steel, keyed couplings; and grooved joints.
 - c. plain ends, steel welding fittings, and welded joints.
 - 2. **NPS 12 (DN300)** and Smaller: Galvanized, standard-weight steel pipe with
 - a. threaded ends; cast- or malleable-iron threaded fittings; and threaded joints.
 - b. grooved ends; steel, grooved-end fittings; steel, keyed couplings; and grooved joints.

3. **NPS 4 (DN100)** and Smaller: Schedule 30 steel pipe with
 - a. threaded ends, cast- or malleable-iron threaded fittings, and threaded joints.
 - b. roll-grooved ends; steel, grooved-end fittings; steel, keyed couplings; and grooved joints.
 - c. plain ends, steel welding fittings, and welded joints.
4. **NPS 10 (DN250)** and Smaller: Schedule 10 steel pipe with
 - a. roll-grooved ends; steel, grooved-end fittings; and grooved joints.
 - b. plain ends, steel welding fittings, and welded joints.
5. **NPS 6 (DN150)** and Smaller: **Type K (Type A)** or **Type L (Type B)** copper tube with roll-grooved ends; copper, grooved-end fittings; copper, keyed couplings; and grooved joints or **Type K (Type A)** or **Type L (Type B)** copper tube with expanded and roll-grooved ends; copper fittings with expanded and roll-grooved ends; steel, keyed couplings; and grooved joints.
6. **NPS 6 (DN150)** and Smaller: **Type K (Type A)** or **Type L (Type B)** copper tube with plain ends, wrought-copper fittings, and brazed joints.

3.5 VALVE APPLICATIONS

- A. Refer to Section 13915 "Fire Protection Suppression Piping".
- B. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
 1. Fire-Protection-Service Valves: UL listed and FM approved for applications where required by NFPA 14 or Local Code.
 - a. Shutoff Duty: Use gate valves.
 2. General-Duty Valves: For applications where UL-listed and FM-approved valves are not required by NFPA 14 or Local Code.
 - a. Shutoff Duty: Use gate, ball, or butterfly valves.
 - b. Throttling Duty: Use globe, ball, or butterfly valves.

3.6 JOINT CONSTRUCTION

- A. Refer to Division 13 Section 13053 "Fire Protection General Materials and Methods" for basic piping joint construction.
- B. Use gaskets listed for dry-pipe service for dry piping.
- C. Dissimilar-Piping-Material Joints: Construct joints using adapters or couplings compatible with both piping materials. Use dielectric fittings if both piping materials are metal. Refer to Division 13 Section 13053 "Fire Protection General Materials and Methods" for dielectric fittings.

3.7 SERVICE-ENTRANCE PIPING

- A. Connect standpipe piping to water-service piping of size and in location indicated for service entrance to building. Refer to Division 2 Section "Water Distribution" for exterior piping.
- B. Install shutoff valve, backflow preventer, pressure gage, drain, and other accessories indicated at connection to water-service piping. Refer to Division 2 Section "Water Distribution" for backflow preventers.
- C. Install shutoff valve, check valve, pressure gage, drain, and other accessories at connection to water service.

3.8 WATER-SUPPLY CONNECTION

- A. Connect standpipe piping to building interior water distribution piping. Refer to Division 15 Section "Water Distribution Piping" for interior piping.
- B. Install shutoff valve, check valve, pressure gage, drain, and other accessories at connection to water service.

3.9 PIPING INSTALLATION

- A. Refer to Division 13 Section 13053 "Fire Protection General Materials and Methods" for basic piping installation.
- B. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated, as far as practical.
 - 1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.
- C. Install underground service-entrance piping according to the Requirements of the Authority having Jurisdiction, NFPA 24 and Section 13053 with restrained joints.
- D. Use approved fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.
- E. Install drain valves on standpipes.
- F. Install ball drip valves to drain piping between fire department connections and check valves. Drain to floor drain or outside building as indicated on drawings.
- G. Install alarm devices in piping systems.
- H. Hangers and Supports: Comply with Section 13060, "Fire Protection Hangers and Supports" for hanger materials.

- I. Install piping with grooved joints according to manufacturer's written instructions. Construct rigid piping joints, unless otherwise indicated.
- J. Install pressure gages on riser or feed main, at each sprinkler test connection, and at top of each standpipe. Include pressure gages with connection not less than **NPS 1/4 (DN8)** and with soft metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they will not be subject to freezing.

3.10 VALVE INSTALLATION

- A. For installing general-duty valves. Install fire-protection specialty valves, trim, fittings, controls, and specialties according to Local Code, NFPA 13 and NFPA 14, manufacturer's written instructions, and authorities having jurisdiction.
- B. Gate Valves: Install fire-protection-service valves supervised-open, located to control sources of water supply except from fire department connections. Provide permanent identification signs indicating portion of system controlled by each valve.
- C. Valves for Wall Fire Hydrants: Install gate valve with nonrising stem in supply pipe.
- D. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water supply sources.
- E. Dry-Pipe Valves: Install trim sets for air supply, drain, priming level, alarm connections, ball drip valves, pressure gages, priming chamber attachment, and fill-line attachment.
 - 1. Air-Pressure Maintenance Devices for Dry-Pipe Systems: Install shutoff valves to permit servicing without shutting down sprinkler system; bypass valve for quick system filling; pressure regulator or switch to maintain system pressure.
 - 2. Install air compressor and compressed-air supply piping.
 - 3. Install compressed-air supply piping from building compressed-air piping system.
- F. Deluge Valves: Install in vertical position, in proper direction of flow, in main supply to deluge system.
- G. Provide equalizing bypass for control valves 6" and larger.

3.11 HOSE-CONNECTION INSTALLATION

- A. Install hose connections adjacent to standpipes, unless otherwise indicated.
- B. Install hose connections to provide maximum access and minimum passage restriction.
- C. Install **NPS 1-1/2 (DN40)** hose-connection valves with pressure regulating device, unless otherwise indicated.
- D. Install **NPS 2-1/2 (DN65)** hose connections with **NPS 2-1/2 by NPS 1-1/2 (DN65 to DN40)** reducer adapter and pressure regulating device, unless otherwise indicated.

- E. Install wall-mounting-type hose connections in cabinets. Include pipe escutcheons, with finish matching valves, inside cabinet where water-supply piping penetrates cabinet. Install valves at angle required for connection of fire hose.

3.12 HOSE-STATION INSTALLATION

- A. Comply with the requirements of Sub-Section 3.11 "Hose Connection Installation".
- B. Install hose stations with support or bracket attached to standpipe or substrate.
- C. Install wall-mounting, rack-type hose stations in cabinets. Include pipe escutcheons, with finish matching valves, inside cabinet where water-supply piping penetrates cabinet. Install valves at angle required for connection of fire hose. Cabinets are specified in Division 13 Section 13520 "Fire-Protection Cabinets".
- D. Install hose-reel hose stations on wall with bracket attached to suitable structural support.

3.13 ROOF HOSE CABINET INSTALLATION

- A. Install cabinets according to manufacturer's written instructions.

3.14 CONNECTIONS

- A. Connect water-supply piping and standpipes to fire pumps. Include backflow preventers.
- B. Connect water supplies to standpipes. Include backflow preventers.
- C. Install ball drip valves at each check valve for fire department connection. Drain to floor drain or outside building.
- D. Connect piping to specialty valves, hose valves, specialties, fire department connections, and accessories.
- E. Electrical Connections: Power wiring is specified in Division 16.
- F. Connect alarm devices to fire alarm.
- G. Connect compressed-air supply to dry-pipe valve.
- H. Connect air compressor to the following piping and wiring:
 - 1. Pressure gages and controls.
 - 2. Electrical power system.
 - 3. Fire alarm system devices, including low-pressure alarm.

3.15 LABELING AND IDENTIFICATION

- A. Install labeling and pipe markers on equipment and piping according to Local Code requirements and requirements of NFPA 14, and Division 13 Section 13075 "Fire Protection Identification."

3.16 FIELD QUALITY CONTROL

- A. Flush, test, and inspect standpipes according to Local Code and NFPA 14, "Tests and Inspection" Chapter.
- B. Replace piping system components that do not pass test procedures and retest to demonstrate compliance. Repeat procedure until satisfactory results are obtained.
- C. Report test results promptly and in writing to Architect and authorities having jurisdiction.

3.17 COMMISSIONING

- A. Verify that specialty valves, trim, fittings, controls, and accessories are installed and operate correctly.
- B. Verify that air compressors and their accessories are installed and operate correctly.
- C. Verify that specified tests of piping are complete.
- D. Verify that potable-water supplies have correct types of backflow preventers.
- E. Verify that hose connections and fire department connections have threads compatible with local fire department equipment.
- F. Drain dry-type standpipe piping.
- G. Pressurize and check dry-pipe valve air-pressure maintenance devices and air compressors.
- H. Fill wet-pipe standpipe piping with water. Restrict flow rate to prevent water hammer or other hydraulic shock to systems.
- I. Verify that hose connections and stations are correct type and size.
- J. Energize circuits to electrical equipment and devices.
- K. Start and run air compressors.
- L. Adjust operating controls and pressure settings.
- M. Coordinate with fire alarm tests. Operate as required.
- N. Coordinate with fire-pump tests. Operate as required.

3.18 DEMONSTRATION

- A. Demonstrate equipment, specialties, and accessories. Review operating and maintenance information.
- B. Schedule demonstration with Owner with at least seven days' advance notice.

END OF SECTION 13975

**NEW PASSENGER TERMINAL
DULUTH INTERNATIONAL AIRPORT
DULUTH, MINNESOTA**

**SECTION 14240 - HYDRAULIC
ELEVATORS**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This section includes hydraulic passenger elevators.
 - 1. Engineering, equipment, labor and permits required to satisfactorily complete elevator installation as required by contract documents.
 - 2. Hydraulic elevator system: hydraulic elevators with double and single entrances.
 - 3. Standard elevator car enclosures, hoistway entrances and signal equipment
 - 4. Motor and pump, jack(s), operation and control systems, hoistway equipment, and accessories as required to complete the elevator installation.
 - 5. Accessibility provisions for physically disabled persons.
 - 6. Maintenance service as described herein.
- B. Related Sections: The following sections contain requirements that relate to this section:
 - 1. Section 05500 "Metal Fabrications" for the following:
 - a. Attachment plates and angle brackets for supporting guide-rail brackets.
 - b. Hoist beams.
 - c. Structural-steel shapes for subsills.
 - d. Pit ladders.
 - e. Cants in hoistways made from steel sheet.
 - 2. Section 05700 "Ornamental Metal" for combination hall push-button stations.
 - 3. Division 9 Finishes: Providing elevator car finish flooring and field painting unfinished and shop primed ferrous materials.
 - 4. Ventilation of hoistway(s) and machine room(s) is specified in Division 15.
 - 5. Section 15240 "Vibration Control" for vibration isolation.
 - 6. Electrical service to each elevator, including fused disconnect switch, is specified in Division 16 sections.

1.3 DEFINITIONS

- A. Hydraulic elevators are hereby defined to include systems in which cars are hoisted either directly or indirectly by action of a hydraulic plunger and cylinder (jack); with other components of the work including fluid storage tank, pump, piping, valves, car enclosures, hoistway entrances, control systems, signal equipment, guide rails, electrical wiring, roping, buffers, and devices for

operating, dispatching, safety, security, leveling, alarm, maintenance, and similar required performances and capabilities.

- B. Definitions in ASME A17.1/CSA B44 apply to work of this Section.
- C. Service Elevator: A passenger elevator that is also used to carry freight.

1.4 REFERENCES:

- A. ADAAG - Americans with Disabilities Act Accessibility Guidelines.
- B. AISC - Design, Fabrication and Erection of Structural Steel for Buildings.
- C. ANSI A117.1 - Buildings and Facilities - Providing Accessibility and Usability for Physically Handicapped People.
- D. ANSI/ASME A17.1 - Safety Code for Elevators and Escalators, latest edition or as required by the local authority having jurisdiction.
- E. ANSI/ASME A17.2 - Inspector's Manual For Elevators and Escalators 1996 Edition.
- F. ANSI/ASME A17.5 - Elevator and Escalator electrical Equipment.
- G. ANSI/AWS D1.1 - Structural Welding Code, Steel.
- H. ANSI/NFPA 70 - National Electrical Code.
- I. ANSI/NFPA 80 - Fire Doors and Windows.
- J. ANSI/UL 10B - Fire Tests of Door Assemblies.
- K. APA - American Plywood Association.
- L. ASTM A 36 - Structural Steel.
- M. ASTM A 53 - Pipe, Steel, Black and Hot Dipped Zinc-Coated, Welded and Seamless.
- N. ASTM A139- Electric-Fusion (ARC)-Welded Steel Pipe (NPS 4-in. and Over).
- O. ASTM A 167 - Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
- P. ASTM A 366 - Steel, Sheet, Carbon, Cold-Rolled, Commercial Quality.
- Q. ASTM A 446 - Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Structural (Physical) Quality.
- R. ASTM B 221 - Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes.
- S. NEMA LD3 - High Pressure Decorative Laminates.

- T. NEMA MG1 - Motors and Generators.
- U. NFPA 101 Life Safety Code.
- V. Steel Structures Painting Council (SSPC) - Steel Structures Painting Manual.

1.5 SYSTEM PERFORMANCE REQUIREMENTS

- A. Elevator schedule indicates required performances, controls, capacities, features, and finishes for each elevator or group of elevators and are included at end of this section.

1.6 ACTION SUBMITTALS

- A. Product Data for each principal component or product of each elevator, including certified test reports on required testing. Indicate capacities, sizes, performance and operating characteristics, features of control system, finishes, and similar information. Indicate any variations from specified requirements, maximum dynamic and static loads imposed on building structure at points of support, and locations of signals. Include maximum and average power demands.
- B. Shop Drawings:
 - 1. Include dimensioned drawings showing plans, elevations, sections and large-scale details indicating service at each landing, coordination with building structure and relationships with other construction, locations of equipment and details of car enclosures and hoistway entrances.
 - a. Complete Shop Drawings of elevator car enclosures, showing details of construction and location of signal and car equipment.
 - b. Complete Shop Drawings of elevator hoistway entrances and doors, showing method of operation, details of construction, and method of fastening to structural members.
 - 2. Include elevating diagrams to indicate elevator service to each level. Illustrate clearly connection of rail supports to building structure.
 - 3. Submit layout of graphics components for coordination by the Architect.
 - 4. Submission of manufacturer's "generic" non-project-specific shop drawings, not showing actual project hoistways will be considered nonresponsive and returned.
- C. Samples for Initial Selection: For finishes involving color selection.
- D. Samples for Verification: For exposed car, hoistway door and frame, and signal equipment finishes; 4-inch-square Samples of sheet materials; and 8-inch lengths of running trim members.
- E. Wiring diagram detailing wiring for power, signal and control systems differentiating clearly between manufacturer-installed wiring and field-installed wiring. Indicate maximum and average power demands. Each device on wiring diagram shall be properly identified by name, letter, or standard symbol identical with markings on devices or controller panel.

1.7 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.

- B. Manufacturer Certificates: Signed by elevator manufacturer certifying that hoistway, pit, and machine room layout and dimensions, as shown on Drawings, and electrical service, as shown and specified, are adequate for elevator system being provided.
- C. Sample Warranty: For special warranty.

1.8 CLOSEOUT SUBMITTALS

- A. Maintenance Manuals: Bound manual for elevator, with operating and maintenance instructions, parts listing, recommended parts inventory listing, purchase source listing for major and critical components, emergency instructions, and similar information.
- B. Inspection and Acceptance Certificates and Operating Permits: As required by authorities having jurisdiction for normal, unrestricted elevator use.

1.9 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Fabrication of hydraulic elevators shall be performed only by a qualified fabricator. The term qualified means experienced in performing the Work required by this section. The qualified fabricator shall have experience on Projects similar in size and scope to this Project. The fabricator shall submit evidence of such qualifications upon request.
- B. Installer Qualifications: Elevator manufacturer or an authorized representative who is trained and approved by manufacturer and who has completed elevator installations similar in material, design, and extent to that indicated for Project which have resulted in installations with a record of successful in-service performance. The installer shall submit evidence of such qualifications upon request.
- C. Regulatory Requirements: Comply with applicable requirements of ASME/ANSI A17.1, Safety Code for Elevators and Escalators, in addition to local governing regulations including Minnesota Rules, Chapter 1307, Elevators and Related Devices. All work performed shall be strict accordance with applicable codes including all maintenance and testing requirements.
- D. Document Verification: in order to discover and resolve conflicts or lack of definition which might create problems, review contract documents for compatibility with proposed product prior to bidding. Review structural, architectural, electrical and mechanical documents, and elevator specification.
- E. Inspection and testing: Elevator Installer shall obtain and pay for all required inspections, tests, permits and fees for elevator installation.
 - 1. Arrange for inspections and make required tests.
 - 2. Deliver to the Owner upon completion and acceptance of elevator work.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle materials, components and equipment in manufacturer's protective packaging. Store materials, components, and equipment off of ground, under cover, and in a dry location.

1.11 COORDINATION

- B. Coordinate installation of sleeves, block outs, elevator equipment with integral anchors, and other items for elevator equipment. Furnish templates, sleeves, elevator equipment with integral anchors, and installation instructions and deliver to Project site in time for installation.
- C. Coordinate locations and dimensions of other work relating to hydraulic elevators including pit ladders; sumps and floor drains in pits; entrance subsills; electrical service; and electrical outlets, lights, and switches in hoistways, pits, and machine rooms.

1.12 WARRANTY

- A. General Warranty: The elevator warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.
- B. Special Project Warranty: Provide special project warranty, signed by Contractor, installer, and manufacturer, agreeing to replace, repair, or restore defective materials and workmanship of elevator work during warranty period. This warranty shall be in addition to, and not a limitation of, other rights the Owner may have against the Contractor under the Contract Documents.
 - 1. "Defective" is hereby defined to include, but not by way of limitation, operation or control system failures, performances below required minimums, excessive wear, unusual deterioration or aging of materials or finishes, unsafe conditions, the need for excessive maintenance, abnormal noise or vibration, and similar unusual, unexpected, and unsatisfactory conditions.
 - 2. Warranty period is twelve (12) months starting on date of Substantial Completion.
- C. Warranties: Provide coincidental product warranties where available for major components of elevator work. Submit with maintenance manuals.

1.13 MAINTENANCE SERVICE

- A. Initial Maintenance Service: Provide full maintenance service by skilled, competent employees of the elevator installer for period of 12 months following Date of Substantial Completion. Include monthly preventive maintenance performed during normal working hours. Include repair or replacement of worn or defective parts or components and lubricating, cleaning, and adjusting as required for proper elevator operation in conformance with specified requirements. Include 24-hours-per-day, 7-days-per-week emergency callback service with a response time of 2 hours or less. Exclude only repair or replacement due to misuse, abuse, accidents, or neglect caused by persons other than installer's personnel.

- B. Continuing Maintenance Service: Installer shall provide a continuing maintenance proposal to Owner, in the form of a standard yearly (or other period) maintenance agreement, starting on date construction contract maintenance requirements are concluded. State services, obligations, conditions, and terms for agreement period and for future renewal options.

1.14 SPECIAL REQUIREMENTS

- D. Field Measurements: Before proceeding with the fabrication of the hydraulic elevator work, verify all dimensions and take such measurements as are required for proper fabrication and erection of the work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturer: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 1. Otis Elevator Co.
 2. Schindler Elevator Corp.
 3. ThyssenKrupp Elevator.
- B. Source Limitations: Obtain elevators from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Comply with ASME A17.1/CSA B44.
- B. Accessibility Requirements: Comply with Section 407 in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and with ICC A117.1.

2.3 MATERIALS AND COMPONENTS

- A. General Requirement: Unless otherwise indicated, provide manufacturer's standard pre-engineered elevator systems that will comply with or fulfill the requirements of elevator schedule sheet at end of this section or, at manufacturer's option, provide custom-manufactured elevator systems that will fulfill requirements. Where components are not otherwise indicated, provide standard components published by manufacturer as included in standard pre-engineered elevator systems and as required for a complete system.
- B. Hydraulic Machines and Elevator Equipment: Provide manufacturer's standard two jack holeless hydraulic plunger-cylinder units for each elevator, with electric pump-tank-control system equipment in machine room as indicated.
- C. Pump Units: Positive-displacement type with a maximum of 10 percent variation between no load and full load and with minimum pulsations.
- D. Piping: Provide size, type, and weight piping recommended by manufacturer, and provide isolation couplings to prevent sound / vibration transmissions from power unit.

- E. Hydraulic Fluid: Elevator manufacturer's standard fire-resistant fluid with additives as needed to prevent oxidation of fluid, corrosion of cylinder and other components, and other adverse effects.
- F. Car Frame and Platform: Manufacturer's standard welded steel units, unless otherwise indicated.
- G. Guides: Roller guides; polymer-coated, nonlubricated sliding guides; or sliding guides with guide-rail lubricators. Provide guides at top and bottom of car and counterweight frames.

2.4 CONTROL SYSTEMS

- A. General: Provide manufacturer's standard microprocessor operation system for each elevator as required to provide automatic operation of the type indicated and defined in the Code as "Operations."
- B. Single Elevator Control - Passenger: Provide solid-state "Selective Collective Automatic Operation," as defined in the Code.
- C. Auxiliary Operations / Controls: In addition to primary control system features, provide the following controls or operational features for elevators, except where otherwise indicated:
 - 1. Single-Car Standby-Powered Lowering: On activation of standby power, car is lowered to the lowest floor, opens its doors, and shuts down..
 - 2. Loaded-Car Bypass: When car load exceeds 80 percent of rated capacity, car responds only to car calls, not to hall calls.
 - 3. Independent service.
 - 4. Automatic 2-way leveling.
 - 5. Automatic dispatching of loaded car, in conjunction with load weighing device.
- D. Security Features: In addition to above operational features, provide the following security features for passenger elevators, except where otherwise indicated. Security features shall not affect emergency firefighter's service.
 - 1. Keyswitch operation feature with car and hall pushbuttons activated and deactivated by security keyswitches. Key is removable only in the deactivated position.
 - 2. Anticrime feature activated by a keyswitch that causes car to return immediately to a predetermined floor and open door for inspection. On deactivation by keyswitch, car completes calls registered before keyswitch activation and resumes normal operation.
- E. Firefighter's Service: Elevator to be provided with firefighter service and shall conform to Rule 211.3 "Firefighter Service" of ASME A17.1.

2.5 SIGNAL EQUIPMENT

- A. General: Provide signal equipment for elevator to comply with requirements indicated below.
 - 1. Provide illuminated hall-call and car-call buttons that light up when activated and remain lighted until call or other function has been fulfilled; fabricate of acrylic or other permanent translucent plastic.

2. Except for buttons and illuminated signal elements, fabricate signal equipment with exposed surfaces of stainless steel with manufacturer's standard directional polish or satin finish.
3. Car Control Stations: Provide car control station in each car with flush-mounted metal faceplates containing illuminated halo call button for each landing served and other buttons, switches, and controls required for specified car operation and control. Mount as shown or scheduled at height complying with ASME/ANSI A117.1. If not otherwise indicated, mount in return panel adjacent to car door. Provide operating device symbols as required by Code. Mark other buttons and switches with manufacturer's standard identification for required use or function.
4. Car Position Indicator: For passenger elevator cars, provide either illuminated-signal type or digital-display type, located near top of each car or in car control station. Include direction-of-next-travel signal if not provided in car control station.
 - a. In addition to visual indicator, provide audible signal to indicate to passengers that car is either stopping at or passing each of the floors served.
5. Hall Push-Button Station: Provide hall push-button station at each landing.
 - a. Locate as is most convenient for approaching passengers. Provide unit with flat faceplate designed for flush-mounting on wall with body of unit recessed in wall.
 - b. Provide 2-button station where passengers can travel either direction; 1-button station where only one direction of travel is available and indicate which direction that is.
6. Hall Lanterns: Provide units with illuminated "up" and "down" signal arrows, but provide single arrow where only one direction is possible. Provide units projecting from faceplate for ease of angular viewing, except provide flush units where a location in hoistway entrance frame is indicated. Match materials, finishes, and mounting method of hall push-button stations.
 - a. At manufacturer's option, hall lantern signals may be placed either above or beside each hoistway entrance or in both jambs of entrance frame for each elevator. Mount at minimum of 6 feet - 0 inches above finished floor.
 - b. In conjunction with each hall lantern device, provide an audible signal to indicate that a car is arriving in response to a hall call and to indicate direction of car travel. Signal shall sound once for up direction of travel and twice for down direction.
7. Hall Position Indicator: Provide illuminated-signal type or digital-display type, located above each hoistway entrance at ground floor. Match materials, finishes, and mounting method of hall push-button stations.
 - a. Integrate ground-floor hall lanterns with hall position indicators.
8. Telephone: Provide manufacturer's standard ADA-compliant, vandal-resistant telephone system contained in flush-mounted cabinet and complete with identification and instructions for use.
9. Alarm System: Provide emergency alarm bell properly located within building and audible outside hoistways, equipped to sound automatically in response to emergency stops and in response to "Alarm" button on each car control station.
10. Car-Top Alarm: Provide switches on top emergency exits that will cause alarm to sound when cover is opened.

2.6 ELEVATOR CAR ENCLOSURES

- A. General: Provide car enclosures as indicated. Include ventilation, lighting, ceiling finish, wall finish, access doors, doors, power door operators, sill (threshold), trim, accessories, and floor finish unless indicated as not work of this section. Unless indicated otherwise, provide horizontal sliding doors of manufacturer's standard flush panel type, with operation and number of panels as indicated. Provide manufacturer's standard protective edge trim system for door and wall panels, except as otherwise indicated.
 - 1. Materials and Fabrication: Provide selections as indicated for each car enclosure surface; provide manufacturer's standards, but not less than the following:
 - a. Stainless Steel: AISI Type 302/304 with No. 4 satin finish.
 - b. Aluminum Sills: Extruded aluminum, with grooved surface, 1/4 inch thickness, mill finish.
 - c. Plastic Laminate: High-pressure type complying with NEMA LD3, Type GP-50; color, texture and pattern to match wood panel wall system – vertical applied panels.
 - d. Fabricate car door frame integrally with front wall of car.
 - e. Fabricate car with recesses and cutouts for signal equipment.
 - f. Low voltage downlight ceiling with stainless steel laminate.

2.7 PERSONAL PROTECTIVE DEVICES

- A. Handrails: Unless indicated otherwise, provide manufacturer's round tubular stainless steel handrails on side walls and back wall either continuous or segmented units.
- B. Door Edge Protective Device: Provide retractable edge shoe on leading edges of elevator entrance doors that causes doors to stop and reopen upon contacting an obstruction in entrance.
- C. Photo-Eye Detection Device: Provide electronic photo-eye device with timed cutout, projecting dual light beams across car entrance at 5 inch and 29 inch heights, that when interrupted will cause closing doors to stop and reopen. Provide keyed switch in car operating panel or toggle switch in service cabinet for disconnecting photo-eye protective device.
- D. Nudging Feature: After car doors are prevented from closing for a predetermined adjustable time period, through activation of detection device or door edge protective device, a loud buzzer shall sound and doors shall begin to close at reduced rate of speed. Doors shall continue to close unless door edge protective device is activated, which shall cause doors to reopen. Process shall repeat continuously until obstruction is removed from entrance.

2.8 PASSENGER HOISTWAY ENTRANCES

- A. General: Unless indicated otherwise, provide manufacturer's standard, pre-engineered, hollow metal type, sliding, door-and-frame hoistway entrances complete with track systems, hardware, safeties, sills, and accessories. Match car enclosure doors for size, number of door panels, and door panel movement. Provide frame-section size and profile to coordinate with hoistway wall construction as indicated.

- B. Materials and Fabrication: Provide selections indicated that comply with manufacturer's standards, but not less than the following:
1. Stainless Steel Frames: Formed stainless steel sheet, AISI Type 302/304 with No. 4 satin finish.
 2. Satin Stainless Steel Door Panels: Flush stainless steel construction, AISI Type 302/304 with manufacturer's standard directional polish or satin finish.
 3. Aluminum Sills: Extruded aluminum, with grooved surface, 1/4 inch thickness, mill finish.
 4. Nonshrink, Nonmetallic Grout: Factory packaged nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107. Provide grout specifically recommended by manufacturer for grouting door sills and similar applications.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Prior to commencing elevator installation, examine hoistways, hoistway openings, pits, and machine rooms, as constructed; verify all critical dimensions and examine supporting structure and all other conditions under which elevator work is to be installed. Notify Contractor in writing of any dimensional discrepancies or other conditions detrimental to the proper installation or performance of elevator work. Do not proceed with elevator installation until unsatisfactory conditions have been corrected in a manner acceptable to the installer.

3.2 INSTALLATION OF ELEVATOR SYSTEM

- A. General: Comply with manufacturer's instructions and recommendations for work required during installation.
- B. Install plunger-cylinder units plumb and accurately centered for elevator car position and travel; anchor securely in place.
- C. Welded Construction: Provide welded connections for installation of elevator work where bolted connections are not required for subsequent removal or for normal operation, adjustment, inspection, maintenance, and replacement of worn parts. Comply with AWS standards for workmanship and for qualifications of welding operators.
- D. Coordination: Coordinate elevator work with work of other trades for proper time and sequence to avoid construction delays. Use benchmarks, lines, and levels designated by Contractor to ensure dimensional coordination of the work.
- E. Sound Isolation: Mount rotating and vibrating elevator equipment and components on vibration-absorption mounts, designed to effectively prevent transmission of vibrations to structure and thereby to eliminate sources of structure-borne noise from elevator system.
- F. Install piping without routing underground, where possible. Where not possible, cover underground piping with permanent protective wrapping before backfilling.

- G. Lubricate operating parts of systems, including ropes, if any, as recommended by manufacturers.
- H. Alignment: Coordinate installation of hoistway entrances with installation of elevator guide rails for accurate alignment of entrances with cars. Where possible, delay installation of sills and frames until car is operable in shaft. Reduce clearances to minimum, safe, workable dimension at each landing.
- I. Leveling Tolerance: 1/4 inch, up or down, regardless of load and direction of travel.
- J. Set sills flush with finished floor surface at landings. Coordinate with other trades to facilitate and ensure proper grouting of sills.

3.3 FIELD QUALITY CONTROL

- A. Acceptance Testing: Upon nominal completion of each elevator installation, and before permitting use of elevator (either temporary or permanent), perform acceptance tests as required and recommended by Code and by governing regulations or agencies.
- B. Operating Tests: Load each elevator to its rated capacity and operate continuously for 30 minutes over its full travel distance, stopping at each level and proceeding immediately to the next. Record temperature rise of pump motor (except submerged pumps) during 30 minute test period. Record failures of elevator to perform as required.
- C. Advise Contractor, Owner, Architect, and inspection department of governing agencies in advance of dates and times tests are to be performed on elevators.

3.4 PROTECTION

- A. At time of Substantial Completion of elevator work (or portion thereof), provide suitable protective coverings, barriers, devices, signs, or such other methods or procedures to protect elevator work from damage or deterioration. Maintain protective measures throughout remainder of construction period.
- B. Provide similar protective measures for elevator units that will be placed in temporary service, including inspection and maintenance service during period of temporary service.

3.5 DEMONSTRATION

- A. Instruct Owner's personnel in proper use, operations, and daily maintenance of elevators. Review emergency provisions, including emergency access and procedures to be followed at time of failure in operation and other building emergencies. Train Owner's personnel in normal procedures to be followed in checking for sources of operational failures or malfunctions. Confer with Owner on requirements for a complete elevator maintenance program.
- B. Make a final check of each elevator operation with Owner's personnel present and just prior to date of Substantial Completion. Determine that control systems and operating devices are functioning properly.

ELEVATOR SCHEDULE - HYDRAULIC PASSENGER ELEVATORS:

EV-1

Capacity:	3,500 pounds center opening.
Speed:	100 / 125 fpm.
Travel:	33'-8"
Landings Served:	3.
Openings:	
Front:	3.
Rear:	2.
Power Supplied:	480 volts AC, 3 phase, 60 hertz.
Machinery:	Twinpost, telescoping holeless hydraulic jacks, positive-displacement pump, AC motor.
Car Enclosure:	6'-8" wide by 5'-5" deep min. clear inside dimensions. 3'-6" wide by 7'-0" high stainless steel car doors. Center opening. Stainless steel front walls with integral stainless steel car door frames. Ceiling: Manufacturer's low voltage downlight with satin stainless steel laminate. Side and Rear Walls: Vertical applied panels with decorative trim – Mart wood panel wall system. Operating Panel: Satin stainless steel finish. Floor prepared to receive thinset resinous epoxy terrazzo. Handrail: 2" flat stainless steel bar w/ No. 4 satin finish.
Hoistway Entrances:	3'-6" wide by 7'-0" high. Satin stainless steel entrance doors and frames, rated and labeled for 30-minute temperature rise of 650 degrees F.
Fixture & Button Style:	Vandal Resistant Signal Fixtures.
Special Operations:	Keyed operation of rear openings with lock-out of front openings in rear opening mode.
Additional Requirements:	Protective blanket hooks in car, 1 complete set of full-height blankets, dark tan color.

EV-2

Capacity:	3,500 pounds center opening.
Speed:	100 / 125 fpm.
Travel:	17'-0"
Landings Served:	2.
Openings:	
Front:	2.
Rear:	None.
Power Supplied:	480 volts AC, 3 phase, 60 hertz.
Machinery:	Twinpost, telescoping holeless hydraulic jacks, positive-displacement pump, AC motor.
Car Enclosure:	6'-8" wide by 5'-5" deep min. clear inside dimensions. 3'-6" wide by 7'-0" high stainless steel car doors. Center opening. Stainless steel front walls with integral stainless steel car door frames. Ceiling: Manufacturer's low voltage downlight with satin stainless steel laminate.

<p>Hoistway Entrances:</p> <p>Fixture & Button Style:</p> <p>Special Operations:</p> <p>Additional Requirements:</p>	<p>Side and Rear Walls: Vertical applied panels with decorative trim – Mart wood panel wall system.</p> <p>Operating Panel: Satin stainless steel finish.</p> <p>Floor prepared to receive thinset resinous epoxy terrazzo.</p> <p>Handrail: 2" flat stainless steel bar w/ No. 4 satin finish.</p> <p>3'-6" wide by 7'-0" high. Satin stainless steel entrance doors and frames, rated and labeled for 30-minute temperature rise of 650 degrees F.</p> <p>Vandal Resistant Signal Fixtures.</p> <p>None.</p> <p>Protective blanket hooks in car, 1 complete set of full-height blankets, dark tan color.</p>
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EV-3

<p>Capacity:</p> <p>Speed:</p> <p>Travel:</p> <p>Landings Served:</p> <p>Openings:</p> <p style="padding-left: 20px;">Front:</p> <p style="padding-left: 20px;">Rear:</p> <p>Power Supplied:</p> <p>Machinery:</p> <p>Car Enclosure:</p>	<p>3,500 pounds center opening.</p> <p>100 / 125 fpm.</p> <p>17'-0"</p> <p>2.</p> <p>1.</p> <p>1.</p> <p>480 volts AC, 3 phase, 60 hertz.</p> <p>Twinpost, telescoping holeless hydraulic jacks, positive-displacement pump, AC motor.</p> <p>6'-8" wide by 5'-5" deep min. clear inside dimensions.</p> <p>3'-6" wide by 7'-0" high stainless steel car doors. Center opening.</p> <p>Glazed front and rear walls with stainless steel trim and integral stainless steel car door frames.</p> <p>Ceiling: Manufacturer's low voltage downlight with satin stainless steel laminate.</p> <p>Side Walls: Glazed w/ stainless steel trim.</p> <p>Operating Panel: Satin stainless steel finish.</p> <p>Floor prepared to receive thinset resinous epoxy terrazzo.</p> <p>Handrails: 2" flat stainless steel bar w/ No. 4 satin finish.</p> <p>3'-6" wide by 7'-0" high. Satin stainless steel entrance doors and frames, rated and labeled for 30-minute temperature rise of 650 degrees F.</p> <p>Vandal Resistant Signal Fixtures.</p> <p>Keyed operation of rear openings with lock-out of front openings in rear opening mode.</p> <p>Protective blanket hooks in car, 1 complete set of full-height blankets, dark tan color.</p>
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<p>Hoistway Entrances:</p> <p>Fixture & Button Style:</p> <p>Special Operations:</p> <p>Additional Requirements:</p>	<p>3'-6" wide by 7'-0" high. Satin stainless steel entrance doors and frames, rated and labeled for 30-minute temperature rise of 650 degrees F.</p> <p>Vandal Resistant Signal Fixtures.</p> <p>Keyed operation of rear openings with lock-out of front openings in rear opening mode.</p> <p>Protective blanket hooks in car, 1 complete set of full-height blankets, dark tan color.</p>
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END OF SECTION 14240

**NEW PASSENGER TERMINAL
DULUTH INTERNATIONAL AIRPORT
DULUTH, MINNESOTA**

SECTION 14310 - ESCALATORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes high-traffic escalators, including but not limited to the following:
 1. Escalators and support trusses, sprocket assemblies, step chains, steps, treads, tracks, handrails with guides and drive, comb plates, driving machine, drip pans, controller, signals, control devices, etc.
 2. Glass balustrades, interior panels, mouldings, deck covers, skirt boards, fillers, skirt lighting, exterior balustrades and vertical walls
 3. Stainless steel side panels and soffit panels
 4. Floor plates and access panels in floors.
 5. Angles, clips, and fasteners.
 6. Machines, motors and safety devices.
 7. Electrical equipment and connections, including switches, electrical circuits and outlets for special use as required; also whatever cutouts, circuit breakers, starters, or other devices which are necessary to meet local code requirements.
 8. Engineering, equipment, labor and permits required to satisfactorily complete elevator installation as required by contract documents.
- B. Related Requirements:
 1. Division 3 Section "Cast-in-Place Concrete" for setting sleeves, inserts, and anchoring devices in concrete.
 2. Division 5 Section "Structural Steel" for attachment plates, angle brackets, and other preparation of structural steel to support escalator trusses.
 3. Division 8 Section "Access Doors and Frames" for wall and ceiling access panels and access doors in escalator enclosures.
 4. Division 13 Section "Fire-Alarm System" for smoke detectors that activate escalator alarm and, after at least 15 seconds, cause the interruption of power to the escalator motor and brake and for connection to escalator controllers.
 5. Division 16 Sections for electrical service to escalators, including disconnect switches.

1.3 DEFINITIONS

- A. High-Traffic Escalators: Designed specifically for high-traffic-volume use that produces dense occupancy resulting in structural, machinery, and brake loads much higher than normal.

1.4 DESIGN REQUIREMENTS

- A. Terms used are defined in the latest edition of the safety code for Elevators and Escalators, ASME A17.1, A17.2, A17.5, NFPA 70, NFPA 101, ADA and the codes having legal jurisdiction.
- B. Designs, clearances, construction, workmanship, and material, unless specifically excepted, shall be in accordance with ANSI/ASME A17.1, except where codes having legal jurisdiction include more rigid requirements or conflict with ANSI/ASME A17.1.
- C. Each escalator shall be a self-contained unit consisting of truss, tracks, step drive units, steps, plates, balustrades, handrails, driving machine, controller, safety devices, and other required parts. The escalator shall operate with quietness, smoothness, and safety.
- D. Pits have been designed to accommodate largest, current, equipment of specified manufacturers. If less space is needed, provide and install attachment plates, angle brackets, and other preparation of structure as required to adequately support escalator trusses and install the escalators and associated equipment.

1.5 ACTION SUBMITTALS

- A. Product Data: Include capacities, sizes, performances, safety features, finishes, and similar information.
- B. Shop Drawings:
 - 1. Provide complete dimensioned layout of each escalator installation. Include plans, elevations, sections, and details indicating coordination with building structure and relationships with other construction.
 - 2. Indicate maximum loads imposed on building structure at points of support, and power requirements.
 - 3. Indicate access and ventilation for escalator machine space.
- C. Samples for Verification: For exposed escalator finishes, 8-inch-square Samples of sheet materials, and 12-inch lengths of running trim members.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Manufacturer Certificates: Signed by manufacturer certifying that escalator layout and dimensions, as shown on Drawings, and electrical service, as shown and specified, are adequate for escalator system being provided.
- C. Sample Warranty: For special warranty.

1.7 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For escalators to include in emergency, operation, and maintenance manuals.

- B. Inspection and Acceptance Certificates and Operating Permits: As required by authorities having jurisdiction for normal, unrestricted escalator use.
- C. Continuing Maintenance Proposal: Submit a continuing maintenance proposal from Installer to Owner, in the form of a standard two-year maintenance agreement, starting on date initial maintenance service is concluded. State services, obligations, conditions, and terms for agreement period and for future renewal options.

1.8 QUALITY ASSURANCE

- A. Installer Qualifications: Escalator manufacturer or an authorized representative who is trained and approved by manufacturer. The installer shall have experience on Projects similar in size and scope to this Project. The installer shall submit evidence of such qualifications upon request.
- B. Document Verification: Review contract documents for compatibility with proposed product prior to bidding.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle materials, components, and equipment in manufacturers protective packaging. Store materials, components, and equipment off of ground, under cover, and in a dry location.

1.10 COORDINATION

- A. Coordinate installation of sleeves, block outs, escalator equipment with integral anchors, and other items that are embedded in concrete or masonry for escalator equipment. Furnish templates, sleeves, escalator equipment with integral anchors, and installation instructions and deliver to Project site in time for installation.
- B. Coordinate locations and dimensions of other work relating to escalators including sumps and floor drains in pits; electrical service; and electrical outlets, lights, and switches in pits.

1.11 WARRANTY

- A. Manufacturer's Special Warranty: Manufacturer agrees to repair, restore, or replace escalator work that fails in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, operation or control system failure, including excessive malfunctions; performances below specified ratings; excessive wear; unusual deterioration or aging of materials or finishes; unsafe conditions; the need for excessive maintenance; abnormal noise or vibration; and similar unusual, unexpected, and unsatisfactory conditions.
 - 2. Warranty Period: One year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Fujitec America, Inc.
 - 2. KONE Inc.
 - 3. Otis Elevator Co.
 - 4. Schindler Elevator Corp.
 - 5. ThyssenKrupp Elevator.
- B. Source Limitations: Obtain escalators from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Comply with ASME A17.1/CSA B44.
- B. Braking Performance: Provide brakes that stop escalator in up-running mode at a rate no greater than 3 ft./s^2 .
- C. Structural and Mechanical Performance for High-Traffic Escalators: For the purposes of structural design, driving machine and power transmission calculations, and brake calculations, design high-traffic escalators for loads not less than 1.5 times the design loads required by ASME A17.1/CSA B44.
- D. Structural Performance of Balustrades, Deck Barricades, and Handrails: Provide components and assemblies capable of withstanding the effects of loads indicated in ASCE/SEI 7 for handrail assemblies and guardrail systems.

2.3 ESCALATORS

- A. High-Traffic Escalators, General: Manufacturer's high-traffic escalators complying with requirements. Unless otherwise indicated, manufacturer's heavy-duty components shall be used, as included in standard high-traffic escalator systems and as required for complete system.
- B. Design and equip escalators to run in either direction.
- C. Provide escalators with two flat steps at top and bottom landings.
- D. Rated Speed: 90 fpm.

2.4 COMPONENTS

- A. Fabricate exposed metalwork, including deck covers, side panels, soffit panels and trim to provide surface flatness equivalent to stretcher-leveled standard of flatness and sufficient strength for indicated use; increase metal thickness or reinforce with concealed stiffeners, backing materials, or both, as necessary. Support joints with concealed stiffeners as needed to hold exposed faces of adjoining sheets in flush alignment.
 - 1. Fabricate side panels of stainless steel panels of size and jointing as shown and to fit the actual construction.

2. Fabricate soffit panels of stainless steel panels of size and jointing as shown and to fit the actual construction.
 3. Joints in exposed metal work, unless otherwise shown or specified, shall be accurately fitted and rigidly secured with hairline contacts.
- B. Transparent Balustrades: Manufacturer's standard profile or arrangement of moving handrails on guide rail that is supported by tempered glass panels, with deck covers, skirts, trim, and accessories.
- C. Guards at Ceiling Intersection: Clear plastic.
- D. Handrails: Smooth, jointless, reinforced neoprene.
1. Color: Black.
- E. Deck Covers and Trim: Satin stainless steel.
- F. Skirt Panels, if Applicable: Manufacturer's standard low-friction material.
- G. Skirt Deflector Devices: Manufacturer's standard brush-type device.
- H. Steps: One-piece, die-cast aluminum with demarcation grooves at front and rear of tread surface.
1. Finish: Powder-coated, gray.
 2. Step Demarcation: 1-1/2- to 2-inch-wide yellow stripe at sides and backs of step treads.
 3. Nosing Demarcation: 2-inch-wide yellow stripe at nosings of step treads.
- I. Combs: Integrally colored structural plastic.
1. Comb Color: Yellow.
- J. Combplate Lights: Provide recessed light fixtures with flush lenses mounted in skirt panels at each side of combplates, designed to illuminate combplate steps.
- K. Floor Plates: Grooved or patterned surface with abrasive material embedded in or metallically bonded to floor-plate surface.

2.5 FEATURES

- A. Operational Control: Provide key-operated starter switches located on exterior deck above newel base at both upper and lower landings of escalators.
- B. Fault Indicator: Provide escalators with a microprocessor unit that monitors safety devices, motor temperature, and escalator speed and records in nonvolatile memory the date, time, and device identification if a safety device is activated or escalator malfunctions.
1. Provide built-in or plug-in unit to display recorded information.
- C. Reduced-Current Starting: Provide escalator motors with wye-delta or solid-state starting.
- D. Energy-Saving Feature: Provide escalator motors and controls designed for motors running on partial windings (at reduced power) when not under full load.
- E. Provide motors complying with NEMA MG 1, Insulation Class B.

- F. Brake-Saving Feature: Provide stopping mechanism that allows escalator to coast to a stop before applying brakes, unless stopping is initiated by a safety device.
- G. Equip step drive mechanism with automatic step-chain lubricators.
- H. Oil Drip Pan: Provide metal pan under full width and length of escalator to collect and hold oil and grease drippings from lubricated components. Design and fabricate drip pan to sustain a load of 250 lbf on a 1.0-sq. ft. area at any location without permanent deflection.
- I. Overspeed Governor: Provide units with overspeed governor that is activated if speed of steps exceeds rated speed by more than 20 percent.
- J. Upper-Landing, Step Upthrust Device: Activated if a step is displaced against upthrust track at upper curve in passenger-carrying line of track system.
- K. Comb-Step Impact Device: Activated if a horizontal force in direction of travel is applied exceeding 112 lbf at either side or exceeding 225 lbf at center of front edge of combplate, or a resultant force in upward direction is applied exceeding 150 lbf at center of front edge of combplate.

2.6 MATERIALS

- A. Stainless Steel: ASTM A 240/A 240M, Type 304.
1. Satin Finish: No. 4 directional satin.
- B. Steel Sheet: Cold-rolled steel sheet, ASTM A 1008/A 1008M, commercial steel, Type B, exposed, matte finish.
- C. Clear Tempered Glass: ASTM C 1048, Condition A (uncoated surfaces), Type 1 (transparent glass, flat), Class 1 (clear), Quality q3 (glazing, select), Kind FT (fully tempered), 12.0 mm thick.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine escalator areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine supporting structure, machine spaces, and pits; verify critical dimensions; and examine conditions under which escalators are to be installed.
- 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 INSTALLATION

- A. Comply with manufacturer's written instructions.

- B. Set escalators true to line and level, properly supported, and anchored to building structure. Use established benchmarks, lines, and levels to ensure dimensional coordination of the Work.
- C. Adjust installed components for smooth, efficient operation, complying with required tolerances and free of hazardous conditions. Lubricate operating parts, including bearings, tracks, chains, guides, and hardware. Test operating devices, equipment, signals, controls, and safety devices. Install oil drip pans and verify that no oil drips outside of pans.
- D. Repair damaged finishes so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop, make required repairs and refinish entire unit, or provide new units as required.

3.3 FIELD QUALITY CONTROL

- A. Acceptance Testing: On completion of escalator installation and before permitting escalator use, perform acceptance tests as required and recommended by ASME A17.1/CSA B44 and by authorities having jurisdiction.
 - 1. For escalators specified to comply with requirements more stringent than those of ASME A17.1/CSA B44, perform tests for compliance with specified requirements. Test safety devices that are not required by ASME A17.1/CSA B44 as well as those that are.
- B. Advise Owner, Architect, and authorities having jurisdiction in advance of dates and times that tests are to be performed.

3.4 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to operate, adjust, and maintain escalators.
- B. Check operation of escalators with Owner's personnel present before date of Substantial Completion and again not more than one month before end of warranty period. Determine that operation systems and devices are functioning properly.

3.5 MAINTENANCE

- A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by skilled employees of escalator Installer. Include monthly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper escalator operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
 - 1. Perform maintenance during normal working hours.
 - 2. Include 24-hour-per-day, 7-day-per-week emergency callback service with response time of six hours or less.

END OF SECTION 14310

