



DULUTH INTERNATIONAL AIRPORT

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**DULUTH INTERNATIONAL AIRPORT
NEW PASSENGER TERMINAL
VOLUNTARY AIRPORT LOW EMISSIONS (VALE)
CONTRACT DOCUMENTS
ISSUED FOR BID**

FAA AIP No. - 3-27-0024-51-11
RS&H PROJ. No. – 213.1882.110
CITY OF DULUTH BID No. 11-4402

**PROJECT MANUAL
VOLUME 2 OF 4**

Date: JUNE 9, 2011



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**NEW PASSENGER TERMINAL
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
VALE Program
Duluth, Minnesota
 - 2. For: Duluth Airport Authority
4701 Grinden Drive
Duluth, MN 55811
- B. The provisions of Part 2 through 11 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, Voluntary Air Low Emissions (VALE) 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.
 - 1. The required work is split into four (4) different Work Scopes, see Section 01014 – Work Scope Descriptions. Each Work Scope has may have multiple Base bids due to project funding. Note that any or all Base Bids (or any combination) of these Base Bids may be awarded within each Work Scope.
 - 2. For Work Scopes with multiple Base bids: Work Scope awards will be based on total bid price of Owner selected Base bids (not all Base bids may be selected for award).
- 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.

1.5 RETAINAGE

A. The amount that will be retained will be as follows:

1. Five percent (5%) of the value of satisfactorily complete work and site stored materials until the Work of the Contract is fully complete for all Work Scopes.
2. Remaining retained percentage may be requested after Final Completion of the Work of the Contract when the Work is fully complete and acceptable to Architect and Owner. Final payment will be made within 30 days thereafter.
3. In event of a very minor amount of work incomplete or not corrected due to weather, unsuitable conditions for testing or similar conditions preventing the Contractor from proceeding, the retained amount may be reduced to three times the value of the incomplete work upon recommendation of the Construction Manager / Architect and approval of the Owner.

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 _____ / Reynolds, Smith & Hills Project Number _____

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. Upon award to the successful bidders, each will assist in refining this schedule for construction sequencing.

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, 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

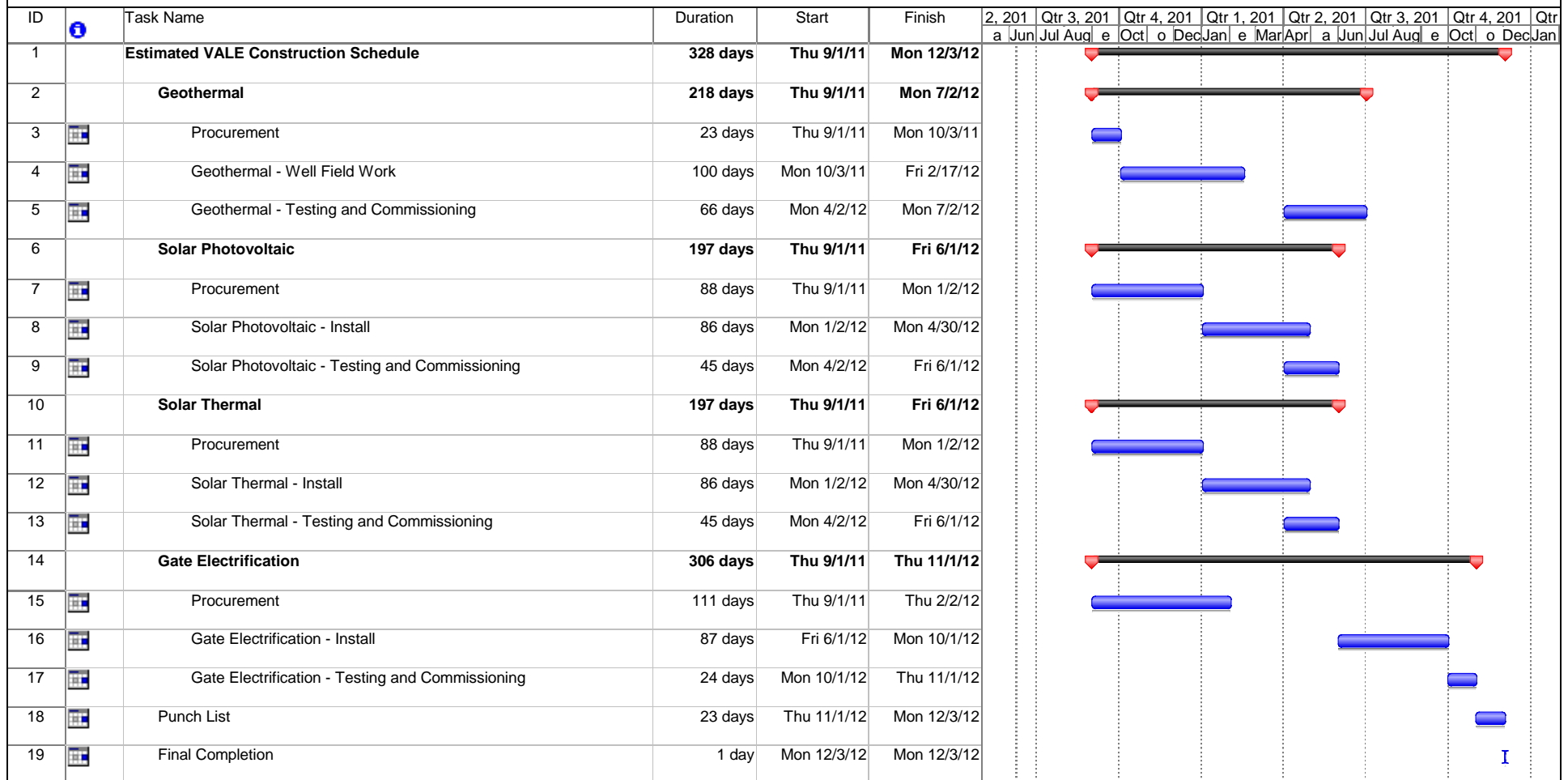
- A. All work shall be completed as follows:
1. Start Construction: On or about September 1, 2011, but within 10 days of Notice to Proceed as directed by the Construction Manager.
 2. Substantial Completion: November 1, 2012.
 3. Final Completion: December 3, 2012.

END OF SECTION 01041

Duluth Airport Authority

VALE Program

Issued for Bid



VALE Program Schedule

Task



Milestone



External Tasks



Split



Summary



External Milestone



Progress



Project Summary



Deadline



**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 in 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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**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 Construction Manager and 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 unless approved in advance. It is mandatory for a representative to be at these meetings.

- 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 (5) 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

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. Shop drawings prepared specifically for this work shall be submitted to the Construction Manager for submittal to the Architect. Submit for review in PDF (electronic format) as an attachment to E-Mail. 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. When shop drawings, product data, design data, certificates, test reports, inspection reports manufacturers instructions, manufacturer's field reports, and other types of submittals are specified in individual sections, submit for review in PDF (electronic format) as an attachment to E-Mail. 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

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

**SECTION 01361 - SUSTAINABLE DESIGN
REQUIREMENTS**

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/.

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 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 shall be revised to state the following:

1. Certified Wood:

- a. The use of “FSC Certified” products is required in all wood products as listed under Item 1.11, Products where available. If a wood product with the “FSC Certified” label does not exist or is not available, a non “FSC Certified” product may be substituted in place. 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.
1. 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.
 2. 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.
 3. 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.
 4. 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 that the products do not contain added urea-formaldehyde resins.
 5. 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.

6. **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)
7. **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).
8. **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.
9. **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.
1. 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
 - 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 (2-ethylhexyl) 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:				
Product	Vendor or Manufacturer	REQUIRED for ALL products identified in specifications		Is the product salvaged, refurbished or reused?	If contains		100% Extracted & Manufactured 4 w/n 500 mile radius of	Partially Extracted & Manufactured 5 w/n 500 mile radius of	For Wood Product s: FSC Certified (Y/N)	VOC Content 8 (for adhesives, sealants, paints and coatings)
		Total Installed COST	Material COST (excluding labor & equipment)		% post-consumer 2	% Pre-consumer 3				
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 ____

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**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

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**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 contract 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

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**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.
- B. Temporary heaters and fuel for heating the enclosed terminal building will be provided by the CM. Any other misc. temp. heat equipment, fuel and associated costs are by the corresponding Work Scope.
- C. Temporary electric service (within New Terminal): The CM will provide a one - 100 amp temporary power panel per level centrally located. Any other power requirements to complete work is the responsibility of each contractor.

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 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 as required.
1. Within the Contractor's facilities, provide enclosed space adequate for holding informal meetings.
 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. 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.

- D. 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.
- E. No other signs or advertising of any kind shall be allowed on the job site, except as specifically approved by the Construction Manager.
- F. Temporary Exterior Lighting: Install exterior yard and sign lights so signs are visible when work is being performed (as required).

3.3 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 approved 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. Construction Enclosure Fence (at excavation areas): 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 Construction Manager.
 - 3. Repair any damage caused by installation and removal, and restore area to original or specified condition.
- F. 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.

3.4 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 Construction Manager 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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DULUTH, MN**

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
DULUTH, MINNESOTA**

**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
DULUTH INTERNATIONAL AIRPORT
DULUTH, MINNESOTA**

**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
DULUTH, MINNESOTA**

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

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

**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

- 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

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.

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 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

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

**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. Concrete toppings.
 - 2. Base slabs.
 - 3. Miscellaneous concrete items.
 - 4. 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 Reinforcement”.

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.

1.4 DEFINITIONS

- A. 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. 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.
- F. 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:

	Top Size Aggregate		
	1 1/2"	1"	3/4"
Sieve Size	% 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: Pozzoloth 210 or Pozzoloth 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: Pozzoloth 80 or Pozzoloth 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.; Con Seal 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. 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

- B. 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

- C. 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 Supplementary Cementitious Materials	60%-100% 0%-40%
Minimum Top Size Aggregate	1/2 inch

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.

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. 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_F30 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.
- J. 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.
- K. 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.
- L. 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.
- M. 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.
- N. 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.
- O. Coordinate final slab texture requirements with Division 9 flooring installer for proper adhesion of final flooring materials.
- P. 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

SLAB USE	SLAB FINISH	OVERALL F _F /F _L	LOCAL F _F /F _L
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 Drawings	CONC FIN-5 Slip-Resistive Aggregate Finish	F _F 25/F _L 20	F _F 17/F _L 15

Q. 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 01 "Section 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 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. 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. 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.
- F. Source quality-control test reports.
- G. Minutes of Pre-Installation conference.
- H. 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.

I. 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 integrated 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 ($F_y = 50$ 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, Grde 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

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**SECTION 05360 – COMPOSITE STEEL
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. Composite steel deck.
 - 2. Related accessories.
- 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 07 Sections for thermal and moisture protection, and applied fireproofing.
 - 5. Division 09 Sections for painting and coating of exposed deck.

1.3 REFERENCES

- A. AISI – North American Specification for the Design of Cold-Formed Steel Structural Members.
- B. AWS D1.1 – Structural Welding Code - Steel.
- C. AWS D1.3
- D. Steel Deck Institute Design Manual

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of deck, accessory, and product indicated.
 - 1. Include name of deck manufacturer as well as type, depth, and gauge 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.

- C. 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.

1.5 INFORMATIONAL SUBMITTALS

- A. Submittal Schedule for all action submittal items.
- B. Product Certificates: For each type of steel deck, signed by product manufacturer certifying that products furnished comply with the requirements.
- C. Welding certificates.
- D. Research/Evaluation Reports: For steel deck.
- E. Sustainable Design Submittals:
 - 1. LEED Credit: Product Data for Credit MR 4.1 and Credit MR4.2 as required: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.
- F. Include statement indicating costs for each product having recycled content.

1.6 CLOSEOUT SUBMITTALS

- A. Sustainable Design Closeout Documentation.

1.7 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Manufacturer offering deck products to be incorporated into the Work must be a member of Steel Deck Institute.
- 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, as documented according to ASTM E 548.
- E. Fire-Test-Response Characteristics: Where indicated, provide steel deck units identical to those tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.
 - 1. Fire-Resistance Ratings: Indicated by design designations of applicable testing and inspecting agency.

2. Steel deck units shall be identified with appropriate markings of applicable testing and inspecting agency.

1.8 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.

1.9 COORDINATION

- A. Provide decking to receive spray-applied fire-resistive materials (SFRM) free of amounts of lubricant 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.
 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 COMPOSITE STEEL DECK

- 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.
- B. Fabricate panels, with integrally embossed or raised pattern ribs, and interlocking side laps to comply with dimensional parameters as defined in "Design Manual for Composite Decks, Form Decks, and Roof Decks" in SDI Publication No. 30. Section properties shall be based in accordance with the AISI Specification for the Design of Cold-Formed Steel Structural Members.
- C. Galvanized Steel Sheet: ASTM A 653, Structural Steel (SS), Grade 40 zinc coating.

- D. Galvanized and Shop-Primed Steel Sheet: ASTM A 653, Structural Steel (SS), Grade 40, zinc coating; with unpainted top surface and cleaned and pretreated bottom surface primed with manufacturer's standard baked-on, rust-inhibitive primer.
- E. Section Properties: Deck profile, depth, design uncoated steel thickness, and finish shall be as indicated on Drawings.
- F. Span Condition: Three span minimum.

2.3 ACCESSORIES

- A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.
- B. Mechanical Fasteners: Corrosion-resistant, low-velocity, powder-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.
- C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 minimum diameter.
- D. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 40,000 psi, not less than 0.0359-inch design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.
- E. Pour Stops and Girder Fillers: Steel sheet, minimum yield strength of 40,000 psi, of same material and finish as deck, and of thickness and profile indicated.
- F. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck, unless otherwise indicated.
- G. Recessed Sump Pans: Single-piece steel sheet, 0.0747 inch thick, of same material and finish as deck, with 3-inch- wide flanges and level recessed pans of 1-1/2-inch minimum depth. For drains, cut holes in the field.
- H. Flat Sump Plate: Single-piece steel sheet, 0.0747 inch thick, of same material and finish as deck. For drains, cut holes in the field.
- I. Galvanizing Repair Paint: [ASTM A 780] [SSPC-Paint 20 or DOD-P-21035, with dry film containing a minimum of 94 percent zinc dust by weight].
- J. 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. 30, 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. Place deck panels flat and square and fasten to supporting frame without warp or deflection.
- E. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.
- F. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.
- G. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.
- H. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install according to deck manufacturer's written instructions.

3.3 FLOOR-DECK INSTALLATION

- A. Fasten floor-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated and as follows:
 - 1. Weld Diameter: As indicated on drawings.
 - 2. Weld Spacing: As indicated on drawings.
- 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. Fasten 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 2.5 inches, with end joints as indicated on drawings.
- D. Pour Stops and Girder Fillers: Weld steel sheet pour stops and girder fillers to supporting structure according to SDI recommendations, unless otherwise indicated.

- E. Floor-Deck Closures: Weld steel sheet column closures, cell closures, and Z-closures to deck, according to SDI recommendations, to provide tight-fitting closures at open ends of ribs and sides of deck.

3.4 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 in accordance with Section 01 45 33 – 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.
 - 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.
 - 3. Report inspection results promptly and in writing to Contractor and Architect.
- C. Deck panels shall be clean, dry, and in firm contact with substrate prior to welding.
- D. Remove and replace work that does not comply with specified requirements.
- E. Additional inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

3.5 REPAIRS AND PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on bottom surface 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 bottom surface of prime-painted deck exposed to view immediately after installation, and apply repair paint of same color as adjacent shop-primed deck.
 - 1. Wire brushing, cleaning, and repair painting of bottom deck surfaces are included in Division 09.
- C. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.

END OF SECTION 05360

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**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

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

**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 applications where framing and supports are not specified in other Sections.
- B. Products furnished, but not installed, under this Section:
 - 1. 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 05 Section "Structural Steel."
 - 3. Division 05 Section "Metal Stairs."

1.3 PERFORMANCE REQUIREMENTS

- A. Thermal Movements; Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.
 - 1. Temperature Change: 120 deg F (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 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.

2.8 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 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

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

**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.
 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 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, 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 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 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 AWPAC C2 (lumber) and AWPAC 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 AWPAC 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 chlorpyrifos 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 AWP 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 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.
 4. Walkways.
- 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.

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- 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.

2.8 WALKWAYS

- A. Flexible Walkways: Factory-formed, nonporous, heavy-duty, solid-rubber, slip-resisting, surface-textured walkway pads, approximately 3/16 inch thick, and acceptable to membrane roofing system manufacturer.

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 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 07710 "Roof Accessories" for set-on-type curbs, equipment supports, roof hatches, vents, and other manufactured roof accessory units.
 - 3. 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 7, Section 07920 - JOINT SEALANTS for non-fire-resistive-rated joint sealants.
 - 3. Division 15 sections specifying ducts and piping penetrations.
 - 4. 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

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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. Section 07842 "Through-Penetration Firestop Systems" for sealing joints in fire-resistance-rated construction.

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 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.

2.6 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 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. 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. 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.
- B. 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:
 - 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 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 HIGH-PERFORMANCE COATING SCHEDULE

- A. Exterior 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.
- B. Exposed Interior Steel Substrates:
 - 1. Pigmented Polyurethane over High-Build Epoxy System:
 - a. Prime Coat: Epoxy primer, high-build, low gloss, (MPI #108 or equal) at a minimum dry film thickness of 5.0 to 6.0 mils.
 - b. 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

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

**SECTION 10200 - LOUVER
BLANK-OFF 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. This section includes blank-off panels for 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.

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.

1.4 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Panels shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of components, noise or metal fatigue 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 panels 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.

1.5 SUBMITTALS

- A. Product Data: For each type of product specified.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
- C. Samples for Verification: For each type of metal finish required.

1.6 QUALITY ASSURANCE

- A. Source Limitations: Obtain through one source from a single manufacturer where alike in one or more respects regarding type, design, or factory-applied finish.
- B. 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 panels 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. Include supports, anchorages, and accessories required for complete assembly.

2.3 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: Black.

2.4 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

2.5 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.

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 panels 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. Clean exposed surfaces that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate during construction period.
- B. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.
- C. Restore panels 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 10202

**NEW PASSENGER TERMINAL
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**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					
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.

Item	Oth	Plb	FP	Htg	Elec	Notes
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			
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					

Item	Oth	Plb	FP	Htg	Elec	Notes
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					
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					

Item	Oth	Plb	FP	Htg	Elec	Notes
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
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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 Caulking &

Sleeve Type Thru Required Fire Rated Construction	Sleeve Type Thru Non-Fire Rated Construction	Location	Sleeve Caulking & Packing Type Designation	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

**NEW PASSENGER TERMINAL
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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.
 - 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).
 - 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 ¾ 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 ¾ 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.
 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-joint 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

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**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

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**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 "Fire Protection Basic Materials and Methods".
 - 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 "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 "Fire Protection Standpipes".
- 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, "Fire Protection Basic 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 "Fire 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 "Fire Protection General Materials".

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 pipe, **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 Basic 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 Supports and Hangers" 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 Supports and Hangers" for additional requirements.
- 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 Supports and Hangers" 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".
- 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 Basic 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 Basic 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 Basic 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 Supports and Hangers".
- 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 Basic 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 Basic 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

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

**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 Basic 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 Horizontal Fire Pumps."
 - 7. Division 13 Section 13926 "Fire Protection Vertical-Turbine Fire Pumps."
 - 8. Division 16 Section "Fire Alarm 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).
 - 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 $\frac{1}{2}$ " 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 Basic 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 Supports and Hangers" 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 $\frac{1}{2}$ " 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

