



**DULUTH INTERNATIONAL AIRPORT**

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## CONTRACT DOCUMENTS

Project No.3-27-0024-48-10

Contract No. SP 6901-164

RS&H No. 2131882.091

DULUTH INTERNATIONAL AIRPORT  
NEW PASSENGER TERMINAL

### VOLUME 2 OF 3

Date: April 11, 2010



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

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

**SECTION 01010 – SUMMARY  
OF WORK**

**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 PROJECT DESCRIPTION**

- A. Project Identification:
  - 1. Name of the Project: NEW PASSENGER TERMINAL.
  - 2. Project Location: DULUTH INTERNATIONAL AIRPORT, DULUTH, MINNESOTA
  - 3. Owner: DULUTH AIRPORT AUTHORITY
  - 4. Architect / Engineer: RS&H ILLINOIS, Inc., NAPERVILLE, ILLINOIS  
SJA, DULUTH, MINNESOTA  
MBJ, DULUTH, MINNESOTA  
COSENTINI ASSOC., CHICAGO, ILLINOIS
  - 5. Contract Documents Dated: MAY 1, 2010
- B. The project and the work of the Contract can be described in summary as follows:
  - 1. The project shall include: Construction of New Passenger Terminal, Staged Demolition of Existing Terminal, Site Utility Relocation, Temporary Paving, Passenger Boarding Bridge Relocations, Access Road Modification, Fencing and Traffic Control.
- C. The Work will be constructed under a single prime contract.
- D. There are multiple Allowances and Additive Allowances, see Project Manual and Project Documents for further information.

**1.3 CONTRACTOR USE OF PREMISES**

- A. Use of the Site: Limit use of the premises to work in areas indicated. Confine operations to areas within contract limits indicated. Do not disturb portions of the site beyond the areas in which the Work is indicated.
- B. Ownership of Property: Do not perform work, disturb or trespass upon properties not possessed by the Owner.

**PART 2 - PRODUCTS (Not Applicable)**

**PART 3 - EXECUTION (Not Applicable)**

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 Architect 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 Architect 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: The "date" for each progress payment is as indicated in the Owner-Contractor Agreement or, if none is indicated therein, it is the 25th 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. 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. Transmittal: Submit five (5) signed and notarized original copies of each Application for Payment to the Architect 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 Architect.
- F. 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, sub-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 who is lawfully entitled to a lien.
  - 5. Waiver Forms: Submit waivers of lien on forms and executed in a manner acceptable to Owner.
- G. 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.
- H. 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 Owner=s 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.
- I. Final Payment Application: Administrative actions and submittals that must precede or coincide with submittal of the final Application for Payment include the following:
1. Completion of Project closeout requirements.
  2. Completion of items specified for payment application at time of Substantial Completion (regardless of whether such application was made).
  3. Assurance, satisfactory to Owner, that unsettled claims will be settled and that work not actually completed or accepted will be completed without undue delay.
  4. Transmittal of required Project construction records to the Owner.
  5. Certified property survey.
  6. Proof, satisfactory to Owner, that taxes, fees, and similar obligations of the Contractor have been paid.
  7. Removal of temporary facilities and services.
  8. Removal of surplus materials, rubbish, and similar elements.
  9. Change of door locks and other Contractor access to Owner's property.
  10. Consent of Surety for Final Payment.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 01027

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

**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 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**

**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 project meetings, including, but not limited to, the following:
  - 1. Preconstruction conferences.
  - 2. Preinstallation conferences.
  - 3. Progress meetings.
- B. Contractor=s Construction Schedule requirements are specified in another Division 1 section.
- C. Refer to individual sections for the portions of the project requiring preinstallation conferences.

**1.3 PRECONSTRUCTION CONFERENCE**

- A. The Owner and / or Architect will schedule a preconstruction conference and organizational meeting prior to the start of construction, but no later than fifteen (15) days after the execution of the Owner-Contractor Agreement. The preconstruction conference will be held at the project site, or an otherwise convenient location. The meeting shall be conducted to review responsibilities and personnel assignments.
- B. Attendees: Authorized representatives of the Owner, Architect and their consultants, the Contractor and its superintendent, major subcontractors, manufacturers, suppliers, and other concerned parties shall attend the conference. All participants at the conference shall be familiar with the Project and authorized to conclude matters relating to the work.
- C. Agenda: Discuss items of significance that could affect progress, including the following:
  - 1. Tentative 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, if not previously distributed.
  - 7. Submittal of Shop Drawings, Product Data, and Samples.
  - 8. Preparation of record documents.
  - 9. Use of the premises.
  - 10. Parking availability.

11. Office, work, storage areas and temporary facilities.
  12. Equipment deliveries and priorities.
  13. Safety procedures.
  14. First aid.
  15. Security.
  16. Housekeeping.
  17. Working hours.
  18. Coordination with work of concurrent and subsequent contracts under other Contractors.
  19. Other appropriate topics.
- D. Schedule of Values: The Contractor shall provide an outline or draft copy of the Schedule of Values, in accordance with the requirements of Section 01027 - APPLICATIONS FOR PAYMENT, for initial review. The intent of this submittal is to review the Schedule of Values for organization and content with respect to the construction progress and work requirements, such that the review time of the formal submittal may be minimized. No dollar values or other monetary breakdowns are required with this outline. The formal submittal of the Schedule of Values with all monetary breakdowns and other requirements shall be in accordance with Section 01027 - APPLICATIONS FOR PAYMENT.
- E. The Architect shall record the results of the meeting and distribute copies to attendees and other interested parties.

#### 1.4 PREINSTALLATION CONFERENCES

- A. The Contractor shall conduct a preinstallation conference at the Project Site before each construction activity that requires coordination with other construction.
- B. Attendees: The Installer and representatives of manufacturers and fabricators involved in or affected by the installation, and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise the Architect at least ten (10) working days in advance of scheduled meeting dates.
- C. Do not schedule conferences until the submittals required by the Contract Documents for work associated with the construction activity requiring the conference have been approved and returned to the Contractor.
- D. Review the progress of other construction activities and preparations for the particular activity under consideration at each preinstallation conference, including requirements for the following:
1. Contract Documents.
  2. Options.
  3. Related Change Orders.
  4. Purchases.
  5. Deliveries.
  6. Shop Drawings, Product Data, and quality-control samples.
  7. Review of mockups.
  8. Possible conflicts.
  9. Compatibility problems.
  10. Time schedules.
  11. Weather limitations.
  12. Manufacturer's recommendations.

13. Warranty requirements.
  14. Compatibility of materials.
  15. Acceptability of substrates.
  16. Temporary facilities.
  17. Space and access limitations.
  18. Governing regulations.
  19. Safety.
  20. Inspecting and testing requirements.
  21. Required performance results.
  22. Recording requirements.
  23. Protection.
- E. The Contractor shall record the results of the meeting and distribute copies to attendees and other interested parties.
- F. Do not proceed with the installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of work and reconvene the conference at the earliest feasible date.

## 1.5 PROGRESS MEETINGS

- A. Conduct progress meetings at the Project Site at regularly scheduled times on a biweekly interval. Notify the Owner and the Architect of scheduled meeting dates. Coordinate dates of meetings with preparation of the payment request and in conjunction with any coordination meetings.
- B. Attendees: In addition to representatives of the Owner and the Architect, each 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. All participants at the conference shall be familiar with the Project and authorized to conclude matters relating to progress.
- C. Agenda: Review and correct or approve minutes of the previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to the 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 insure that current and subsequent activities will be completed within the Contract Time.
  2. Review the present and future needs of each entity present, including the following:
    - a. Interface requirements.
    - b. Time.
    - c. Sequences.
    - d. Status of submittals.
    - e. Deliveries.
    - f. Off-site fabrication problems.
    - g. Access.
    - h. Site utilization.
    - i. Temporary facilities and services.
    - j. Hours of work.

- k. Hazards and risks.
  - l. Housekeeping.
  - m. Quality and work standards.
  - n. Change Orders.
  - o. Documentation of information for payment requests.
- D. Reporting: Contractor shall record minutes of the meeting and distribute to each party present and to parties who should have been present. Contractor shall revise the construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Contractor shall issue the revised schedule to attendees and others who should have been present no later than three (3) days after the meeting.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 01200

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**SECTION 01210 - ALLOWANCES**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

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

**1.3 SELECTION AND PURCHASE**

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

**1.4 SUBMITTALS**

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

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

#### 1.5 COORDINATION

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

#### 1.6 LUMP-SUM / UNIT-COST AND QUANTITY ALLOWANCES

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

#### 1.7 TESTING AND INSPECTING ALLOWANCES

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

#### 1.8 UNUSED MATERIALS

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

## PART 2 - PRODUCTS (Not Used)

## PART 3 - EXECUTION

## 3.1 EXAMINATION

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

## 3.2 PREPARATION

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

## 3.3 SCHEDULE OF ALLOWANCES

- A. **Allowance No. 1** Include Construction testing and inspection services that are specified to be provided by Owner in the amount of **\$XX,000.**
- B. **Allowance No. 2** Include utility connection service fees and facility charges that are required as part of the services for the buildings in the amount of **\$XX,000.**

END OF SECTION 01210



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**SECTION 01230 - ALTERNATES**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

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

**1.3 DEFINITIONS**

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

**1.4 PROCEDURES**

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

**PART 2 - PRODUCTS (Not Used)**

## PART 3 - EXECUTION

## 3.1 SCHEDULE OF ALTERNATES

**ALTERNATES SHALL INCLUDE:****A. Alternate No. 1.**

Add (deduct) the sum of: \_\_\_\_\_Dollars (\$\_\_\_\_\_).

**B. Alternate No. 2.**

Add (deduct) the sum of: \_\_\_\_\_Dollars (\$\_\_\_\_\_).

**C. Alternate No. 3.**

Add (deduct) the sum of: \_\_\_\_\_Dollars (\$\_\_\_\_\_).

END OF SECTION 01230

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**SECTION 01300 - SUBMITTALS**

**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 submittals required for performance of the work, including the following:
  - 1. Contractor's construction schedule.
  - 2. Submittal schedule.
  - 3. Daily construction reports.
  - 4. Construction photographs.
  - 5. Shop Drawings.
  - 6. Product Data.
  - 7. Samples.
  - 8. Quality assurance submittals.
- B. Administrative Submittals: Refer to other Division 1 Sections and other Contract Documents for requirements for administrative submittals. Such submittals include, but are not limited to, the following:
  - 1. Permits.
  - 2. Applications for Payment.
  - 3. Performance and payment bonds.
  - 4. Insurance certificates.
  - 5. List of subcontractors.
- C. Related Sections: The following sections contain requirements that relate to this section:
  - 1. Division 1, Section 01027 - APPLICATIONS FOR PAYMENT specifies requirements for submittal of the Schedule of Values.
  - 2. Division 1, Section 01040 - COORDINATION specifies requirements governing preparation and submittal of required Coordination Drawings.
  - 3. Division 1, Section 01200 - PROJECT MEETINGS specifies requirements for submittal and distribution of meeting and conference minutes.
  - 4. Division 1, Section 01400 - QUALITY CONTROL specifies requirements for submittal of inspection and test reports.
  - 5. Division 1, Section 01700 - CONTRACT CLOSEOUT specifies requirements for submittal of Project Record Documents at project closeout.

**1.3 QUALITY ASSURANCE**

- A. Compatibility of Options: When the Contractor is given the option of selecting between 2 or more products for use on the Project, the product selected shall be compatible with products previously selected, even if previously selected products were also options.

## 1.4 SUBMITTAL PROCEDURES

- A. Coordination: Coordinate preparation and processing of submittals with performance of construction activities. Transmit each submittal sufficiently in advance of performance of related construction activities to avoid delay.
1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
  2. Coordinate transmittal of different types of submittals for related elements of the work so processing will not be delayed by the need to review submittals concurrently for coordination.
    - a. The Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until all related submittals are received.
  3. Processing: Allow sufficient review time so that installation will not be delayed as a result of the time required to process submittals, including time for resubmittals.
    - a. Allow 2 weeks plus time in transit for initial review. Allow additional time if processing must be delayed to permit coordination with subsequent submittals. The Architect will advise the Contractor when a submittal being processed must be delayed for coordination.
    - b. If an intermediate submittal is necessary, process the same as the initial submittal.
    - c. Allow 2 weeks plus time in transit for reprocessing each submittal.
    - d. No extension of Contract Time will be authorized because of failure to transmit submittals to the Architect sufficiently in advance of the work to permit processing.
  4. The Architect will review up to 2 submissions (original and one resubmission) of shop drawings and other data submitted by the Contractor. Thereafter, additional reviews will be at the expense of the Contractor. These two referenced submissions shall be the only two whose associated review costs shall be borne by the Owner, regardless of whether a different product is submitted in subsequent submittals and regardless of whether a product is submitted as an equal product or substitution. The Architect will record the time required by him or his consultants in reviewing and approving submission in excess of the original and one 1 resubmission and notify the Contractor of the charges therefore. The Owner shall deduct any such expenses of the Architect from the Contractor's monthly periodic pay requests.
- B. Submittal Preparation: Place a permanent label or title block on each submittal for identification. Indicate the name of the entity that prepared each submittal on the label or title block.
1. Provide a space approximately 4 by 5 inches on the label or beside the title block on Shop Drawings to record the Contractor's review and approval markings and the action taken.
  2. Include the following information on the label for processing and recording action taken.
    - a. Project name.
    - b. Date.
    - c. Name and address of the Architect.
    - d. Name and address of the Contractor.
    - e. Name and address of the Subcontractor.
    - f. Name and address of the supplier.

- g. Name of the manufacturer.
  - h. Number and title of appropriate Specification section.
  - i. Drawing number and detail references, as appropriate.
- C. Submittal Transmittal: Package each submittal appropriately for transmittal and handling. Transmit each submittal from Contractor to Architect using the standard transmittal form. Submittals received from sources other than the Contractor will be returned without action. A separate transmittal shall be used for each required submittal and the contents shall be itemized separately thereon to allow indication of disposition for each element of the submittal.
- D. Contractor's Action: Each shop drawing sheet and the cover sheet of bound packets of product data shall bear a stamp indicating the Contractor's disposition following his review and checking. The disposition shall be indicated as "approved," "approved as noted," or similar as applicable. The stamp shall include the Contractor's name, the signature of the reviewer and the date checked. The notated sample shall be construed as evidence the Contractor has performed the review, check, verification and coordination as required by the GENERAL CONDITIONS. Shop drawing submittals received without this stamp (executed) will be returned to the Contractor with no action taken.

## 1.5 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. Bar-Chart Schedule: Prepare a fully developed, horizontal bar-chart-type, Contractor's construction schedule. Submit within thirty (30) days after the date established for "Commencement of the Work."
- 1. Provide a separate time bar for each significant construction activity. Provide a continuous vertical line to identify the first working day of each week. At the minimum, use the same breakdown of units of the work as indicated in the "Schedule of Values."
  - 2. Within each time bar, indicate estimated completion percentage in 10 percent increments. As work progresses, place a contrasting mark in each bar to indicate actual completion.
  - 3. Prepare the schedule on a sheet, or series of sheets, of stable transparency, or other reproducible media, of sufficient width to show data for the entire construction period.
  - 4. Secure time commitments for performing critical elements of the work from parties involved. Coordinate each element on the schedule with other construction activities; include minor elements involved in the sequence of the work. Show each activity in proper sequence. Indicate graphically the sequences necessary for completion of related portions of the work.
  - 5. Coordinate the Contractor's construction schedule with the schedule of values, list of subcontracts, submittal schedule, progress reports, payment requests, and other schedules.
  - 6. Indicate completion in advance of the date established for Substantial Completion. Indicate Substantial Completion on the schedule to allow time for the Architect's procedures necessary for certification of Substantial Completion.
- B. Phasing: On the schedule, show how requirements for phased completion to permit work by separate Contractors and partial occupancy by the Owner affect the sequence of work.

- C. Work Stages: Indicate important stages of construction for each major portion of the work, including submittal review, testing, and installation.
- D. Area Separations: Provide a separate time bar to identify each major construction area for each major portion of the work. Indicate where each element in an area must be sequenced or integrated with other activities.
- E. Cost Correlation: At the head of the schedule, provide a cost correlation line, indicating planned and actual costs. On the line, show dollar volume of work performed as of the dates used for preparation of payment requests.
  - 1. Refer to Division 1, Section 01027 - APPLICATIONS FOR PAYMENT for cost reporting and payment procedures.
- F. Distribution: Following response to the initial submittal, print and distribute copies to the Architect, Owner, subcontractors, and other parties required to comply with scheduled dates. Post copies in the Project meeting room and temporary field office.
  - 1. When revisions are made, distribute to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the work and are no longer involved in construction activities.
- G. Schedule Updating: Revise the schedule after each meeting, event, or activity where revisions have been recognized or made. Issue the updated schedule concurrently with the report of each meeting.

## 1.6 SUBMITTAL SCHEDULE

- A. After development and acceptance of the Contractor's Construction Schedule, prepare a complete schedule of submittals. Submit the schedule within 10 days of the date required for establishment of the Contractor's Construction Schedule.
  - 1. The submittal schedule shall include all product data, shop drawings, samples, inspection reports, test reports and similar items as called out in the individual specification sections, to be submitted by the Contractor during the course of the project.
  - 2. Coordinate Submittal Schedule with the list of subcontracts, Schedule of Values, and the list of products as well as the Contractor's Construction Schedule.
  - 3. Prepare the schedule in chronological order; include submittals required during the first 90 days of construction. Provide the following information:
    - a. Scheduled date for the first submittal.
    - b. Related section number.
    - c. Submittal category.
    - d. Name of the subcontractor.
    - e. Description of the part of the work covered.
    - f. Scheduled date for resubmittal.
    - g. Scheduled date for the Architect's final release or approval.
- B. Distribution: Following response to the initial submittal, print and distribute copies to the Architect, Owner, subcontractors, and other parties required to comply with submittal dates indicated. Post copies in the project meeting room and field office.
  - 1. When revisions are made, distribute to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the work and are no longer involved in construction activities.

- C. Schedule Updating: Revise the schedule after each meeting or activity where revisions have been recognized or made. Issue the updated schedule concurrently with the report of each meeting.

## 1.7 DAILY CONSTRUCTION REPORTS

- A. Prepare a daily construction report recording the following information concerning events at the site, and submit duplicate copies to the Architect at weekly intervals:
  1. List of subcontractors at the site.
  2. Approximate count of personnel at the site.
  3. High and low temperatures, general weather conditions.
  4. Accidents and unusual events.
  5. Meetings and significant decisions.
  6. Stoppages, delays, shortages, and losses.
  7. Meter readings and similar recordings.
  8. Emergency procedures.
  9. Orders and requests of governing authorities.
  10. Change Orders received, implemented.
  11. Services connected, disconnected.
  12. Equipment or system tests and startups.
  13. Partial Completions, occupancies.
  14. Substantial Completions authorized.

## 1.8 SHOP DRAWINGS

- A. Submit newly prepared information drawn accurately to scale. Highlight, encircle, or otherwise indicate deviations from the Contract Documents. Do not reproduce Contract Documents or copy standard information as the basis of Shop Drawings. Standard information submitted without being specifically tailored to this Project is not a Shop Drawing.
- B. Shop Drawings include fabrication and installation Drawings, setting diagrams, schedules, patterns, templates and similar drawings. Include the following information:
  1. Dimensions.
  2. Identification of products and materials included.
  3. Compliance with specified standards.
  4. Notation of coordination requirements.
  5. Notation of dimensions established by field measurement.
  6. Sheet Size: Except for templates, patterns and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches but no larger than 36 by 48 inches.
  7. Submittal Quantity and Type: Submit one correctable, translucent, reproducible print and two blueline or blackline prints for the Architect's review. The Architect will return the reproducible print.
  8. Do not use Shop Drawings without an appropriate final stamp indicating action taken in connection with construction.

## 1.9 PRODUCT DATA

- A. Collect product data into a single submittal for each element of construction or system. Product data includes printed information, such as manufacturer's installation instructions, catalog cuts, standard color charts, roughing-in diagrams

and templates, standard wiring diagrams, and performance curves. Where product data must be specially prepared because standard printed data is not suitable for use, submit as "shop drawings."

1. Mark each copy to show applicable choices and options. Where printed product data includes information on several products, some of which are not required, mark copies to indicate the applicable information. Include the following information:
  - a. Manufacturer's printed recommendations.
  - b. Compliance with recognized trade association standards.
  - c. Compliance with recognized testing agency standards.
  - d. Application of testing agency labels and seals.
  - e. Notation of dimensions verified by field measurement.
  - f. Notation of coordination requirements.
2. Do not submit product data until compliance with requirements of the Contract Documents has been confirmed.
3. Submittals: Submit 6 copies of each required submittal. The Architect will retain 3 and will return the others marked with action taken and corrections or modifications required.
4. Distribution: Furnish copies of final submittal to installers, subcontractors, suppliers, manufacturers, fabricators, and others required for performance of construction activities. Show distribution on transmittal forms.
  - a. Do not proceed with installation until an applicable copy of product data is in the Installer's possession.
  - b. Do not permit use of unmarked copies of product data in connection with construction.

#### 1.10 SAMPLES

- A. Submit full-size, fully fabricated samples cured and finished as specified and physically identical with the material or product proposed. Samples include partial sections of manufactured or fabricated components, cuts or containers of materials, color range sets, and swatches showing color, texture, and pattern.
  1. Mount, display or package samples in the manner to facilitate review of qualities indicated. Prepare samples to match the Architect's sample. Include the following:
    - a. Specification section number and reference.
    - b. Generic description of the sample.
    - c. Sample source.
    - d. Product name or name of the manufacturer.
    - e. Compliance with recognized standards.
    - f. Availability and delivery time.
  2. Submit samples for review of size, kind, color, pattern, and texture. Submit samples for a final check of these characteristics with other elements and a comparison of these characteristics between the final submittal and the actual component as delivered and installed.
    - a. Where variation in color, pattern, texture, or other characteristic is inherent in the material or product represented, submit at least 3 multiple units that show approximate limits of the variations.
    - b. Refer to other Specification sections for requirements for samples that illustrate workmanship, fabrication techniques, details of assembly, connections, operation, and similar construction characteristics.



3. Preliminary Submittals: Where samples are for selection of color, pattern, texture or similar characteristics from a range of standard choices, submit a full set of choices for the material or product.
    - a. Preliminary submittals will be reviewed and returned with the Architect's notation indicating selection and other action.
  4. Submittals: Except for samples illustrating assembly details, workmanship, fabrication techniques, connections, operation, and similar characteristics, submit 3 sets. The Architect will return one set marked with the action taken.
  5. Maintain sets of samples, as returned, at the Project Site, for quality comparisons throughout the course of construction.
    - a. Unless noncompliance with Contract Document provisions is observed, the submittal may serve as the final submittal.
    - b. Sample sets may be used to obtain final acceptance of the construction associated with each set.
- B. Distribution of Samples: Prepare and distribute additional sets to subcontractors, manufacturers, fabricators, suppliers, installers, and others as required for performance of the work. Show distribution on transmittal forms.
1. Field samples specified in individual sections are special types of samples. Field samples are full-size examples erected on-site to illustrate finishes, coatings, or finish materials and to establish the standard by which the work will be judged.
    - a. Comply with submittal requirements to the fullest extent possible. Process transmittal forms to provide a record of activity.

#### 1.11 QUALITY ASSURANCE SUBMITTALS

- A. Submit quality-control submittals, including design data, certifications, manufacturer's instructions, manufacturer's field reports, and other quality-control submittals as required under other sections of the Specifications.
- B. Certifications: Where other sections of the Specifications require certification that a product, material, or installation complies with specified requirements, submit a notarized certification from the manufacturer certifying compliance with specified requirements.
  1. Signature: Certification shall be signed by an officer of the manufacturer or other individual authorized to sign documents on behalf of the company.
- C. Inspection and Test Reports: Requirements for submittal of inspection and test reports from independent testing agencies are specified in Division 1, Section 01400 - QUALITY CONTROL.

#### 1.12 CONSTRUCTION PHOTOGRAPHS

- A. General: Provide construction progress photographs taken one day each month to coincide with monthly pay request, until Substantial Completion. Take photographs at Substantial Completion as specified.
- B. Photographer Qualifications: A professional commercial photographer acceptable to the Owner.
- C. Format: Color photographic prints in 8-inch by 10-inch size, smooth surface, glossy finish and in a plastic jacket with a left hand binding margin.

1. Provide 3 copies of each monthly set, with negatives, to the Architect, within 5 working days of taking photograph.
  2. Label each photograph, in lower right-hand corner, with the name of the project, date and time of the exposure, description of the view, Contractor's name and other pertinent data.
  3. Consecutively number each exposure from beginning of project through Substantial Completion.
- D. Quantity:
1. Monthly: Until Substantial Completion, take photographs of 4 representative views of the project showing, as much as possible, the work installed during the previous month. Architect reserves the right to determine location of photographs.
  2. At Substantial Completion: Take photographs of the project from 10 locations as selected by the Owner and Architect.

### 1.13 ARCHITECT'S ACTION

- A. Except for submittals for the record, information or similar purposes, where action and return is required or requested, the Architect will review each submittal, mark to indicate action taken, and return in accordance with the Article "Submittal Procedures".
1. Compliance with specified characteristics is the Contractor's responsibility.
- B. Action Stamp: The Architect will stamp each submittal with a uniform, self-explanatory action stamp. The stamp will be appropriately marked, as follows, to indicate the action taken:
1. Final Unrestricted Release: When submittals are marked "Approved," the work covered by the submittal may proceed provided it complies with requirements of the Contract Documents. Final acceptance and payment depends on that compliance.
  2. Final-But-Restricted Release: When submittals are marked "Approved as Noted," the work covered by the submittal may proceed provided it complies with notations or corrections on the submittal and requirements of the Contract Documents. Final acceptance and payment depends on that compliance.
  3. Returned for Resubmittal: When submittals are marked "Not Approved" or "Returned for Correction", do not proceed with work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Revise or prepare a new submittal according to the notations; resubmit without delay. Repeat if necessary to obtain different action mark. Do not permit submittals so marked to be used at the project site or elsewhere where work is in progress.
  4. Other Action: Where a submittal is for information or record purposes, special processing or other activity, the submittal will be returned marked "Returned Without Action".
- C. Unsolicited Submittals: The Architect will return unsolicited submittals to the sender without action.
- D. Except for verification of finishes, colors and other aesthetic matters left to the Architect's discretion by the Contract Documents, Architect's review of shop drawings is only for the convenience of the Owner in following the work and shall not relieve the Contractor from responsibility for any deviations from the requirements of

the Contract Documents. The Architect's review shall not be construed as a complete check nor shall it relieve the Contractor from responsibility for errors of any sort in shop drawings or schedules or from the necessity of furnishing any work required by the Contract Documents which may have been omitted on the shop drawings. The Architect's review of a separate item shall not indicate review of the complete assembly in which it functions.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 01300

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**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/](http://www.carpet-rug.com/).

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**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/](http://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)

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- 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.

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- 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

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- 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.



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- 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.

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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)

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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](http://www.aqmd.gov).
- C. “Green Seal Standard for Commercial Adhesives”, GS-36, requirements in effect October 19, 2000, [www.greenseal.org/](http://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/](http://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](http://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](http://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](http://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  
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.
  2. Prerequisite EA 1, Fundamental Commissioning of the Building Energy Systems

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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.

3. Prerequisite EA 2, Minimum Energy Performance  
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".
4. Prerequisite EA 3, CFC Fundamental Refrigerant Management  
Chlorofluorocarbon (CFC) refrigerants are prohibited from all HVAC&R systems installed as part of the project.
5. Prerequisite MR 1, Storage & Collection of Recyclables  
The project includes dedicated storage/collection facilities for recyclable materials, including paper, corrugated cardboard, glass, plastics and metals.
6. Prerequisite EQ 1, Minimum IAQ Performance  
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.
7. Prerequisite EQ 2, Environmental Tobacco Smoke (ETS) Control  
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

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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

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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

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- 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

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to comply with these requirements. VOC content shall be documented in accordance with Item 1.9, LEED Submittals below.

**F. DIVISION 6 – WOODS, PLASTICS AND COMPOSITES**

**1. Certified Wood:**

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

**2. Low-emission Products:**

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

**G. DIVISION 7 - THERMAL AND MOISTURE PROTECTION**

**1. Recycled Content Materials:**

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



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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

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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.

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**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

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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.

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**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

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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.\*

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- 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.

- 2. 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.

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- 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.
3. **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.
4. **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.
5. **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
6. **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.
7. **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.
8. **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/](http://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



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GS-03 (2nd Edition, January 1997)

- c. Aerosol Adhesives: refer to Green Seal standard GS-36 (1st edition, October 2000)
  - 9. 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).
  - 10. 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  $\geq$  2:12)
    - c. 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.
    - d. Vegetated roof surfaces are exempt from the SRI criteria.
  - 11. 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.
- B. CONSTRUCTION PROGRESS**
- Concurrent with each Application for Payment, submit reports comparing actual construction and purchasing activities with LEED action plans for the following:
- 1. Waste Reduction Progress Reports complying with Division 01524 Section "Construction Waste Management".
  - 2. Regional Materials. Provide updated spreadsheet to track Regional Materials.
  - 3. Recycled Content Materials. Provide updated spreadsheet to track Recycled Content.
  - 4. FSC Certified Wood Products. Provide updated spreadsheet to track FSC Certified Wood Materials.
  - 5. Low Emitting VOC Content Materials. Provide updated spreadsheet to track Low Emitting VOC Content Materials.
  - 6. Low Emitting Composite Wood. Provide updated spreadsheet to track low emitting (non-urea-formaldehyde) composite and engineered wood products.

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**C. LEED ACTION PLANS**

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.

1. Erosion and Sedimentation Control Plan (ESC): Indicate what ESC for site work measures are anticipated and how they will be documented.
2. 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.
3. 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

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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

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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

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- 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

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- |    |      |                   |     |     |
|----|------|-------------------|-----|-----|
|    | 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 (specialized 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 SCAQMD, 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 |     |

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- 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

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recycled content shall be excluded.

**F. LOW EMITTING VOC CONTENT MATERIALS**

1. Maintain a spreadsheet of all adhesives, sealants, and sealant primers, paints and coatings used on the project. Include product manufacturer, product name/model, VOC content, allowable VOC content as per Item 1.11, Products, Sub-Item D., VOC Limits for Low-Emitting Materials, the source of the VOC data, an estimated quantity of the product used on the project and an estimated cost for each product.

**G. LOW EMITTING CARPET**

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

**H. LOW EMITTING COMPOSITE WOOD**

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

**I. CONSTRUCTION INDOOR AIR QUALITY MANAGEMENT**

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

END OF SECTION 01361



GREEN BUILDING MATERIALS REPORTING FORM							PROJECT NAME:			
CONTRACTOR:				TEL. NO:			SPEC SECTION:			
CONTACT NAME:				SUBMITTAL NO:						
Product	Vendor or Manufacturer	REQUIRED for ALL products identified in specifications (except MEPS)		Is the product salvaged, refurbished or reused? <sup>1</sup> (Y/N)	If contains Recycled Content		100% Extracted & Manufactured <sup>4</sup> w/n 500 mile radius of site (Y/N)	Partially Extracted & Manufactured <sup>5</sup> w/n 500 mile radius of site (Enter % by weight)	For Wood Products: FSC Certified (Y/N) <sup>7</sup>	VOC Content <sup>8</sup> (for adhesives, sealants, paints and coatings)
		Total COST	Installed		Material COST (excluding labor & equipment)	% post consumer <sup>2</sup>				
1.										
2.										
3.										
4.										
5.										
6.										
7.										

- 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).
- 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)
- 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.
- 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'
- 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.
- 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)
- 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.
- 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  
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 SUMMARY**

- A. This section includes administrative and procedural requirements for quality-control services.
- B. Quality-control services include inspections, tests, and related actions, including reports performed by Contractor, by independent agencies, and by governing authorities. They do not include contract enforcement activities performed by Architect.
- C. Inspection and testing services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with Contract Document requirements.
- D. Requirements of this section relate to customized fabrication and installation procedures, not production of standard products.
  - 1. Specific quality-control requirements for individual construction activities are specified in the sections that specify those activities. Those requirements, including inspections and tests, cover production of standard products as well as customized fabrication and installation procedures.
  - 2. Specified inspections, tests, and related actions do not limit Contractor's quality-control procedures that facilitate compliance with Contract Document requirements.
  - 3. Requirements for Contractor to provide quality-control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this section.

**1.3 RESPONSIBILITIES**

- A. Contractor Responsibilities: Unless otherwise indicated as the responsibility of another identified entity, Contractor shall provide inspections, tests, and similar quality-control services specified elsewhere in the Contract Documents and required by authorities having jurisdiction. Costs for these services are included in the Contract Sum.
- B. Contractor's Convenience Testing: Inspecting and testing performed exclusively for the Contractor's convenience shall be the sole responsibility of the Contractor.
- C. Retesting: The Contractor is responsible for retesting where results of inspections, tests, or other quality-control services prove unsatisfactory and indicate

noncompliance with Contract Document requirements, regardless of whether the original test was Contractor's responsibility.

1. The cost of retesting construction, revised or replaced by the Contractor, is the Contractor's responsibility where required tests were performed on original construction.
- D. Associated Services: Cooperate with agencies performing required inspections, tests, and similar services, and provide reasonable auxiliary services as requested. Notify the agency sufficiently in advance of operations to permit assignment of personnel. Auxiliary services required include, but are not limited to, the following:
1. Provide access to the work.
  2. Furnish incidental labor and facilities necessary to facilitate inspections and tests.
  3. Take adequate quantities of representative samples of materials that require testing or assist the agency in taking samples.
  4. Provide facilities for storage and curing of test samples.
  5. Deliver samples to testing laboratories.
  6. Provide the agency with a preliminary design mix proposed for use for materials mixes that require control by the testing agency.
  7. Provide security and protection of samples and test equipment at the Project Site.
- E. Duties of the Testing Agency: The independent testing agency engaged to perform inspections, sampling, and testing of materials and construction specified in individual sections shall cooperate with the Architect and the Contractor in performance of its duties and shall provide qualified personnel to perform required inspections and tests.
1. The agency shall notify the Architect and the Contractor promptly of irregularities or deficiencies observed in the work during performance of its services.
  2. The agency is not authorized to release, revoke, alter, or enlarge requirements of the Contract Documents or approve or accept any portion of the work.
  3. The agency shall not perform any duties of the Contractor.
- F. Coordination: The Contractor and each agency engaged to perform inspections, tests and similar services shall coordinate the sequence of activities to accommodate required services with a minimum of delay. In addition, the Contractor and each agency shall coordinate activities to avoid the necessity of removing and replacing construction to accommodate inspections and tests.
1. The Contractor is responsible for scheduling times for inspections, tests, taking samples, and similar activities.

#### 1.4 SUBMITTALS

- A. The independent testing agency shall submit a certified written report, in duplicate, of each inspection, test, or similar service to the Architect and the Contractor.
1. Submit additional copies of each written report directly to the governing authority, when the authority so directs.
  2. Report Data: Written reports of each inspection, test, or similar service shall include, but not be limited to, the following:
    - a. Date of issue.
    - b. Project title and number.
    - c. Name, address, and telephone number of testing agency.

- d. Dates and locations of samples and tests or inspections.
- e. Names of individuals making the inspection or test.
- f. Designation of the work and test method.
- g. Identification of product and specification section.
- h. Complete inspection or test data.
- i. Test results and an interpretation of test results.
- j. Ambient conditions at the time of sample taking and testing.
- k. Comments or professional opinion on whether inspected or tested work complies with Contract Document requirements.
- l. Name and signature of laboratory inspector.
- m. Recommendations on retesting.

## 1.5 QUALITY ASSURANCE

- A. Qualifications for Service Agencies: Engage inspection and testing service agencies, including independent testing laboratories, that are prequalified as complying with the American Council of Independent Laboratories' "Recommended Requirements for Independent Laboratory Qualification" and that specialize in the types of inspections and tests to be performed.
  - 1. Each independent inspection and testing agency engaged on the Project shall be authorized by authorities having jurisdiction to operate in the state where the Project is located.

## PART 2 - PRODUCTS (Not Applicable)

## PART 3 - EXECUTION

### 3.1 REPAIR AND PROTECTION

- A. General: Upon completion of inspection, testing, sample taking and similar services, repair damaged construction and restore substrates and finishes to eliminate deficiencies including deficiencies in visual qualities of exposed finishes. Comply with Contract Document requirements for "Cutting and Patching."
- B. Protect construction exposed by or for quality-control service activities, and protect repaired construction.
- C. Repair and protection is Contractor's responsibility, regardless of the assignment of responsibility for inspection, testing, or similar services.

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



**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 judgement 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 03) - 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 03) - 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 31) - 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)**

## **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	
31200	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.

(1) Permit No. to be provided by the Building Official.

(2) Reference to specific technical scope section in program.

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

(4) Special Inspector – Technical, Special Inspector – Structural.

(5) Weekly, monthly, per test/inspection, per floor, etc.

(6) Firm contracted to perform services.



## ACKNOWLEDGEMENTS

Each appropriate representative shall sign below:

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

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

### LEGEND:

SER = Structural Engineer of Record

SI-S = Special Inspector – Structural

TA = Testing Agency

SI-T = Special Inspector – Technical

F = Fabricator.

Accepted for the Building Department By \_\_\_\_\_

Date. \_\_\_\_\_

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

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

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

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

**1.3 QUALITY ASSURANCE**

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

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

#### 1.4 PROJECT CONDITIONS

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

#### PART 2 - PRODUCTS (Not Applicable)

#### PART 3 - EXECUTION

##### 3.1 INSTALLATION

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

##### 3.2 TEMPORARY UTILITY INSTALLATION

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

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

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

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

### 3.3 TEMPORARY CONSTRUCTION AND SUPPORT FACILITIES INSTALLATION

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

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

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

### 3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

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

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

### 3.5 OPERATION, TERMINATION, AND REMOVAL

- A. Supervision: Enforce strict discipline in use of temporary facilities. Limit availability of temporary facilities to essential and intended uses to minimize waste and abuse.
- B. Maintenance: Maintain facilities in good operating condition until removal. Protect from damage by freezing temperatures and similar elements.
1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
  2. Protection: Prevent water-filled piping from freezing. Maintain markers for underground lines. Protect from damage during excavation operations.
- C. Termination and Removal: Unless the Architect requests that it be maintained longer, remove each temporary facility when the need has ended, when replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with the temporary facility. Repair damaged work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
1. Materials and facilities that constitute temporary facilities are the Contractor's property. The Owner reserves the right to take possession of project identification signs.



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

END OF SECTION 01500

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

**SECTION 01631 – PRODUCTS  
AND SUBSTITUTIONS**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

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

**1.3 DEFINITIONS**

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

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

#### 1.4 SUBMITTALS

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

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

## PART 2 - PRODUCTS

### 2.1 PRODUCT SELECTION

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

- d. Speed.
- e. Ratings.

## 2.2 SUBSTITUTIONS

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

## PART 3 - EXECUTION (Not Applicable)

END OF SECTION 01631

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

**SECTION 01700 - CONTRACT  
CLOSEOUT**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

- A. This Section includes general procedural requirements governing execution of the Work including, but not limited to, the following:
1. Construction layout.
  2. Field engineering and surveying.
  3. General installation of products.
  4. Coordination of Owner-installed products.
  5. Progress cleaning.
  6. Starting and adjusting.
  7. Protection of installed construction.
  8. Correction of the Work.
- B. Related Sections include the following:
1. Division 1 Section "Project Management and Coordination" for procedures for coordinating field engineering with other construction activities.
  2. Division 1 Section "Submittal Procedures" for submitting surveys.
  3. Division 1 Section "Cutting and Patching" for procedural requirements for cutting and patching necessary for the installation or performance of other components of the Work.
  4. Division 1 Section "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.

**1.3 SUBMITTALS**

- A. Qualification Data: For **[land surveyor] [professional engineer]**.
- B. Certificates: Submit certificate signed by **[land surveyor] [professional engineer]** certifying that location and elevation of improvements comply with requirements.
- C. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.
- D. Certified Surveys: Submit **[two] <Insert number>** copies signed by **[land surveyor] [professional engineer]**.
- E. Final Property Survey: Submit **[10] <Insert number>** copies showing the Work performed and record survey data.

## 1.4 QUALITY ASSURANCE

- A. Land Surveyor Qualifications: A professional land surveyor who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated.

## PART 2 - PRODUCTS (Not Used)

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Existing Conditions: The existence and location of site improvements, utilities, and other construction indicated as existing are not guaranteed. Before beginning work, investigate and verify the existence and location of mechanical and electrical systems and other construction affecting the Work.
  - 1. Before construction, verify the location and points of connection of utility services.
- B. Existing Utilities: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities and other construction affecting the Work.
  - 1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; and underground electrical services.
  - 2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.
- C. Acceptance of Conditions: Examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
  - 1. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:
    - a. Description of the Work.
    - b. List of detrimental conditions, including substrates.
    - c. List of unacceptable installation tolerances.
    - d. Recommended corrections.
  - 2. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
  - 3. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
  - 4. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
  - 5. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.



### 3.2 PREPARATION

- A. Existing Utility Information: Furnish information to **[local utility] [Owner]** that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.
- B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents, submit a request for information to Architect. Include a detailed description of problem encountered, together with recommendations for changing the Contract Documents. **[Submit requests on CSI Form 13.2A, "Request for Interpretation."]**

### 3.3 CONSTRUCTION LAYOUT

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

surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect.

### 3.4 FIELD ENGINEERING

- A. Identification: Owner will identify existing benchmarks, control points, and property corners.
- B. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.
  - 1. Do not change or relocate existing benchmarks or control points without prior written approval of Architect. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect before proceeding.
  - 2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.
- C. Benchmarks: Establish and maintain a minimum of **[two] <Insert number>** permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.
  - 1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
  - 2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
  - 3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.
- D. Certified Survey: 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 sitework.
- E. Final Property Survey: Prepare a final property survey showing significant features (real property) for Project. Include on the survey a certification, signed by **[land surveyor] [professional engineer]**, that principal metes, bounds, lines, and levels of Project are accurately positioned as shown on the survey.
  - 1. Show boundary lines, monuments, streets, site improvements and utilities, existing improvements and significant vegetation, adjoining properties, acreage, grade contours, and the distance and bearing from a site corner to a legal point.
  - 2. Recording: At Substantial Completion, have the final property survey recorded by or with authorities having jurisdiction as the official "property survey."

### 3.5 INSTALLATION

- A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
  - 1. Make vertical work plumb and make horizontal work level.
  - 2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.

3. Conceal pipes, ducts, and wiring in finished areas, unless otherwise indicated.
  4. Maintain minimum headroom clearance of **[8 feet (2.4 m)] <Insert dimension>** in spaces without a suspended ceiling.
- B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
  - C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.
  - D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.
  - E. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.
  - F. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.
  - G. Anchors and Fasteners: Provide anchors and fasteners as required to anchor each component securely in place, accurately located and aligned with other portions of the Work.
    1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
    2. Allow for building movement, including thermal expansion and contraction.
    3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
  - H. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.
  - I. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

### 3.6 OWNER-INSTALLED PRODUCTS

- A. Site Access: Provide access to Project site for Owner's construction forces.
- B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction forces.
  1. Construction Schedule: Inform Owner of Contractor's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify

Owner if changes to schedule are required due to differences in actual construction progress.

2. Preinstallation Conferences: Include Owner's construction forces at preinstallation conferences covering portions of the Work that are to receive Owner's work. Attend preinstallation conferences conducted by Owner's construction forces if portions of the Work depend on Owner's construction.

### 3.7 PROGRESS CLEANING

- A. General: Clean Project site and work areas daily, including common areas. Coordinate progress cleaning for joint-use areas where more than one installer has worked. Enforce requirements strictly. Dispose of materials lawfully.
  1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
  2. Do not hold materials more than seven (7) days during normal weather or three (3) days if the temperature is expected to rise above 80 deg F (27 deg C).
  3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
- B. Site: Maintain Project site free of waste materials and debris.
- C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
  1. Remove liquid spills promptly.
  2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.
- D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.
- E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.
- F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
- G. Waste Disposal: Burying or burning waste materials on-site will not be permitted. Washing waste materials down sewers or into waterways will not be permitted.
- H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
- I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

- J. Limiting Exposures: Supervise construction operations to 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.

### 3.8 STARTING AND ADJUSTING

- A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
- B. Adjust operating components for proper operation without binding. Adjust equipment for proper operation.
- C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Manufacturer's Field Service: If a factory-authorized service representative is required to inspect field-assembled components and equipment installation, comply with qualification requirements in Division 1 Section "Quality Requirements."

### 3.9 PROTECTION OF INSTALLED CONSTRUCTION

- A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.
- B. Comply with manufacturer's written instructions for temperature and relative humidity.

### 3.10 CORRECTION OF THE WORK

- A. Repair or remove and replace defective construction. Restore damaged substrates and finishes. Comply with requirements in Division 1 Section "Cutting and Patching."
  - 1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.
- B. Restore permanent facilities used during construction to their specified condition.
- C. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.
- D. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.
- E. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION 01700

**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 rely on substrates exposed by selective demolition operations.
- 5) Review areas where existing construction is to remain and requires protection.

## 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.
- F. Warranties: Documentation indicated that existing warranties are still in effect after completion of selective demolition.

## 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.

## 1.9 FIELD CONDITIONS

- A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.
- B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
  - 1) Before selective demolition, Owner will remove the following items:
    - a) **<Insert items to be removed by Owner>.**
- 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 Architect and 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.

## 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. 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.
  - E. Engage a professional engineer 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.
- 3.2 Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.
- A. Survey of Existing Conditions: Record existing conditions by use of preconstruction photographs and / or preconstruction video.
- 3.3 Comply with requirements specified in Division 1 Section "Photographic Documentation."
- A. 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.
- 3.4 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS
- A. Existing Services / Systems to Remain: Maintain Services / Systems indicated to remain and protect them against damage.
- 3.5 Comply with requirements for existing Services / Systems interruptions specified in Division 1 Section "Summary."
- A. 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.
- 3.6 Owner will arrange to shut off indicated Services / Systems when requested by Contractor.
- 1. 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.
  - 2. 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.

### 3.7 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.
- J. Strengthen or add new supports when required during progress of selective demolition.

### 3.8 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.

### 3.9 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.

### 3.10 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.

### 3.11 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.

### 3.12 SELECTIVE DEMOLITION SCHEDULE

- A. Existing [Items] [Construction] to Be Removed: <Insert description of items and construction to be removed>.
- B. Existing Items to Be Removed and Salvaged: <Insert description of items to be removed and salvaged>.
- C. Existing Items to Be Removed and Reinstalled: <Insert description of items to be removed and reinstalled>.
- D. Existing Items to Remain: <Insert description of items to remain>.

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  
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**SECTION 01742 - CONSTRUCTION  
WASTE MANAGEMENT**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

- A. This Section includes administrative and procedural requirements for the following:
  - 1. Salvaging non-hazardous demolition and construction waste
  - 2. Recycling non-hazardous demolition and construction waste
  - 3. Disposing of non-hazardous demolition and construction waste
- B. Related Sections include the following:
  - 1. Division 1 Section "Summary of Multiple Contracts" for coordination of responsibilities for waste management
  - 2. Division 1 Section "Sustainable Design Requirements"
  - 3. Division 1 Section "Temporary Facilities and Controls" for environmental-protection measures during construction
  - 4. Division 2 Section "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](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 02221 – BUILDING  
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 buildings and site improvements.
  - 2) **[Abandoning in-place] [Removing]** below-grade construction.
  - 3) Disconnecting, capping or sealing, and **[abandoning in-place] [removing]** site utilities.
  - 4) Salvaging items for reuse by Owner.
- B. Related Sections:
  - 1) Division 1 Section "Summary" for use of the premises and phasing requirements.
  - 2) Division 1 Section "Selective Demolition" for partial demolition of buildings, structures, and site improvements.
  - 3) Division 2 Section "Site Clearing" for site clearing and removal of above- and below-grade site improvements not part of building demolition.
  - 4) Division 2 Section "Piped Utilities - Basic Materials and Methods" for shutting off, disconnecting, removing, and sealing or capping utilities.
  - 5) Division 15 Sections for demolishing or relocating site plumbing and mechanical items.

**1.3 DEFINITIONS**

- A. Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged.
- B. Remove and Salvage: Carefully detach from existing construction, in a manner to prevent damage, and deliver to Owner. Include fasteners or brackets needed for reattachment elsewhere.

**1.4 MATERIALS OWNERSHIP**

- A. Unless otherwise indicated, demolition waste becomes property of Contractor.
- B. Historic items, relics, antiques, 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 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified refrigerant recovery technician.
- B. Proposed Protection Measures: Submit informational report, including Drawings, that indicates the measures proposed for protecting individuals and property. Indicate proposed locations and construction of barriers.
- C. Schedule of Building Demolition Activities: Indicate the following:
  - 1) Detailed sequence of demolition work, with starting and ending dates for each activity.
  - 2) Temporary interruption of utility services.
  - 3) Shutoff and capping or re-routing of utility services.
- D. Inventory: Submit a list of items to be removed and salvaged and deliver to Owner prior to start of demolition.
- E. Pre-demolition Photographs or Video: Show existing conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by demolition operations. Comply with Division 1 "Photographic Documentation." Submit before the Work begins.
- F. Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.
- G. 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.

## 1.6 QUALITY ASSURANCE

- A. Refrigerant Recovery Technician Qualifications: Certified by 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.
- D. Predemolition Conference: Conduct conference at Project site.
  - 1) Inspect and discuss condition of construction to be demolished.
  - 2) Review structural load limitations of existing structures.
  - 3) Review and finalize building demolition schedule and verify availability of demolition personnel, equipment, and facilities needed to make progress and avoid delays.
  - 4) Review and finalize protection requirements.
  - 5) Review procedures for **[noise control] [and] [dust control]**.
  - 6) Review procedures for protection of adjacent buildings.
  - 7) Review items to be salvaged and returned to Owner.

## 1.7 PROJECT CONDITIONS

- A. Buildings to be demolished will be vacated and their use discontinued before start of the Work.
- B. Buildings immediately adjacent to demolition area will be occupied. Conduct building demolition so operations of occupied buildings 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.
- C. Owner assumes no responsibility for buildings and structures to be demolished.
  - 1) Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
  - 2) Before building demolition, Owner will remove the following items:
    - a) **<Insert items to be removed by Owner>.**
- 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.
  - 2) If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.
- E. On-site storage or sale of removed items or materials is not permitted.

## 1.8 COORDINATION

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

## PART 2 - PRODUCTS (Not Used)

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verify that utilities have been disconnected and capped before starting demolition operations.
- B. Review Project Record Documents of existing construction provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in Project Record Documents.
- C. 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. Comply with Division 1 Section "Photographic Documentation."

- D. 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 building demolition operations.

### 3.2 PREPARATION

- A. Refrigerant: Remove refrigerant from mechanical equipment according to 40 CFR 82 and regulations of authorities having jurisdiction before starting demolition.
- B. Existing Utilities: Locate, identify, disconnect, and seal or cap off indicated utilities serving buildings and structures to be demolished.
  - 1) Owner will arrange to shut off indicated utilities when requested by Contractor.
  - 2) If removal, relocation, or abandonment of utility services will affect adjacent occupied buildings, then provide temporary utilities that bypass buildings and structures to be demolished and that maintain continuity of service to other buildings and structures.
  - 3) Cut off pipe or conduit a minimum of 24 inches (610 mm) below grade. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing according to requirements of authorities having jurisdiction.
- C. Existing Utilities: See Divisions 15 and 16 Sections for shutting off, disconnecting, removing, and sealing or capping utilities. Do not start demolition work until utility disconnecting and sealing have been completed and verified in writing.
- D. Temporary Shoring: Provide and maintain interior and exterior shoring, bracing, or structural support to preserve stability and prevent unexpected movement or collapse of construction being demolished.
  - 1) Strengthen or add new supports when required during progress of demolition.
- E. Salvaged Items: Comply with the following:
  - 1) Clean salvaged items of dirt and demolition debris.
  - 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 storage area designated by Owner.
  - 5) Protect items from damage during transport and storage.

### 3.3 PROTECTION

- A. Existing Facilities: Protect adjacent walkways, loading docks, building entries, and other building facilities during demolition operations. Maintain exits from existing buildings.
- B. Existing Utilities: Maintain utility services to remain and protect from damage during demolition operations.
  - 1) Do not interrupt existing utilities serving adjacent occupied or operating facilities unless authorized in writing by Owner and authorities having jurisdiction.
  - 2) Provide temporary services during interruptions to existing utilities, as acceptable to Owner and authorities having jurisdiction.
    - a. Provide at least seventy-two (72) hours notice to occupants of affected buildings if shutdown of service is required during changeover.

- C. Temporary Protection: Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction and as indicated. Comply with requirements in Division 1 Section "Temporary Facilities and Controls."
  - 1) Protect adjacent buildings and facilities from damage due to demolition activities.
  - 2) Protect existing site improvements, appurtenances, and landscaping to remain.
  - 3) Erect a plainly visible fence around drip line of individual trees or around perimeter drip line of groups of trees to remain.
  - 4) Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
  - 5) Provide protection to ensure safe passage of people around building demolition area and to and from occupied portions of adjacent buildings and structures.
  - 6) Protect walls, windows, roofs, and other adjacent exterior construction that are to remain and that are exposed to building demolition operations.
  - 7) Erect and maintain dustproof partitions and temporary enclosures to limit dust, noise, and dirt migration to occupied portions of adjacent buildings.
- D. Remove temporary barriers and protections where hazards no longer exist. Where open excavations or other hazardous conditions remain, leave temporary barriers and protections in place.

### 3.4 DEMOLITION, GENERAL

- A. General: Demolish indicated buildings and site improvements completely. Use methods required to complete the Work within limitations of governing regulations and as follows:
  - 1) Do not use cutting torches until work area is cleared of flammable materials. Maintain portable fire-suppression devices during flame-cutting operations.
  - 2) Maintain fire watch during and for at least **<Insert number>** hours after flame cutting operations.
  - 3) Maintain adequate ventilation when using cutting torches.
  - 4) Locate building demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
- B. Engineering Surveys: During demolition, perform surveys to detect hazards that may result from building demolition activities.
- C. Site Access and Temporary Controls: Conduct building demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
  - 1) Do not close or obstruct streets, walks, walkways, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.
  - 2) Use water mist and other suitable methods to limit spread of dust and dirt. Comply with governing environmental-protection regulations. Do not use water when it may damage adjacent construction or create hazardous or objectionable conditions, such as ice, flooding, and pollution.
- D. Explosives: Use of explosives is not permitted.

### 3.5 DEMOLITION BY MECHANICAL MEANS

- A. Proceed with demolition of structural framing members systematically, from higher to lower level. Complete building demolition operations above each floor or tier before disturbing supporting members on the next lower level.
- B. Remove debris from elevated portions of the building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
  - 1) Remove structural framing members and lower to ground by method suitable to minimize ground impact and dust generation.
- C. Salvage: Items to be removed and salvaged are indicated on Drawings.
- D. Below-Grade Construction: Demolish foundation walls and other below-grade construction.
  - 1) Remove below-grade construction, including basements, foundation walls, and footings, to depths indicated.
- E. Existing Utilities: Demolish and remove existing utilities and below-grade utility structures.
  - 1) Piping: Disconnect piping at unions, flanges, valves, or fittings.
  - 2) Wiring Ducts: Disassemble into unit lengths and remove plug-in and disconnecting devices.

### 3.6 SITE RESTORATION

- A. Below-Grade Areas: Rough grade below-grade areas ready for further excavation or new construction.
- B. Site Grading: Uniformly rough grade area of demolished construction to a smooth surface, free from irregular surface changes. Provide a smooth transition between adjacent existing grades and new grades.

### 3.7 REPAIRS

- A. Promptly repair damage to adjacent buildings caused by demolition operations.

### 3.8 DISPOSAL OF DEMOLISHED MATERIALS

- A. Remove demolition waste materials from Project site and legally dispose of them in an EPA-approved landfill acceptable to authorities having jurisdiction. See Division 1 Section "Construction Waste Management" for recycling and disposal of demolition waste.
  - 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.
- B. Do not burn demolished materials.

### 3.9 CLEANING

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



END OF SECTION 02221

**SECTION 03100  
CONCRETE FORMWORK**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

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

**1.3 REFERENCES**

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

**1.4 ACTION SUBMITTALS**

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

**1.5 INFORMATIONAL SUBMITTALS**

- A. Submittal Schedule for all action submittal items.
- B. Minutes of Pre-Installation conference.

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

## 1.6 QUALITY ASSURANCE

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

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

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

### 2.2 FORM-FACING MATERIALS

- A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
  - 1. Plywood, metal, or other approved panel materials.
  - 2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
    - a. High-density overlay, Class 1 or better.
    - b. Medium-density overlay, Class 1 or better; mill-release agent treated and edge sealed.
    - c. Structural 1, B-B or better; mill oiled and edge sealed.
    - d. B-B (Concrete Form), Class 1 or better; mill oiled and edge sealed.
- B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

- C. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that will produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.
- D. Void Forms: Biodegradable paper surface, treated for moisture resistance, structurally sufficient to support weight of plastic concrete and other superimposed loads.
- E. Soil Retainers: Material to be rigid and non-degradable.
- F. Chamfer Strips: Wood, metal, PVC, or rubber strips.
- G. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.
- H. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
  - 1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
- I. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
  - 1. Furnish units that will leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
  - 2. Furnish ties that, when removed, will leave holes no larger than 1 inch in diameter in concrete surface.
  - 3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

### **PART 3 - EXECUTION**

#### **3.1 FORMWORK**

- A. Work shall conform to ACI 117 and ACI 301, except as modified by requirements of these Contract Documents.
- B. Design, erect, shore, brace, and maintain formwork, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.
- C. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated.
- D. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:
  - 1. Class B, 1/4 inch for smooth-formed finished surfaces exposed to view and as indicated by the Architect.
  - 2. Class C, 1/2 inch, for rough-formed finished surfaces unless noted otherwise.
- E. Construct forms tight enough to prevent loss of concrete mortar.
- F. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
  - 1. Install keyways, reglets, recesses, and the like, for easy removal.
  - 2. Do not use rust-stained steel form-facing material.

- G. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.
- H. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.
- I. Chamfer exterior corners and edges of permanently exposed concrete. Size chamfer as indicated on drawings.
- J. Form openings, chases, offsets, sinkages, keyways, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.
- K. Fastening Devices for Other Work:
  - 1. Provide for installation of inserts, reglets, hangers, metal ties, anchor bolts and other fastening devices required for attachment of other work.
  - 2. Properly locate fastening devices in cooperation with other trades and secure position before concrete is placed.
  - 3. Where concrete surfaces are veneered with masonry, install masonry anchor slots.
    - a. In concrete forms set vertically 2'-0" on center.
    - b. Install two continuous slots per face at each column face wider than 1'-4".
  - 4. Where masonry abuts concrete surface, install one continuous masonry anchor slot in concrete forms set vertically for each eight inches width of masonry, centered in masonry width.
- L. Install sleeves in concrete piers, columns, beams or joists only upon approval of the Architect.
- M. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- N. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- O. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

### **3.2 INSTALLATION OF VOID FORMS AND SOIL RETAINERS**

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

### **3.3 REMOVING AND REUSING FORMS**

- A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50

deg F for 24 hours after placing concrete, if concrete is hard enough to not be damaged by form-removal operations and curing and protection operations are maintained.

1. Leave formwork for beam soffits, joists, slabs, and other structural elements that supports weight of concrete in place until concrete has achieved at least 75 percent of its 28-day design compressive strength.
  2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.
- B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.
- C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

### **3.4 FIELD QUALITY CONTROL**

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

**END OF SECTION 03100**

**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**

**SECTION 03300  
CAST-INPLACE CONCRETE**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

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

**1.3 REFERENCES**

- A. ACI 117 – Specifications for Tolerances for Concrete Construction and Materials.
- B. ACI 214 - Recommended Practice for Evaluation of Strength Test Results of Concrete.
- C. ACI 223 – Standard Practice for the Use of Shrinkage Compensation Concrete.
- D. ACI 301 - Specifications for Structural Concrete for Buildings.
- E. ACI 302 – Guide for Concrete Floor and Slab Construction.
- F. ACI 304 - Guide for Measuring, Mixing, Transporting and Placing Concrete.
- G. ACI 305 - Hot Weather Concreting.
- H. ACI 306 - Cold Weather Concreting.
- I. ACI 308 – Standard Practice for Curing Concrete.
- J. ACI 309 - Guide for Consolidation of Concrete.
- K. ACI 318 - Building Code Requirements for Structural Concrete.

- L. ASTM E 1155 – Standard Test Method for Determining  $F_F$  Floor Flatness and  $F_L$  Floor Levelness Numbers.

#### 1.4 DEFINITIONS

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

#### 1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
  - 1. Form-release agents
  - 2. Concrete Admixtures.
  - 3. Curing Materials.
  - 4. Joint Fillers.
  - 5. Waterstops.
  - 6. Floor and Slab Treatments.
  - 7. Bonding Agents.
  - 8. Adhesives.
  - 9. Repair Materials
- B. Concrete Mix Designs: Each concrete mix design submittal shall contain the following information:
  - 1. Mix Number (which will correspond to mix ticket on trucks delivered to site).
  - 2. Application for which concrete is designed (i.e. – footings, slabs, etc...)
  - 3. Applicable mix performance criteria including:
    - a. Final Design strength at 28 days.
    - b. Unit Weight.
    - c. Air Content.
    - d. Slump (with water only and after addition of WRA and/or HRWRA).
    - e. For shrinkage compensating concrete, provide results of restrained prism expansion tests, ASTM C878, with mix design.
  - 4. Applicable mix ingredients including quantities, ASTM designations, and sources for:
    - a. Cementitious materials.
    - b. Aggregate source, geological type, size, and shape.
      - 1) Include total gradation for combined coarse and fine aggregates for mixes specified to contain Well Graded Aggregate.

- 2) Included calculated Coarseness Factor and Workability Factor for mixes specifying limits on these values.
  - c. Water.
    - 1) Indicate amount of mixing water to be withheld for later addition at Project site.
  - d. Water cementitious materials ratio, w/cm.
  - e. Admixtures.
  - f. Fibers, color pigments, and other additions.
  - 5. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
- C. Proposed construction joint and saw-cut contraction joint locations for slabs-on-grade.

## 1.6 INFORMATIONAL SUBMITTALS

- A. Submittal Schedule for all action submittal items.
- B. Manufacturer's Instructions for each type of product indicated:
- 1. Curing and Sealing Compounds.
  - 2. Joint Fillers.
  - 3. Waterstops.
  - 4. Floor and Slab Treatments.
  - 5. Bonding Agents.
  - 6. Adhesives.
  - 7. Repair Materials.
- C. Preconstruction Material Test Reports:
- 1. Cementitious Materials.
  - 2. Compressive strength results of trial batches or historical test data, in accordance with ACI 318 Chapter 5, indicating following:
    - a. Specified compressive strength,  $f'_c$ .
    - b. Average compressive strength,  $f'_{cr}$ .
    - c. Number of consecutive tests.
    - d. Overall standard deviation.
    - e. Overall coefficient of variation.
    - f. Minimum moving average of three consecutive strength tests.
  - 3. Aggregate gradation, specific gravity, and absorption.
  - 4. Aggregate potential alkali-silica reactivity (ASR) for concrete in exterior, corrosive, or wet environments in accordance with ASTM C 289.
- D. Minutes of Pre-Installation conference.
- E. Sustainable Design Submittals:
- 1. LEED Credit: Product Data for Credit MR 4.1 and Credit MR 4.2 if required: For products having recycled content, documentation indicating weights, costs, and percentages by weight of postconsumer and preconsumer recycled content.
    - a. Include statement indicating material weights and costs for each product having recycled content.
    - b. Design Mixtures for Credit ID 1.1: For each concrete mixture containing recycled pozzolanic or cementitious materials as a replacement for portland cement and for equivalent concrete mixtures that do not contain portland cement replacements.
  - 2. LEED Credit: Product Data for Credit MR 5.1 and Credit MR 5.2 if required: For products having Regional content (Extracted, and processed or manufactured within 500 miles of site), documentation indicating total weights, costs and percentages by weight of regional content.

- a. Include statement indicating material weights, and costs for each product having regional content.
- F. Construction Test Reports:
  - 1. Concrete tests.
  - 2. Floor tolerance measurement.
  - 3. Industrial floor joint filler inspection.

## 1.7 CLOSEOUT SUBMITTALS

- A. Floor Correction Agreement: Submit written floor slab extended correction period agreement in duplicate within ten days after date of Substantial Completion.
- B. Maintenance Contracts:
  - 1. Curing and Sealing Compounds.
  - 2. Floor and Slab Treatments.
- C. Operation and Maintenance Data:
  - 1. Curing and Sealing Compounds.
  - 2. Floor and Slab Treatments.
- D. Bonds.
- E. Warranty Documentation.
- F. Record Documentation.
- G. Sustainable Design Closeout Documentation.

## 1.8 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has completed concrete work similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94 requirements for production facilities and equipment.
  - 1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."
- C. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548.
- D. Source Limitations: Obtain materials from same source throughout Work.
- E. Mockups: Construct mockups as directed by the Architect to demonstrate aesthetic effects and qualities of materials and execution. Build mockups to comply with the following requirements, using materials indicated for the completed Work:
  - 1. Exposed Concrete Panel Samples: Cast concrete formed-surface panels to demonstrate typical joints, surface finish, texture, tolerances, and standard of workmanship for review and acceptance by Architect and Owner.
    - a. Build panel to size and in the location as directed by the Architect.



- b. Approved mockups may become part of the completed Work and shall remain exposed to view for duration of work as basis for quality of final construction.
  - c. Sample mockups not selected for incorporation shall be demolished and removed from site.
- F. Contractor shall assign a qualified staff member to perform quality control on their own work in the field on a daily basis, for each day work is performed. The Contractor's quality control staff shall review their own work for compliance with contract documents before the Contractor notifies the design team of readiness for required inspections, tests and observations to be provided by the Owner's Representatives.
- G. Pre-Installation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination" and Division 01 Section "Structural Tests and Special Inspections".
  - 1. Review installer qualifications, methods, scheduling and testing procedures before work is started.
  - 2. Review special inspection and testing and inspecting agency procedures for field quality control, steel reinforcement installation, concrete finishes and finishing, cold- and hot-weather concreting procedures, curing procedures, construction contraction and isolation joints, and joint-filler strips, semirigid joint fillers, vapor-retarder installation, anchor rod and anchorage device installation tolerances, floor and slab flatness and levelness measurement, concrete repair procedures, and concrete protection.
  - 3. Authorized representatives of concrete supplier, industrial floor supplier and installer, floor finisher, testing and inspection agency, admixture supplier, steel fiber reinforcement supplier, Engineer, Owner and Construction Manager.

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

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

## **1.10 SITE CONDITIONS**

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

## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURERS**

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

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

## 2.2 CONCRETE MATERIALS

- A. Cementitious and Pozzolanic Materials: Use the following materials, of the same type, brand, and source for each required type of concrete and on which selection of concrete proportions was based:
  1. Portland Cement: ASTM C 150, Type I or Type II.
  2. Fly Ash: ASTM C 618, Class C or F, and as specified herein.
    - a. Available Alkalis, as  $\text{Na}_2\text{O}$  equivalent: 1.5% maximum
    - b. Loss On Ignition (LOI): 1% maximum
    - c. Calcium Oxide Limit (CaO): 20% maximum
  3. Microsilica: ASTM C 1240, amorphous silica.
  4. Replacement Ratio: Portland cement shall be replaced on an equal mass (not weight) basis. Material replacements shall be expressed as a percent, by mass, of the total cementitious materials content, with proportions selected for 28 day compressive strengths equal to those specified. The change in volume resulting from the substitutions shall be determined and an adjustment in both coarse and fine aggregate proportions shall be determined in order to ensure a unit volume.
    - a. Fly Ash replacement shall not exceed 30% for Class C, 20% for Class F, or as specified for a particular mix design.
    - b. Microsilica replacement shall not exceed 10%.
    - c. Maximum cement replacement of concrete mixes containing pozzolan shall not exceed 40% unless specified otherwise.
- B. Normal-Weight Aggregates: ASTM C 33. Do not use aggregates containing soluble salts or other substances which can cause stains on exposed surfaces. Use aggregates from one source of supply corresponding to that on which selection of concrete proportions was based.
  1. Coarse Aggregate: Minimum Class Designation:
    - a. Class 3S Typical
    - b. Class 4S Exterior horizontal concrete
      - 1) Maximum absorption 1.7%
    - c. Class 5S Exterior exposed architectural concrete
      - 1) Maximum absorption 1.7%
  2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

3. Aggregate Gradation: Conform to ASTM C 33 and as specified herein.
- a. Well Graded Aggregate: Provide in concrete mixes indicated with the combined coarse and fine aggregates meeting the following criteria:

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

- 1) At least 55% by weight shall be retained on or above the #4 sieve.
- 2) A maximum of two non-adjacent sieves between 1 inch and No. 50 may fall outside the prescribed limits above with a minimum of 5% retained and a maximum of 22% retained on these nonconforming sieves.

4. Aggregates for Exposed Architectural Finish Concrete: Aggregates shall be specially selected for color and size as selected by Architect.

- C. Water: ASTM C 94 and potable.

## 2.3 ADMIXTURES

- A. General: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use admixtures containing calcium chloride or thiocyanates.
- B. Air-Entraining Admixture (AEA): ASTM C 260.
1. Available Products:
- BASF: MB AE 90 or Micro Air.
  - Euclid Chemical Company: Air-Mix.
  - General Resource Technology: Polychem AE.
  - Grace Construction Products: Daravair series or Darex series.
  - Protex Industries: Protex AES.
- C. Water-Reducing Admixture (WRA): ASTM C 494, Type A.
1. Available Products:
- BASF: Pozzoloth 210 or Pozzoloth 322 N
  - Euclid Chemical Company: Eucon WR-75.
  - General Resource Technology: Polychem 1000.
  - Grace Construction Products: WRDA.
- D. Mid-Range Water-Reducing Admixture (MRWRA): ASTM C 494, Type A.
1. Available Products:
- BASF: Polyheed 997 or Polyheed FC100.
  - Euclid Chemical Company: Eucon A+.
  - General Resource Technology: KB-1000.

- d. Grace Construction Products: Daracem-65.
- E. Polycarboxylate High-Range Water-Reducing Admixture (HRWRA): ASTM C 494, Type F.
  - 1. Available Products:
    - a. BASF: Glenium 3000 NS, 3030 NS, or 3200 HES.
    - b. Euclid Chemical Company: Plastol 5000.
    - c. Grace Construction Products: ADVA.
- F. Whelan Gum or Methylcellulose Viscosity Modifying Admixture (VMA):
  - 1. Available Products:
    - a. BASF: Rheomac VMA 358, 362, or 450.
    - b. Euclid Chemical Company: Viscrol.
- G. Water-Reducing and Retarding Admixture: ASTM C 494, Type B and D.
  - 1. Available Products:
    - a. BASF: Pozzolith 80 or Pozzolith 200 N.
    - b. Euclid Chemical Company: Eucon Retarder-75.
    - c. General Resource Technology: Polychem R.
    - d. Grace Construction Products: Daratard 17.
- H. Non-Corrosive, Non-Chloride Accelerator: ASTM C494, Type C or E.
  - 1. Available Products:
    - a. BASF: Pozzolith NC 534.
    - b. Euclid Chemical Company: Accelguard 80.
    - c. General Resource Technology: Polychem Super Set.
    - d. Grace Construction Products: Polarset.
- I. Integral Water Repellant Admixtures:
  - 1. Available Products:
    - a. Grace Construction Products: Darapel
    - b. Xypex Chemical Corporation: Admix C-1000 or C-2000.
- J. Prohibited Admixtures: Calcium chloride, thiocyanates or admixtures effectively containing chloride ions (more than 0.05 percent) are not permitted.

## 2.4 WATERSTOPS

- A. Self-Expanding Butyl Strip Waterstops: Manufactured rectangular or trapezoidal strip, butyl rubber with sodium bentonite or other hydrophilic polymers, for adhesive bonding to concrete, 3/4 by 1 inch.
  - 1. Available Products:
    - a. Colloid Environmental Technologies Company; Volclay Waterstop-RX.
    - b. Concrete Sealants Inc.; Conseal CS-231.
    - c. Greenstreak; Swellstop.
    - d. Henry Company, Sealants Division; Hydro-Flex.
    - e. JP Specialties, Inc.; Earthshield Type 20.
    - f. Progress Unlimited, Inc.; Superstop.
    - g. TCMiraDRI; Mirastop.

## 2.5 MISCELLANEOUS EMBEDDED ITEMS

- A. Headed Anchor Rods: ASTM F 1554, Grade 36, straight.
  - 1. Nuts: ASTM A 563 heavy hex carbon steel.
  - 2. Plate Washers: ASTM A 36 carbon steel.
  - 3. Washers: ASTM F 436 hardened carbon steel.

- B. Miscellaneous angles, channels, and plates: ASTM A 36.
- C. Reglets: Fabricate reglets of not less than 0.0217-inch- thick (26-ga.), galvanized steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.
  - 1. Available Manufacturers:
    - a. Gateway Building Products.
    - b. Heckman Building Products.
    - c. Hohmann-Bernard.
- D. Stair Nosings:
  - 1. Available Products:
    - a. Wooster Products: Spectra Type WP4C.

## 2.6 CURING, CLEANING, AND SEALING MATERIALS

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

- F. Penetrating Liquid Densifier and Sealer: Clear, chemically reactive, waterborne solution of inorganic silicate or silicate materials and proprietary components; odorless; colorless; that penetrates, hardens, and densifies concrete surfaces.
1. Available Products:
    - a. Burke by Edoco; Titan Hard.
    - b. ChemMasters; Chemisil Plus.
    - c. Curecrete Distribution Inc.; Ashford Formula.
    - d. Dayton Superior Corporation; Day-Chem Sure Hard.
    - e. Euclid Chemical Company; Euco Diamond Hard.
    - f. Kaufman Products, Inc.; SureHard.
    - g. L&M Construction Chemicals, Inc.; Seal Hard.

## 2.7 JOINT MATERIALS

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

## 2.8 RELATED MATERIALS

- A. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
- B. Under Slab Vapor Retarder: ASTM E1745, Class A.
1. Manufacturers and Products:
    - a. Barrier Bac, Inc., VB250 or VB350.
    - b. Raven Industries, Vapor Block 10 or 15.
    - c. Reef Industries, Inc., Vaporguard.
    - d. Stego Industries, Stego Wrap Vapor Barrier 15 mil.
  2. Accessories:
    - a. Seam tape: High density polyethylene tape with pressure sensitive adhesive, minimum 4 inches wide.
    - b. Pipe boots: Constructed from vapor barrier membrane and seam tape.

## 2.9 REPAIR MATERIALS

- A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.

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

## 2.10 CONCRETE MIXING

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
- B. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94, with exceptions specified herein, and ASTM C 1116 where fibers are used, and furnish batch ticket information.
1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.
- C. Admixtures: Use approved admixtures according to manufacturer's written instructions.
1. Use chemical admixtures in concrete, as required, for placement, workability, durability, and controlled set time.
- D. Air Content: Do not allow air content of hard-troweled finished floors to exceed 3 percent.
- E. Concrete Slump Limits: Measured according to ASTM C 143 at point of placement.
1. 4 inches without water reducing admixtures
  2. 5 inches after addition of WRA or MWRA.
  3. 7 inches after addition of HRWRA.
  4. A tolerance of up to one inch above indicated maximum will be allowed for one batch in any five consecutive batches tested.
  5. If the maximum water-cement ratio is not exceeded, concrete arriving at the jobsite within 60 minutes of the initial batching that has a slump less than the maximum allowed may have water added when accepted by the project inspector.
  6. Water reducing admixtures will not be incorporated in combination with shrinkage compensating concrete unless approved by the Engineer.
  7. Water reducing admixtures may be added to increase the slump when water can not be added and additional slump is necessary for workability when accepted by the project inspector.
  8. Water shall not be added to the mix after any supplemental water reducing admixtures have been dosed into the mixer.

## 2.11 CONCRETE MIXTURES FOR BUILDING ELEMENTS

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

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

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

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

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

Item	Requirements
Compressive Strength at 28 days (min), $f'_c$	4000 psi
Maximum Cementitious Content	520 lbs/yd <sup>3</sup>
Maximum water/cementitious materials ratio, w/cm	0.44
Cementitious Materials Portland Cement, Type I or Type I/II Fly Ash, Class C or F	70%-100% 20% - 30%
Maximum Top Size Aggregate	1-1/2 inch
Aggregate Gradation	Well Graded
Coarseness Factor	52 - 70
Workability Factor	32 - 40
Air Content (at point of placement) for slabs exposed to freezing and thawing	5.5% ( $\pm 1.5\%$ )

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

Item	Requirements
Compressive Strength at 28 days (min), $f'_c$	4000 psi
Equilibrium Unit Weight	150 lbs/ft <sup>3</sup> ( $\pm 3$ lbs/ft <sup>3</sup> )
Cementitious Materials Content	520 lbs/yd <sup>3</sup>
Maximum water/cementitious materials ratio, w/cm	0.44
Cementitious Materials	



Portland Cement, Type I or Type I/II	60% maximum
Fly Ash, Class C or F	20% - 30%
Top Size Aggregate	1.5 inch
Coarseness Factor	52-70
Workability Factor	32-40
Aggregate Gradation	Well Graded
Air Content (at point of placement)	3% maximum
Strux 90/40 Synthetic Fiber Reinforcement	As indicated on drawings

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

Item	Requirements
Compressive Strength at 28 days (min), $f'_c$	3000 psi
Maximum Cementitious Content	564 lbs/yd <sup>3</sup>
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	60% maximum 20% - 30%
Minimum Top Size Aggregate	1 1/2 inch
Aggregate Gradation	Well Graded

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

Item	Requirements
Compressive Strength at 28 days (min), $f'_c$	3000 psi
Maximum water/cementitious materials ratio, w/cm	0.45
Cementitious Materials Portland Cement, Type I or Type I/II Supplementary Cementitious Materials	60% maximum 40% minimum
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.
- C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows where not specifically shown on Drawings:
  - 1. Exterior Slabs:
    - a. Spacing shall not exceed 24 times slab thickness; 10 feet on center, maximum.
    - b. Short: long side ratio shall not be less than 3:4.
  - 2. Interior Slabs:
    - a. As indicated on drawings.
  - 3. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
  - 4. Sawed Joints: Form contraction joints with early-entry dry-cut power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.
    - a. Install cuts 0 to 2 hours after final finishing and prior to final set.
    - b. Install joint protector at saw-cut intersections prior to cross cut.
  - 5. Provide cleanly cut, straight joints in toppings over joints in base slab.
  - 6. Do not saw cut slabs on metal deck.
- D. Isolation Joints in Slabs-on-Grade: After removing formwork, install expansion joint material at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
  - 1. Extend expansion joint material full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated.
  - 2. Terminate full-width expansion joint material not less than 1/2 inch or more than 1 inch below finished concrete surface where joint sealants, specified in Division 07 Section "Joint Sealants," are indicated.
  - 3. Install expansion joint material in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

### 3.4 WATERSTOPS

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

### 3.5 INSTALLING UNDER SLAB VAPOR RETARDER

- A. Install according to membrane manufacturer's current published instructions and ASTM E1643.
- B. Install over level granular base and under reinforcing and slabs on grade.
- C. Lap over footings and seal to foundation walls.
- D. Overlap membrane joints minimum 6 inches and seal continuously with seam tape.
- E. Seal penetrations and pipes with pipe boot fashioned from membrane and sealed with seam tape.
- F. Repair damaged membrane with patches of membrane overlapping damage minimum 6 inches and sealing completely with seam tape.

### 3.6 CONCRETE PLACEMENT

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

4. Place interior slabs only after permanent walls and roof enclose slab area.
  5. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
  6. Maintain reinforcement in position on chairs during concrete placement.
  7. Do not insert vibrators to bottom of slabs-on-grade with underfloor vapor retarders to avoid damaging this membrane.
  8. Screed slab surfaces with a straightedge and strike off to correct elevations.
  9. Slope surfaces uniformly to drains where required.
  10. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.
- F. Concrete Finish Topping:
1. Prior to placing topping, remove laitance and loose particles of sand and dirt.
  2. Remove oil and grease spots by washing with 10 percent solution of muriatic acid or strong washing soda.
  3. After cleaning, hose down with pressure hose and keep base slab wet for at least 12 hours.
- G. Do not use concrete that has partially hardened or been contaminated by foreign materials, nor concrete that has been retempered or remixed after initial set.
- H. Before depositing new concrete on or against concrete that has set at construction joints, clean, wet and apply bonding agent to existing surfaces. Tighten forms prior to resuming pouring.
- I. Exercise care to prevent splashing of forms or reinforcing with concrete above level of concrete being placed.
- J. Clean reinforcement projecting above or out of concrete immediately after completion of particular unit of pour.
- K. Do not place concrete under adverse weather conditions unless adequate protection is provided. Refer to ACI 301, for weather restrictions and placing temperatures.

### 3.7 COLD WEATHER CONCRETING

- A. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
1. When average high and low temperature is expected to fall below 40 deg F, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
  2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
  3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.
  4. Ensure minimum temperatures are maintained for the duration of the curing period in accordance with ACI 306.1.
  5. Concrete shall be allowed to dry for at least 12 hours before removing temperature protection for water cured or moisture retention cured concrete.

### 3.8 HOT WEATHER CONCRETING

- A. Hot-Weather Placement: Comply with ACI 301 and as follows:

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

### 3.9 FINISHING FLOORS AND SLABS

- A. Finish bare concrete floors (adjacent to floors with other surfacing) so concrete surface is level with other finishes, unless otherwise noted.
- B. At areas to receive floor covering, grind smooth joints between slabs on grade and structural slabs and between existing and new surfaces to eliminate unevenness and to provide smooth, level surface across joints.
- C. Wetting the concrete surface during finishing operations is prohibited.
- D. Power floating with troweling machines equipped with normal trowel blades is prohibited.
- E. Use caution when finishing lightweight concrete slabs to maintain trowel blades at shallow angle as possible during final finishing operations.
  1. Do not provide a tight steel trowel finish to lightweight concrete slabs.
- F. Protect finished surfaces from damage. Keep free of abrasive materials.
- G. In areas where water will be present (interior and exterior) place and finish slabs so areas will drain and water will not stand in puddles. Conform to slopes shown. At structural slabs, verify elevations of drains to insure drains will be at low points. Where elevations and slopes are not indicated, generally slope floors 1/8 inch per foot uniformly to drains, unless otherwise directed by Architect.
- H. Finish and measure surface so gap at any point between concrete surface and an unleveled, freestanding, 10-foot-long straightedge resting on 2 high spots and placed anywhere on the surface does not exceed 1/4-inch.
- I. Apply slab finish to Floor Profile Number tolerances listed unless specifically noted otherwise on Drawings, according to ASTM E 1155 "Standard Test Method for Determining F<sub>F</sub> Floor Flatness and F<sub>L</sub> Floor Levelness Numbers" for randomly trafficked floor surfaces.
  1. Refer to ACI 302, Chapter 8 and Table 8.15.3, for recommended typical procedures to attain specified Floor Profile Numbers.
- J. General Finishing Requirements: Comply with ACI 302.1R recommendations for screeding, restraighening, and finishing operations for concrete surfaces as appropriate to attain slab finish specified.

1. Utilize wet-screed guides, dry-screed guides, and/or edge forms for initial strikeoff set with optical or laser instruments as appropriate to attain specified Floor Profile Number. Check elevation after initial strikeoff and repeat as necessary.
  2. Smooth and restraighten 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,  $F_{30}$  or greater.
  3. Wait until bleed water sheen has disappeared and concrete can sustain finishing operations employed without digging in or disrupting the levelness of the surface.
  4. Float surface with one or more passes using a power float (float shoe blades or pans) or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.
- K. CONC FIN-1: Float Finish.
1. Follow General Finishing Requirements for initial procedures.
- L. CONC FIN-2: Light Trowel Finish.
1. Follow General Finishing Requirements for initial procedures.
  2. Restraighten 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.
- M. CONC FIN-3: Medium Trowel Finish.
1. Follow General Finishing Requirements for initial procedures.
  2. Restraighten 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.
- N. CONC FIN-4: Hard Trowel Finish.
1. Follow General Finishing Requirements for initial procedures.
  2. Restraighten 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 three or more passes using power trowel. Hand trowel areas inaccessible by power trowel.
- O. CONC FIN-5: 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.
- P. CONC FIN-6: Scratch Finish.
1. Follow General Finishing Requirements for initial procedures.
  2. While still plastic, scarify slab surface to 1/8-inch amplitude with transverse scored texture by drawing broom, stiff brush, or rake across surface.
- Q. CONC FIN-8: 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.
- R. CONC FIN-9: Exposed Aggregate Finish.
1. Aggregate to be exposed to be colorful and uniform size: 1/4 inches to 1/2 inch in size.
    - a. Flat or sliver-shaped particles are not allowed.
    - b. Exposed Aggregate shall not be reactive with cement when tested in accordance with ASTM standard test methods.
  2. Follow General Finishing Requirements, steps 1 through 3, for initial procedures.
  3. As soon as concrete will support weight of workmen on kneeboards, surface shall be hand floated using magnesium float or darby until aggregate is entirely embedded and mortar completely surrounds and slightly covers it, leaving no holes in surface.
  4. After floating surface set retarder may be sprayed or brushed over surface, following manufacturer's recommendations.
  5. Exposing operations by using stiff fiber brush and hosing of surface with water shall commence as soon as work can be done without dislodging aggregate.
  6. Kneeboards shall be used to move about on surface and they shall be gently brought into contact and not slid or twisted on surface.
- S. CONC FIN-10: 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.
- T. CONC FIN-11: Industrial Concrete Slabs with Monolithic Mineral Floor Finish.
1. Apply monolithic mineral floor finish to areas indicated on the Drawings.
  2. Installation:
    - a. Apply monolithic floor finish at rate of 1-1/2 pounds per square foot unless approved otherwise by Architect.
    - b. Use mechanical finishing machine to trowel slab surface and follow with additional trowelings to secure smooth hard dense burnished finish.
    - c. For at least ten days after finishing slab, permit only pedestrian traffic.
  3. Wet Produce Areas: After concrete has completed curing cycle, lightly bead blast concrete slab surface in aisles to attain slip resistive surface.
- U. CONC FIN-12: Industrial Concrete Slabs with Two-Stage Floor Finish.
1. Apply monolithic mineral floor finish to areas indicated on the Drawings.
  2. Installation:

- a. Hold base slab 5/8 to 3/4 inch below finish floor so top of topping is same elevation as rest of floor slab.
- b. Finish base slab by troweling to smooth, dense finish in areas where concrete panels are to be cast and wire brooming in other areas to expose coarse aggregate and remove cement laitance.
- c. Keep surface clean and oil free until topping is placed.
- d. At time of installation of topping, scarify or provide bonding agent to surface of base slab.
- e. Finish topping by troweling to smooth, dense burnished finish.
- f. Joints:
  - 1) Saw construction and control joints full depth of topping.
  - 2) Saw joints directly over base joints.
- g. For at least ten days after finishing slab, permit only pedestrian traffic.
3. Field Quality Control:
  - a. Qualified representative of supplier will be present during entire installation of topping, directing its mix, testing, placement, finishing and curing.
  - b. Conform to slab installation tolerances and provide floors free from defects of dusting, cracks, tendency toward spalling, pitting or curling as described in industrial floor correction period requirements.
  - c. Propose remedial procedures in writing to Architect within ten days after notification of deficiency.
  - d. Do not proceed without approval of Architect and Owner.
- V. Coordinate final slab texture requirements with Division 9 flooring installer for proper adhesion of final flooring materials.
- W. Summary Slab Finish Schedule:

SLAB USE	SLAB FINISH	OVERALL F <sub>F</sub> /F <sub>L</sub>	LOCAL F <sub>F</sub> /F <sub>L</sub>
Fluid-applied or sheet waterproofing; built-up or membrane; sand-bed terrazzo	CONC FIN-1 Float Finish	F <sub>F</sub> 18/F <sub>L</sub> 15	F <sub>F</sub> 15/F <sub>L</sub> 10
Carpet; raised access floor; or base slabs below acoustic concrete topping slabs	CONC FIN-2 Light Trowel Finish	F <sub>F</sub> 25/F <sub>L</sub> 20	F <sub>F</sub> 17/F <sub>L</sub> 15
Thin set resilient flooring; paint; or other thin film-finish coating system	CONC FIN-3 Medium Trowel Finish	F <sub>F</sub> 30/F <sub>L</sub> 25	F <sub>F</sub> 24/F <sub>L</sub> 15
Exposed to view with light foot traffic or to receive Penetrating Liquid Densifier and Sealer	CONC FIN-4 Hard Trowel Finish	F <sub>F</sub> 30/F <sub>L</sub> 25	F <sub>F</sub> 24/F <sub>L</sub> 15
Thin set ceramic or quarry tile; stone flooring; epoxy terrazzo	CONC FIN-5 Trowel and Fine Broom Finish	F <sub>F</sub> 18/F <sub>L</sub> 15	F <sub>F</sub> 15/F <sub>L</sub> 10
Below bonded concrete floor topping or mortar setting beds for tile, portland cement terrazzo, and other bonded applied cementitious finish floor-	CONC FIN-6 Scratch Finish	F <sub>F</sub> 18/F <sub>L</sub> 15	F <sub>F</sub> 15/F <sub>L</sub> 10



SLAB USE	SLAB FINISH	OVERALL F <sub>F</sub> /F <sub>L</sub>	LOCAL F <sub>F</sub> /F <sub>L</sub>
ing material			
Parking ramps; exterior concrete pavement (Ramp > 7%)	CONC FIN-8 Broom Finish (Rake Finish)	F <sub>F</sub> 18/F <sub>L</sub> 15	F <sub>F</sub> 15/F <sub>L</sub> 10
Where shown on Drawings	CONC FIN-9 Exposed Aggregate Finish	F <sub>F</sub> 18/F <sub>L</sub> 15	F <sub>F</sub> 15/F <sub>L</sub> 10
Egress stair exposed concrete treads and landings; where shown on Drawings	CONC FIN-10 Slip-Resistive Aggregate Finish	F <sub>F</sub> 25/F <sub>L</sub> 20	F <sub>F</sub> 17/F <sub>L</sub> 15
Monolithic Mineral Floor Finish	CONC FIN-11 Shake On Burnished Finish	F <sub>F</sub> 30/F <sub>L</sub> 25 F <sub>F</sub> 100/F <sub>L</sub> 75 (Super flat)	F <sub>F</sub> 24/F <sub>L</sub> 15
Two-Stage Floor Finish	CONC FIN-12 Burnished Finish	F <sub>F</sub> 30/F <sub>L</sub> 25	F <sub>F</sub> 24/F <sub>L</sub> 15
Base Slab for support of low temperature insulation	CONC FIN-1 Float Finish	Surface deviation +0" and -1/2" without ridges or bull float marks	

X. 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<sub>F</sub>100/F<sub>L</sub>75 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. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
  1. Apply to formed concrete surfaces unless indicated otherwise.
- B. 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.

- C. 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.
- D. CONC FIN-22: Grout-Cleaned Finish: Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix one part portland cement to one and one-half parts fine sand with a 1:1 mixture of bonding admixture and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hours.
  - 1. Apply to Smooth-Formed Finish as-cast concrete where indicated.
- E. CONC FIN-23: Cork-Floated Finish: Wet concrete surfaces and apply a stiff grout. Mix one part portland cement and one part fine sand with a 1:1 mixture of bonding agent and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Compress grout into voids by grinding surface. In a swirling motion, finish surface with a cork float.
  - 1. Apply to Smooth-Formed Finish as-cast concrete where indicated.
- F. 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 yd<sup>3</sup> is placed, plus one additional set for each additional 100 yd<sup>3</sup> 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 dos not comply with the Contract Documents.
- H. Fill core holes with concrete specified for location.

**END OF SECTION 03300**



**SECTION 04200  
UNIT MASONRY**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

- A. This Section includes unit masonry assemblies consisting of the following:
  - 1. Concrete masonry units (CMUs).
  - 2. Mortar and grout.
  - 3. Reinforcing steel.
  - 4. Masonry joint reinforcement.
  - 5. Ties and anchors.
  - 6. Miscellaneous masonry accessories.
- B. Related Sections include the following:
  - 1. Division 07 Section "Bituminous Dampproofing" for dampproofing applied to cavity face of backup wythes of cavity walls.
  - 2. Division 07 Section "Water Repellents" for water repellents applied to unit masonry assemblies.
  - 3. Division 07 Section "Sheet Metal Flashing and Trim" for sheet metal flashing.
  - 4. Division 07 Section "Penetration Firestopping" for firestopping at openings in masonry walls.
  - 5. Division 07 Section "Fire-Resistive Joint Systems" for fire-resistive joint systems at heads of masonry walls.
  - 6. Division 07 Section "Joint Sealants" for sealing control and expansion joints in unit masonry.
- C. Products installed, but not furnished, under this Section include the following:
  - 1. Manufactured reglets in masonry joints for metal flashing, furnished under Division 07 Section "Sheet Metal Flashing and Trim."

**1.3 DEFINITIONS**

- A. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

**1.4 PERFORMANCE REQUIREMENTS**

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

## 1.5 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For the following:
  - 1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
  - 2. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement." Show elevations of reinforced walls.
  - 3. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.
- C. Sustainable Design Submittals:
  - 1. LEED Credit: Product Data for Credit MR 4.1 and Credit MR4.2: For products having recycled content, documentation indicating weights, costs, and percentages by weight of postconsumer and preconsumer recycled content.
    - a. Include statement indicating material weights and costs for each product having recycled content.
  - 2. LEED Credit: Product Data for Credit MR 5.1 and Credit MR 5.2: For products having Regional content (Extracted, and processed or manufactured within 500 miles of site), documentation indicating total weights, costs and percentages by weight of regional content.
    - a. Include statement indicating material weights, and costs for each product having regional content.
- D. Samples for Initial Selection: For the following:
  - 1. Decorative concrete masonry units
  - 2. Exposed concrete masonry unit
  - 3. Weep holes/vents.
- E. Samples for Verification: For each type and color of the following:
  - 1. Exposed and/or Decorative concrete masonry units.
  - 2. Weep holes/vents.
  - 3. Accessories embedded in masonry.
- F. List of Materials Used in Constructing Mockups: List generic product names together with manufacturers, manufacturers' product names, model numbers, lot numbers, batch numbers, source of supply, and other information as required to identify materials used. Include mix proportions for mortar and grout and source of aggregates.
  - 1. Submittal is for information only. Neither receipt of list nor approval of mockup constitutes approval of deviations from the Contract Documents unless such deviations are specifically brought to the attention of Architect and approved in writing.
- G. Material Certificates: Include statements of material properties indicating compliance with requirements including compliance with standards and type designations within standards. Provide for each type and size of the following:
  - 1. Masonry units.
    - a. Include material test reports substantiating compliance with requirements.
    - b. For masonry units used in structural masonry, include data and calculations establishing average net-area compressive strength of units.

2. Cementitious materials. Include brand, type, and name of manufacturer.
  3. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
  4. Grout mixes. Include description of type and proportions of ingredients.
  5. Reinforcing bars.
  6. Joint reinforcement.
  7. Anchors, ties, and metal accessories.
- H. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.
1. Include test reports, per ASTM C 780, for mortar mixes required to comply with property specification.
  2. Include test reports, per ASTM C 1019, for grout mixes required to comply with compressive strength requirement.
- I. Cold-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with cold-weather requirements.

## 1.6 QUALITY ASSURANCE

- A. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, through one source from a single manufacturer for each product required.
- B. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from a single manufacturer for each cementitious component and from one source or producer for each aggregate.
- C. Preconstruction Testing Service: Owner will engage a qualified independent testing agency to perform preconstruction testing indicated below. Retesting of materials that fail to meet specified requirements shall be done at Contractor's expense.
1. Concrete Masonry Unit Test: For each type of unit required, per ASTM C 140.
  2. Mortar Test (Property Specification): For each mix required, per ASTM C 780.
  3. Grout Test (Compressive Strength): For each mix required, per ASTM C 1019.
  4. Prism Test: For each type of construction required, per ASTM C 1314.
- D. Fire-Resistance Ratings: Where indicated, provide materials and construction identical to those of assemblies with fire-resistance ratings determined per ASTM E 119 by a testing and inspecting agency, by equivalent concrete masonry thickness, or by other means, as acceptable to authorities having jurisdiction.
- E. Sample Panels: Build sample panels to verify selections made under sample submittals and to demonstrate aesthetic effects. Comply with requirements in Division 01 Section "Quality Requirements" for mockups.
1. Build sample panels for each type of exposed unit masonry construction in sizes approximately 48 inches by 48 inches.
  2. Clean exposed faces of panels with masonry cleaner indicated.
  3. Protect approved sample panels from the elements with weather-resistant membrane.
  4. Approval of sample panels is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; aesthetic qualities of workmanship; and other material and construction qualities specifically approved by Architect in writing.

- a. Approval of sample panels does not constitute approval of deviations from the Contract Documents contained in sample panels unless such deviations are specifically approved by Architect in writing.
- F. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

## 1.7 DELIVERY, STORAGE, AND HANDLING

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

## 1.8 PROJECT CONDITIONS

- A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
  - 1. Extend cover a minimum of 24 inches down both sides and hold cover securely in place.
- B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least 3 days after building masonry walls or columns.
- C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
  - 1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
  - 2. Protect sills, ledges, and projections from mortar droppings.
  - 3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
  - 4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.
- D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by

frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602 and Section 2104.3 in the Uniform Building Code.

1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and above and will remain so until masonry has dried, but not less than 7 days after completing cleaning.
- E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURERS**

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

### **2.2 MASONRY UNITS, GENERAL**

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

### **2.3 CONCRETE MASONRY UNITS (CMUs)**

- A. Shapes: Provide shapes indicated and as follows:
1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
  2. Provide square-edged or bullnose units for outside corners, as directed by the Architect.
- B. Integral Water Repellent: Provide units made with integral water repellent where indicated.
1. Integral Water Repellent: Liquid polymeric, integral water-repellent admixture that does not reduce flexural bond strength. Units made with integral water repellent, when tested as a wall assembly made with mortar containing integral water-repellent manufacturer's mortar additive according to ASTM E 514, with test period extended to 24 hours, show no visible water or leaks on the back of test specimen.

a. Products:

- 1) Addiment Incorporated; Block Plus W-10.
- 2) Grace Construction Products, a unit of W. R. Grace & Co. - Conn.; Dry-Block.
- 3) Master Builders, Inc.; Rheopel.

C. Concrete Masonry Units: ASTM C 90.

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2800 psi (f'm = 2000 psi)
2. Weight Classification: Normal weight
3. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.
4. Exposed Faces: Provide color and texture matching the range represented by Architect's sample.

D. Decorative Concrete Masonry Units: ASTM C 90.

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2800 psi (f'm = 2000 psi).
2. Weight Classification: Normal weight.
3. Size (Width): Manufactured to dimensions specified in "Concrete Masonry Units" Paragraph above.
4. Pattern and Texture:
  - a. As directed by Architect.
5. Colors: As directed by Architect.
6. Special Aggregate: Provide units made with aggregate matching aggregate in Architect's sample.

## 2.4 MASONRY LINTELS

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

## 2.5 MORTAR AND GROUT MATERIALS

- A. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.
- B. Hydrated Lime: ASTM C 207, Type S.
- C. Portland Cement-Lime Mix: Packaged blend of portland cement complying with ASTM C 150, Type I or Type III, and hydrated lime complying with ASTM C 207, Type S.
- D. Masonry Cement: ASTM C 91.
1. Available Manufacturers:
    - a. Capital Materials Corporation.
    - b. Essroc, Italcementi Group.

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

## 2.6 REINFORCEMENT

- A. Uncoated Steel Reinforcing Bars: ASTM A 615 or ASTM A 996, Grade 60.

- B. Masonry Joint Reinforcement, General: ASTM A 951.
  - 1. Interior Walls: Hot-dip galvanized, carbon steel.
  - 2. Exterior Walls: Hot-dip galvanized, carbon steel.
  - 3. Wire Size for Side Rods: As indicated on drawings.
  - 4. Wire Size for Cross Rods: As indicated on drawings.
  - 5. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches o.c.
  - 6. Provide in lengths of not less than 10 feet, with prefabricated corner and tee units.
- C. Masonry Joint Reinforcement for Single-Wythe Masonry: Either ladder or truss type with single pair of side rods.

## 2.7 TIES AND ANCHORS

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

## 2.8 MISCELLANEOUS ANCHORS

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

## 2.9 MISCELLANEOUS MASONRY ACCESSORIES

- A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene urethane or PVC.
- B. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D 2000, Designation M2AA-805 or PVC, complying with ASTM D 2287, Type PVC-65406 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.



- C. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).
- D. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells with loops for holding reinforcing bars in center of cells. Units are formed from 0.142-inch steel wire, hot-dip galvanized after fabrication. Provide units with either two loops or four loops as needed for number of bars indicated.
  - 1. Available Manufacturers:
    - a. Dayton Superior Corporation, Dur-O-Wal Division.
    - b. Heckmann Building Products Inc.
    - c. Hohmann & Barnard, Inc.
    - d. Wire-Bond.

## **2.10 MASONRY CLEANERS**

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

## **2.11 MORTAR AND GROUT MIXES**

- A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.
  - 1. Do not use calcium chloride in mortar or grout.
  - 2. Limit cementitious materials in mortar to portland cement, mortar cement, and lime.
  - 3. Limit cementitious materials in mortar for exterior and reinforced masonry to portland cement, mortar cement, and lime.
  - 4. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.
- B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.
- C. Mortar for Unit Masonry: Comply with ASTM C 270 Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated.
  - 1. For interior non-load-bearing partitions, Type N.
  - 2. For all other walls, Type S.
- D. Grout for Unit Masonry: Comply with ASTM C 476.

1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 1.15.1 in ACI 530.1/ASCE 6/TMS 602 for dimensions of grout spaces and pour height.
2. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C 143/C 143M.

## **2.12 SOURCE QUALITY CONTROL**

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

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

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

### **3.2 INSTALLATION, GENERAL**

- A. Thickness: Build single-wythe walls to actual widths of masonry units, using units of widths indicated.
- B. Build chases and recesses to accommodate items specified in this and other Sections.
- C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.
- D. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

- E. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures. Mix units from several pallets or cubes as they are placed.
- F. Comply with construction tolerances in ACI 530.1/ASCE 6/TMS 602 and with the following:
  - 1. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
  - 2. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet, or 1/2 inch maximum.
  - 3. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
  - 4. For exposed bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch. Do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
  - 5. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch. Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch.
  - 6. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch except due to warpage of masonry units within tolerances specified for warpage of units.
  - 7. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16 inch from one masonry unit to the next.

### 3.3 LAYING MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.
- B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.
- C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 4-inches. Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.
- D. Stopping and Resuming Work: Stop work by racking back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.
- E. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.
- F. Fill cores in hollow concrete masonry units with grout 24 inches under bearing plates, beams, lintels, posts, and similar items, unless otherwise indicated.
- G. Build non-load-bearing interior partitions full height of story to underside of solid floor or roof structure above, unless otherwise indicated on architectural drawings. Fasten partitions to structure above with methods indicated on drawings.

### 3.4 MORTAR BEDDING AND JOINTING

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

### 3.5 MASONRY-CELL INSULATION

- A. Pour granular insulation into cavities to fill void spaces. Maintain inspection ports to show presence of insulation at extremities of each pour area. Close the ports after filling has been confirmed. Limit the fall of insulation to 1 story in height, but not more than 20 feet.
- B. Install molded-polystyrene insulation units into masonry unit cells before laying units.

### 3.6 MASONRY JOINT REINFORCEMENT

- A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches.
  - 1. Space reinforcement not more than 16 inches o.c.
  - 2. Space reinforcement not more than 8 inches o.c. in foundation walls and parapet walls.
  - 3. Provide reinforcement not more than 8 inches above and below wall openings and extending 12 inches beyond openings.
    - a. Reinforcement above is in addition to continuous reinforcement.
- B. Interrupt joint reinforcement at control and expansion joints, unless otherwise indicated.
- C. Provide continuity at wall intersections by using prefabricated T-shaped units.
- D. Provide continuity at corners by using prefabricated L-shaped units.
- E. Cut and bend reinforcing units as directed by manufacturer for continuity at corners, returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

### 3.7 CONTROL AND EXPANSION JOINTS

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

### 3.8 LINTELS

- A. Install lintels as indicated on drawings.

### 3.9 REINFORCED UNIT MASONRY INSTALLATION

- A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.
  - 1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
  - 2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other temporary loads that may be placed on them during construction.
- B. Placing Reinforcement: Comply with requirements in ACI 530.1/ASCE 6/TMS 602.
- C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.
  - 1. Comply with requirements in ACI 530.1/ASCE 6/TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
  - 2. Limit height of vertical grout pours to not more than 60 inches, unless project special inspector is notified in writing 7 days prior to placement that high lift grout procedures will be used.

### 3.10 FIELD QUALITY CONTROL

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

### 3.11 REPAIRING, POINTING, AND CLEANING

- A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.
- B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.
- C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.
- D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
  - 1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
  - 2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
  - 3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
  - 4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.

5. Clean brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.
6. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.
7. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.
8. Clean stone trim to comply with stone supplier's written instructions.
9. Clean limestone units to comply with recommendations in ILI's "Indiana Limestone Handbook."

### 3.12 MASONRY WASTE DISPOSAL

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

**END OF SECTION 04200**

## SECTION 05120

### STRUCTURAL STEEL FRAMING

#### PART 1 GENERAL

##### 1.1 RELATED DOCUMENTS

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

##### 1.2 SUMMARY

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

##### 1.3 REFERENCES

- A. AISC Specification for Design, Fabrication, and Erection of Structural Steel for Buildings.
- B. AISC Code of Standard Practice for Steel Buildings and Bridges.
- C. AISC Specification for the Design of Steel Hollow Structural Sections.
- D. AWS D1.1 – Structural Welding Code.



- E. RCSC Specification for Structural Joints Using ASTM A 325 or A 490 Bolts.
- F. ASTM Standards in Building Codes.
- G. Steel Structures Painting Council (SSPC) – PS7.01.

#### 1.4 DEFINITIONS

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

#### 1.5 CONNECTION DESIGN PERFORMANCE REQUIREMENTS

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

3. For repetitive connections a spreadsheet summary may be used, but provide all pertinent input and resulting values plus an example long-hand calculation.
4. Provide drawings/sketches showing the overall locations of the connections that are keyed/referenced to each connection calculation.
5. Provide calculation checks for all forces shown on the drawings. All AISC code requirements apply. "OK by inspection" is not permitted.

## 1.6 SUBMITTALS – PART A (FOR REVIEW)

- A. Product Data: For each type of product indicated.
- B. Typical Connection Design Submittal: For each classification of connections (shear, axial, moment, truss and braced frame), submit a proposed typical connection and the supporting calculations for review prior to commencing substantial connection design.
- C. Provide placement plan and details for shear studs on all composite steel framing.
- D. Shop Drawings and related submittals: Show complete information for fabrication and erection of structural steel components.
  1. Submit shop drawings under provisions of Division 1 Section "Submittal Procedures." Phase submittals to match sequence of actual construction to avoid delay of work.
  2. Include overall floor plans with piece marks labeled and erection detail cuts.
  3. Include full height elevations where appropriate for elements such as brace frames.
  4. Include details of cuts, connections, splices, camber, holes, and other pertinent erection data.
  5. Include embedment, anchor bolt and erection drawings.
  6. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld.
  7. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical high-strength bolted connections.
  8. List paint manufacturer's name and paint number where painting is required.
  9. Indicate items to be galvanized or coated where required.
  10. Connection design calculations: Submit connection design calculations and location references indicators at the same time that the shop drawings for the related connections are submitted. These shop drawings will be rejected without the following:
    - A. Complete connection calculations.
    - B. References of connection label and required loads on the shop drawings.
    - C. Signed letter from the Connection Engineer that they have already reviewed and incorporated their comments into the submitted shop drawings. This review shall be for all connections that are required to be designed by the Contractor's Engineer.
  11. Submittal Process and Review:

- A. Submittal of shop and erection drawings and other submittals by the General Contractor shall constitute General Contractor's representation that the General Contractor has verified all quantities, dimensions, materials, catalog numbers and similar data with respect thereto and reviewed or coordinated each drawing with other drawings and other trades. The General Contractor shall place their shop drawing stamp on all submittals confirming the above.
  - B. The Contractor shall submit to the Design Team two (2) black-line prints and one (1) electronic copy (pdf) for shop drawing review.
  - C. The Contractor shall allow at least ten (10) working days between receipt and release by the Design Team for the review of shop and erection drawings, other than connection design calculations, which shall be allowed fifteen (15) working days. The size of the submittals is limited to that which is agreed upon during the submittal schedule required below.
  - D. Resubmittals: Completely address previous comments prior to resubmitting a drawing. Resubmit only those drawings that require resubmittal. All modifications or revisions to submittals, shop drawings, connection design calculations and erection drawings must be clouded, with an appropriate revision number clearly indicated.
  - E. The Contractor shall deliver to the Design Team at the completion of the job two (2) electronic versions of the final as-built shop drawings on a CD-ROM or other media acceptable to the Design Team.
  - F. The review of connection design and the review and approval of shop and erection drawings shall be for general conformance with the design intent of the work and with the information given in the Contract Documents only and will not in any way relieve the Contractor or the Contractor's Engineer from their responsibilities stated herein.
12. Substitution Request:
- A. Requests for any departure from Contract Documents must be submitted in writing by the Contractor and accepted in writing by the Design Team, prior to receipt of submittals.
  - B. Such substitutions or modifications, if acceptable to the Design Team, shall be coordinated and incorporated in the work at the sole expense of the Contractor.
  - C. Compensation for Additional Services: Should additional work by the Design Team, such as design, drafting, meetings and/or visits be required, which are necessitated for the review and/or incorporation of the Contractor-requested substitution, including indirect effects on other portions of the work, the Contractor is responsible for paying for additional work at the standard billing rates plus out-of-pocket expenses incurred at cost + 10%.
  - D. Contractor is responsible for means and methods and any impacts on other portions of the work that may arise from this substitution.

## 1.7 SUBMITTALS – PART B (FOR RECORD)

- A. Submittal Schedule for all Part A submittal items.
- B. Welding certificates for all welders that will perform work for this project..

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

"All connection design calculations for this project will be designed by me, or by qualified personnel under my direct supervision, to resist the loads and reactions indicated on the Contract Documents, except those connections which are completely designed on the Contract Documents."
- F. Preconstruction Survey: Submit for record. For all steel construction, before steel erection commences, perform and submit a complete survey for position and alignment at all points where construction by other trades will support steel elements, including but not limited to pockets, embedded plates, anchor rods and base plates.
- G. Source quality-control test reports.
- H. Minutes of Pre-Installation conference.
- I. Mill Test Reports: Signed by manufacturers certifying that the following products comply with requirements:
  - 1. Structural steel including chemical and physical properties.
  - 2. Bolts, nuts, and washers including mechanical properties and chemical analysis.
  - 3. Direct-tension indicators.
  - 4. Tension-control, high-strength bolt-nut-washer assemblies.
- J. Sustainable Design Submittals:
  - 1. LEED Credit: Product Data for Credit MR 4.1 and Credit MR 4.2: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.
    - A. Include statement indicating costs for each product having recycled content.

## 1.8 CLOSEOUT SUBMITTALS

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

## 1.9 QUALITY ASSURANCE

- A. Fabricator Qualifications; A qualified fabricator who participates in the AISC Quality Certification Program and is designated an AISC Certified Plant, Category STD. Fabricator shall be experienced in the preparation of shop drawings using

intergrated three-dimensional modeling software parametrically linking all major structural piece marks and overall building framing model.

- B. Installer (erector) Qualifications: A qualified installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category CSE (minimum).
- C. Fabricator's/Contractor's Qualified Professional Engineer/Specialty Structural Engineer Qualifications: Qualified Professional Engineer(s), licensed in the State of Minnesota, with 10 years of experience being in responsible charge to work of this nature. The proposed engineer(s) shall be subject to approval of the Design Team.
- D. Comply with applicable provisions of the following specifications and documents:
  - 1. AISC's "Code of Standard Practice for Steel Buildings and Bridges."
  - 2. AISC's "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design" or "Load and Resistance Factor Design Specification for Structural Steel Buildings."
  - 3. AISC's "Specification for the Design of Steel Hollow Structural Sections."
  - 4. AISC's "Specification for Allowable Stress Design of Single-Angle Members" or "Specification for Load and Resistance Factor Design of Single-Angle Members."
  - 5. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- E. Contractor shall assign a qualified staff member to perform quality control on their own work in the field on a daily basis, for each day work is performed. The Contractor's quality control staff shall review their own work for compliance with contract documents before the Contractor notifies the design team or others, of readiness for required inspections, tests and observations to be provided by the Owner's Representatives.
- B. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel."
- C. 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.
- D. 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, han-

dling, 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.
  - 1. Store fasteners in a protected place. Bolts and nuts that become dry or rusty before use shall not be allowed.
  - 2. Store welding electrodes in hermetically sealed containers. Electrodes exposed to atmosphere for periods greater than those permitted shall be re-dried in accordance with AWS D1.1.
  - 3. 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, Grade 1035, cold-finished carbon steel.

## 2.4 SHOP COATINGS

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

## 2.5 GROUT

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

## 2.6 FABRICATION

- A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC's "Specification for Structural Steel Buildings."
  - 1. Camber structural-steel members where indicated.
  - 2. Identify high-strength structural steel according to ASTM A 6 and maintain markings until structural steel has been erected.
  - 3. Mark and match-mark materials for field assembly.
  - 4. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.
- B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
  - 1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1.
- C. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.
- D. Cleaning: Clean and prepare steel surfaces that are to remain unpainted and/or not exposed to view or exterior conditions according to SSPC-SP 2 - "Hand Tool Cleaning". For interior steel exposed to view, clean and prepare per SSPC-SP 6 - "Commercial Blast Cleaning". For Exterior steel that is not galvanized, prepare to SSPC-SP-6. For members to be hot Dipped Galvanized, prepare to SSPC-SP-3, "Power Tool Cleaning".
- E. Holes: Provide holes required for securing other work to structural steel and for passage of other work through steel framing members.
  - 1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
  - 2. Base-Plate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.



3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

- F. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1 and manufacturer's written instructions.

## 2.7 SHOP CONNECTIONS

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

## 2.8 SHOP PRIMING

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

## 2.9 GALVANIZING

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

## PART 3 EXECUTION

### 3.1 EXAMINATION

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

### 3.2 PREPARATION

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

### 3.3 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and according to AISC's "Code of Standard Practice for Steel Buildings and Bridges".
- B. Base Plates: Clean concrete bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting base plates. Clean bottom surface of base plates.
  - 1. Set base plates for structural members on wedges, shims, or setting nuts as required.
  - 2. Weld plate washers to top of base plate.
  - 3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of base plate before packing with grout.
  - 4. Promptly pack grout solidly between bearing surfaces and base plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.
- C. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."
- D. Align and adjust various members forming part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

1. Level and plumb individual members of structure.
  2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.
- E. Splice members only where indicated.
- F. Do not use thermal cutting during erection.
- G. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.
- H. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1 and manufacturer's written instructions. The top flanges of the beams receiving stud shear connectors shall be free of any substances that might interfere with the welding operations. During welding the steel decking panels shall be free of detrimental substances and rest tightly upon the top flange of the beam.
- I. No trades may field cut or alter structural members without specific approval of the Structural Engineer. Submit dimensioned plan and detail sketch of proposed modification under cover of a "Request for Information" (RFI) or cloud proposed changes on shop drawings.

### 3.4 FIELD CONNECTIONS

- A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
1. Joint Type:
    - A. Typical shear connections: Snug Tightened.
    - B. Moment connections: Slip Critical.
    - 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. 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 judgement of the Structural Engineer of Record, are critical to the integrity of the building structure.
- B. Special Inspection and Testing Criteria. Refer to Division 1, Section "Structural Tests and Special Inspections" for standard requirements and definitions.
1. Special Testing and Inspection Requirements
    - a. High Strength Bolting (Field Installed).
      - 1) General (Technical II)
        - a) Visually inspect mating surfaces and bolt type for all slip-critical bolted connections for general conformance with the contract documents prior to bolting.
        - b) Determine the requirements for bolts, nuts, washers, paint and installation/tightening standards are met.
        - c) Observe calibration procedures when such procedures are required in the contract documents and verify that selected procedure is used to tighten bolts.
      - 2) Slip Critical Bolts and Tension Bolts (Technical II)
        - a) Test bolt tightening in 10% of all bolts. Test a minimum of two bolts in each connection. Verify that all plies of connected elements have been brought into contact, at 100% of connection. Verify all tips are removed from "twist-off" bolts.
      - 3) Bearing Bolts (Technical II)
        - a) Visually inspect to conform all plies of connected elements have been brought into contact, at 100% of connections. (Applies only to bolts designed for values not requiring exclusion of threads from failure plane, all other bolts require testing as for tension bolts.)

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

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

## 2. Conventional Testing and Inspection Requirements

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

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

## 3.6 REPAIRS AND PROTECTION

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

**END OF SECTION 05120**

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

**SECTION 05121 - ARCHITECTURALLY  
EXPOSED STRUCTURAL STEEL**

**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 architecturally exposed structural-steel framing.
  - 1) Requirements in Division 5 Section "Structural Steel" also apply to AESS framing.
- B. Related Sections:
  - 1) Division 1 Section "Quality Requirements" for independent testing agency procedures and administrative requirements.
  - 2) Division 5 Section "Structural Steel" for additional requirements applicable to AESS.
  - 3) Division 5 Section "Metal Fabrications" for other metal items not defined as structural steel.
  - 4) Division 5 Section "Metal Stairs."
  - 5) Division 9 Section "High-Performance Coatings" for surface preparation and priming requirements.

**1.3 DEFINITIONS**

- A. Architecturally Exposed Structural Steel: Structural steel designated as "architecturally exposed structural steel" or "AESS" in the Contract Documents.

**1.4 ACTION SUBMITTALS**

- A. Shop Drawings: Show fabrication of AESS components.
  - 1) Include details of cuts, connections, splices, camber, holes, and other pertinent data.
  - 2) Include embedment drawings.
  - 3) Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain. Indicate grinding, finish, and profile of welds.
  - 4) Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical high-strength bolted connections. Indicate orientation of bolt heads.
  - 5) Indicate exposed surfaces and edges and surface preparation being used.
  - 6) Indicate special tolerances and erection requirements.

## 1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified fabricator.

## 1.6 QUALITY ASSURANCE

- A. Mockups: Build mockups of AESS to set quality standards for fabrication and installation.
  - 1) Build mockup of typical portion of AESS as shown on Drawings.
  - 2) Coordinate finish painting requirements with Division 9 painting Sections.
  - 3) Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

## 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Use special care in handling to prevent twisting, warping, nicking, and other damage. 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 corrosion and deterioration.
  - 1) 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.

## 1.8 PROJECT CONDITIONS

- A. Field Measurements: Where AESS is indicated to fit against other construction, verify actual dimensions by field measurements before fabrication.

## 1.9 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' recommendations to ensure that shop primers and topcoats are compatible with one another.

## PART 2 - PRODUCTS

### 2.1 BOLTS, CONNECTORS, AND ANCHORS

- A. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852, Type 1, round-head assemblies, consisting of steel structural bolts with splined ends, heavy-hex carbon-steel nuts, and hardened carbon-steel washers.
  - 1) Finish: Mechanically deposited zinc coating.
- B. Corrosion-Resisting (Weathering Steel), Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852, Type 3, round-head assemblies, consisting of steel structural bolts with splined ends, heavy-hex carbon-steel nuts, and hardened carbon-steel washers.



## 2.2 PRIMER

- A. Primer: Comply with Division 9 painting Sections and Division 9 Section "High-Performance Coatings."
- B. Etching Cleaner for Galvanized Metal: Complying with MPI#25.
- C. Galvanizing Repair Paint: ASTM A 780.

## 2.3 FABRICATION

- A. Shop fabricate and assemble AESS to the maximum extent possible. Locate field joints at concealed locations if possible. Detail assemblies to minimize handling and to expedite erection.
- B. In addition to special care used to handle and fabricate AESS, comply with the following:
  - 1) Fabricate with exposed surfaces smooth, square, and free of surface blemishes including pitting, rust, scale, and roughness.
  - 2) Grind sheared, punched, and flame-cut edges of AESS to remove burrs and provide smooth surfaces and edges.
  - 3) Fabricate AESS with exposed surfaces free of mill marks, including rolled trade names and stamped or raised identification.
  - 4) Fabricate AESS with exposed surfaces free of seams to maximum extent possible.
  - 5) Remove blemishes by filling or grinding or by welding and grinding, before cleaning, treating, and shop priming.
  - 6) Fabricate with piece marks fully hidden in the completed structure or made with media that permits full removal after erection.
  - 7) Fabricate AESS to the tolerances specified in AISC 303 for steel that is designated AESS.
  - 8) Fabricate AESS to the tolerances specified in AISC 303 for steel that is not designated AESS.
  - 9) Seal-weld open ends of hollow structural sections with 3/8-inch (9.5-mm) closure plates for AESS.
- C. Curved Members: Fabricate indicated members to curved shape by rolling to final shape in fabrication shop.
  - 1) Distortion of webs, stems, outstanding flanges, and legs of angles shall not be visible from a distance of 20 feet (6 m) under any lighting conditions.
  - 2) Tolerances for walls of hollow steel sections after rolling shall be approximately 1/2 inch (13 mm).
- D. Coping, Blocking, and Joint Gaps: Maintain uniform gaps of 1/8 inch (3.2 mm) with a tolerance of 1/32 inch (0.8 mm) for AESS.
- E. Bolt Holes: Cut, drill, mechanically thermal cut, or punch standard bolt holes perpendicular to metal surfaces.
- F. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel framing members.
  - 1) Cut, drill, or punch holes perpendicular to steel surfaces

- 2) Baseplate 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.

## 2.4 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) Provide continuous welds of uniform size and profile where AESS is welded.
  - 2) Make butt and groove welds flush to adjacent surfaces within tolerance of plus 1/16 inch, minus 0 inch (plus 1.5 mm, minus 0 mm) for AESS. Do not grind unless required for clearances or for fitting other components, or unless directed to correct unacceptable work.
  - 3) Remove backing bars or runoff tabs; back-gouge and grind steel smooth for AESS.
  - 4) At locations where welding on the far side of an exposed connection of AESS occurs, grind distortions and marking of the steel to a smooth profile aligned with adjacent material.
  - 5) Make fillet welds for AESS of uniform size and profile with exposed face smooth and slightly concave. Do not grind unless directed to correct unacceptable work.

## 2.5 SHOP PRIMING

- A. Shop prime steel surfaces except the following:
  - 1) Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches (50 mm).
  - 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.
- B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:
  - 1) SSPC-SP 2, "Hand Tool Cleaning."
  - 2) SSPC-SP 3, "Power Tool Cleaning."
  - 3) SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
- C. Preparing Galvanized Steel for Shop Priming: After galvanizing, thoroughly clean steel of grease, dirt, oil, flux, and other foreign matter, and treat with etching cleaner.
- D. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils (0.038 mm). Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verify, with steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.
  - 1) Prepare a certified survey of bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.
- B. Examine AECS for twists, kinks, warping, gouges, and other imperfections before erecting.
- C. 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 AECS 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.
  - 1) If possible, locate welded tabs for attaching temporary bracing and safety cabling where they will be concealed from view in the completed Work.
  - 2) Do not remove temporary shoring supporting composite deck construction until cast-in-place concrete has attained its design compressive strength.

### 3.3 ERECTION

- A. Set AECS accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.
- B. Do not use thermal cutting during erection unless approved by Architect. Finish thermally cut sections within smoothness limits in AWS D1.1/D1.1M.

### 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.
- B. Weld Connections: Comply with requirements in "Weld Connections" Paragraph in "Shop Connections" Article.
  - 1) Remove backing bars or runoff tabs; back-gouge and grind steel smooth for AECS.
  - 2) Remove erection bolts in AECS, fill holes, and grind smooth.
  - 3) Fill weld access holes in AECS and grind smooth.

### 3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to inspect AECS as specified in Division 5 Section "Structural

Steel." The testing agency will not be responsible for enforcing requirements relating to aesthetic effect.

- B. Architect will observe AESS in place to determine acceptability relating to aesthetic effect.

### 3.6 REPAIRS AND PROTECTION

- A. Remove welded tabs that were used for attaching temporary bracing and safety cabling and that are exposed to view in the completed Work. Grind steel smooth.
- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.
- C. Touchup Painting: Cleaning and touchup painting are specified in Division 9 painting Sections.

END OF SECTION 05121

**SECTION 05310  
STEEL ROOF DECK**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

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

**1.3 SUBMITTALS FOR REVIEW**

- A. Product Data: For each type of deck, accessory, and product indicated.
  - 1. Include name of deck manufacturer as well as type, depth, gauge and finish of deck.
- B. Shop Drawings:
  - 1. Show layout and types of deck panels, anchorage details, attachment patterns, field welding requirements, side lap fastenings, pans, cut deck openings, special jointing, accessories, and attachments to other construction required for complete installation of decking.
  - 2. Describe types and locations of acoustical materials and closures.
  - 3. Include deck manufacturer's ICBO Approval Number.
- C. Certificates:
  - 1. Product Certificates: For each type of steel deck, signed by product manufacturer.
  - 2. Welding certificates signed by contractor certifying that welders comply with requirements of Article 1.5 – "Quality Assurance."
- D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that each of the following complies with requirements:
  - 1. Powder-actuated mechanical fasteners.
    - a. Substitute for deck welds at contractor's option. Product data and test reports shall demonstrate fasteners have equal or greater capacity than welds indicated and are suitable for attachment to base material.
- E. FMG Listings for description of roofing products evaluated to meet minimum requirements for Factory Mutual Research Approval recognition.
- F. Sustainable Design Submittals:
  - 1. LEED Credit: Product Data for Credit MR 4.1 and Credit MR4.2 (if required): For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.
    - a. Include statement indicating costs for each product having recycled content.

#### 1.4 CLOSEOUT SUBMITTALS

- A. Sustainable Design Closeout Documentation.

#### 1.5 QUALITY ASSURANCE

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

#### 1.6 DELIVERY, STORAGE, AND HANDLING

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

#### 1.7 COORDINATION

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

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Canam Steel Corp.
  - 2. Epic Metals Corporation.
  - 3. Nucor Corp.; Vulcraft Division.
  - 4. United Steel Deck, Inc.

5. Verco Manufacturing Co.
6. Wheeling Corrugating Company.

## 2.2 ROOF DECK

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

## 2.3 ACCESSORIES

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

## PART 3 - EXECUTION

### 3.1 EXAMINATION

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

### 3.2 INSTALLATION, GENERAL

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

### 3.3 ROOF-DECK INSTALLATION

- A. Fasten roof-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter that is not less than 1-1/2 inches long, and as follows:
  - 1. Weld Diameter: 5/8 inch, nominal.
  - 2. Weld Spacing: Space welds as indicated on Drawings.
  - 3. Cover weld burn holes with metallic tape.
- B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals as indicated on Drawings, and as follows:
  - 1. Mechanically fasten with self-drilling, No. 10 diameter or larger, carbon-steel screws.
  - 2. If deck is 0.0474 inches thick (18-ga) or more, fastenings may be welded with a minimum of 1-1/2-inch- long welds.
- C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with end joints as follows:
  - 1. End Joints: Lapped 2 inches minimum.
- D. Roof Sump Pans and Sump Plates: Install over openings provided in roof deck and weld flanges to top of deck. Space welds not more than 8 inches apart with at least one weld at each corner.
  - 1. Install reinforcing channels or zees in ribs to span between supports and weld.



- E. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions. Weld to substrate to provide a complete deck installation.
  - 1. Weld cover plates at changes in direction of roof-deck panels, unless otherwise indicated.
- F. Flexible Closure Strips: Install flexible closure strips over partitions, walls, and where indicated. Install with adhesive according to manufacturer's written instructions to ensure complete closure.

### 3.4 PROTECTION AND REPAIR

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

### 3.5 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports in accordance with Division 01 Section "Structural Testing and Special Inspections".
- B. Inspections:
  - 1. Visually inspect size, location, length and burn-through for 100% of puddle welds on metal deck, per AWS D1.3, Section 6. (Technical I).
  - 2. Visually inspect size, location, and seating for 100% of powder-actuated or pneumatically driven fasteners on metal deck, per AWS D1.3, Section 6. (Technical I).
  - 3. Report inspection results promptly and in writing to Contractor and Architect.
- C. Inspection Procedure:
  - 1. After five to ten squares of roof deck have been erected, arrange for inspection agency to visually inspect fastening system for size, quality and spacing at interior supporting members, perimeter supports and side laps.
  - 2. Demonstrate corrective procedures for deficiencies found by inspection agency to satisfaction of the Architect and inspection agency before erection of roof deck is resumed.
  - 3. Use approved fastening system, including corrective procedures, as standard for comparison for remaining deck fastening.
  - 4. When erection of roof deck is completed, but before placing roofing materials, arrange for inspection agency to make inspection of complete deck installation and submit written report to Architect.

- D. Deck panels shall be clean, dry, and in firm contact with substrate prior to welding.
- E. Remove and replace work that does not comply with specified requirements.
- F. Additional inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

**END OF SECTION 05310**

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

**SECTION 05312 -  
STEEL ROOF DECK**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

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

**1.3 SUBMITTALS FOR REVIEW**

- A. Product Data: For each type of deck, accessory, and product indicated.
  - 1. Include name of deck manufacturer as well as type, depth, gauge and finish of deck.
- B. Shop Drawings:
  - 1. Show layout and types of deck panels, anchorage details, attachment patterns, field welding requirements, side lap fastenings, pans, cut deck openings, special jointing, accessories, and attachments to other construction required for complete installation of decking.
  - 2. Describe types and locations of acoustical materials and closures.
  - 3. Include deck manufacturer's ICBO Approval Number.
- C. Certificates:
  - 1. Product Certificates: For each type of steel deck, signed by product manufacturer.
  - 2. Welding certificates signed by contractor certifying that welders comply with requirements of Article 1.4 – "Quality Assurance."
- D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that each of the following complies with requirements:
  - 1. Powder-actuated mechanical fasteners.
    - a. Substitute for deck welds at contractor's option. Product data and test reports shall demonstrate fasteners have equal or greater capacity than welds indicated and are suitable for attachment to base material.

2. Acoustical roof deck.

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

1.4 CLOSEOUT SUBMITTALS

- A. Sustainable Design Closeout Documentation.

1.5 QUALITY ASSURANCE

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

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.
- B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.
  - 1. Protect and ventilate acoustical cellular roof deck with factory-installed insulation to maintain insulation free of moisture.
- C. Keep construction loads and stored materials, including other decking, off steel deck until it is permanently fastened and inspected.

- D. Do not overload deck beyond 75% rated capacity with stored materials or equipment.

## 1.7 COORDINATION

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

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  1. Canam Steel Corp.
  2. Epic Metals Corporation.
  3. Nucor Corp.; Vulcraft Division.
  4. United Steel Deck, Inc.
  5. Verco Manufacturing Co.
  6. Wheeling Corrugating Company.

### 2.2 ROOF DECK

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

### 2.3 ACCESSORIES

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

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

## PART 3 - EXECUTION

### 3.1 EXAMINATION

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

### 3.2 INSTALLATION, GENERAL

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

- I. Mechanical fasteners may be used in lieu of welding to fasten deck at contractor's option. Locate mechanical fasteners and install according to deck manufacturer's written instructions.

### 3.3 ROOF-DECK INSTALLATION

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

### 3.4 PROTECTION AND REPAIR

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Repair Painting: Wire brush and clean rust spots, welds, and abraded areas on both surfaces of prime-painted deck immediately after installation, and apply repair paint.
  - 1. Apply repair paint, of same color as adjacent shop-primed deck, to bottom surfaces of deck exposed to view.

- C. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.
- D. No hangers, fasteners or loads shall be hung from the underside of the deck unless specifically indicated thus on the structural drawings. Such items as mechanical/electrical equipment, utility lines, architectural bulkheads, ceilings, signage, etc, shall have their own sub-framing designed, supplied and installed by their related trade, as required span to adjacent beams, joists or walls for any support needed.

### 3.5 FIELD QUALITY CONTROL

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

END OF SECTION 05312



**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

**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 SUMMARY**

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

**1.2 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.

**1.3 SUBMITTALS**

- A. Product Data: For the following:
  - 1. Paint products.
  - 2. Grout
- B. 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.
- C. 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.

- D. Qualification Data: For qualified structural engineer.

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

## 2.5 FABRICATION, GENERAL

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

1. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches (3.2 by 38 mm), with a minimum 6 inch (150 mm) embedment and 2 inch (50 mm) hook, not less than 8 inches (200 mm) from ends and corners of units and 24 inches (600 mm) o.c., unless otherwise indicated.

## 2.6 MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.
- B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.
  1. Fabricate units from slotted channel framing where indicated.
  2. Furnish inserts for units installed after concrete is placed.
- C. Galvanize miscellaneous framing and supports where indicated.
- D. Prime miscellaneous framing and supports with primer specified in Division 09 Section "Painting."

## 2.7 MISCELLANEOUS STEEL COLUMNS

- A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.
- B. Fabricate steel columns with steel baseplates and top plates as indicated. Drill or punch baseplates and top plates for anchor and connection bolts and weld to pipe with fillet welds all around. Make welds the same size as pipe wall thickness unless otherwise indicated.
- C. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.
- D. Prime miscellaneous steel columns with primer specified in Division 09 Section "Painting."

## 2.8 LOOSE STEEL LINTELS

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

## 2.9 FINISHES, GENERAL

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

## 2.10 STEEL AND IRON FINISHES

- A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.
  - 1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesives.
  - 2. Galvanized Repair Paint: Where shop-applied galvanized coating is damaged, burned, abraded, or otherwise removed from the substrate, provide galvanizing repair compound with minimum 95% zinc content.
    - a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, ZRC Worldwide "Galvtite Galvanizing Repair Compound."
- B. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.
  - 1. Shop prime with primers specified in Division 09 Section, "Painting."
- C. Preparation for Shop Priming: Prepare surfaces to comply with requirements indicated below:
  - 1. Exterior Items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
  - 2. Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3 "Commercial Blast Cleaning."
  - 3. Items Indicated to Receive Primers Specified in Division 09 Section "High-Performance Coatings:" SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
  - 4. Other Items: SSPC-SP 3, "Power Tool Cleaning."
- D. Shop Priming: Apply shop primer to comply with SSOPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
  - 1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

## PART 3 - EXECUTION

### 3.1 INSTALLATION, GENERAL

- A. Cutting, Fitting and Placement: Perform cutting, drilling and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment and elevation; with edges and surfaces level, plumb, true and free of rack; and measured from established lines and levels.

- B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitation. Do not weld, cut or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- C. Field Welding: Comply with the following requirements:
  - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  - 2. Obtain fusion without undercut or overlap.
  - 3. Remove welding flux immediately.
  - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws and other connectors.

### 3.2 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

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

### 3.3 INSTALLING MISCELLANEOUS COLUMNS

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

### 3.4 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erections, clean field welds, bolted connections and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting and to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Apply by brush or spray to provide a minimum 2.0 mil (0.05 mm) dry film thickness.
- B. Galvanized Surfaces: Clean field welds, bolted connections and abraded areas and repair galvanizing to comply with ASTM A 780. Apply Galvanizing Repair Compound in accordance with manufacturer's recommendations.
  1. Apply by brush or spray to provide a minimum 1.5 mil (0.04 mm) dry film thickness.

END OF SECTION 05500

**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 reglazing 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**

**SECTION 05530**  
**METAL GRATINGS**

**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. Metal bar gratings.
- B. Related Sections include the following:
  - 1. Division 05 Section "Structural Steel Framing" for structural-steel framing system components.
  - 2. Division 05 Section "Metal Stairs" for grating treads and landings of steel-framed stairs.

**1.3 PERFORMANCE REQUIREMENTS**

- A. Structural Performance of Gratings: Provide gratings capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
  - 1. Floors: Uniform load of 100 psf or concentrated load of 300 lbf, whichever produces the greater stress.
  - 2. Walkways and Elevated Platforms Used as Exits: Uniform load of 100 psf
  - 3. Limit deflection to L/240 or 1/4 inch, whichever is less.

**1.4 SUBMITTALS**

- A. 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.
  - 2. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- B. Mill Certificates: Signed by manufacturers of stainless-steel sheet certifying that products furnished comply with requirements.
- C. Welding certificates.
- D. Qualification Data: For professional engineer.

**1.5 QUALITY ASSURANCE**

- A. Metal Bar Grating Standards: Comply with NAAMM MBG 531, "Metal Bar Grating Manual."
- B. Welding: Qualify procedures and personnel according to the following:
  - 1. AWS D1.1, "Structural Welding Code--Steel."

**1.6 PROJECT CONDITIONS**

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with gratings by field measurements before fabrication and indicate measurements on Shop Drawings.
  - 1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating gratings without field measurements. Coordinate wall and other contiguous construction to ensure that actual dimensions correspond to established dimensions.
  - 2. Provide allowance for trimming and fitting at site.

**1.7 COORDINATION**

- A. Coordinate installation of anchorages for gratings, grating frames, and supports. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

**PART 2 - PRODUCTS**

**2.1 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 (or approved equal):
  - 1. Metal Bar Gratings:
    - a. Alabama Metal Industries Corporation.
    - b. All American Grating, Inc.
    - c. Barnett/Bates Corp.
    - d. Borden Metal Products (Canada) Limited.
    - e. Fisher & Ludlow.
    - f. Grupo Metelmex, S.A. de C.V.
    - g. IKG Industries; a Harsco Company.
    - h. Marwas Steel Co.; Laurel Steel Products Division.
    - i. McNichols Company
    - j. Ohio Gratings, Inc.
    - k. Seidelhuber Metal Products, Inc.
    - l. Tru-Weld.

## **2.2 FERROUS METALS**

- A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- B. Wire Rod for Grating Crossbars: ASTM A 510.

## **2.3 FASTENERS**

- A. General: Unless otherwise indicated, provide Type 316 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, at exterior walls. Provide stainless-steel fasteners for fastening aluminum. Select fasteners for type, grade, and class required.
- B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.
- C. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, nuts, and, where indicated, flat washers; ASTM F 593 for bolts and ASTM F 594 for nuts, Alloy Group 1.
- D. Plain Washers: Round, ASME B18.22.1.
- E. Lock Washers: Helical, spring type, ASME B18.21.1.

## **2.4 MISCELLANEOUS MATERIALS**

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy that is 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.

## **2.5 FABRICATION**

- A. Shop Assembly: Fabricate grating sections in shop to greatest extent possible to minimize field splicing and assembly. 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 material 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 from materials of size, thickness, and shapes indicated, but not less than that needed to support indicated loads.
- D. Fit exposed connections accurately together to form hairline joints.



- E. Welding: Comply with AWS recommendations and 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.
- F. Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space the anchoring devices to secure gratings, frames, and supports rigidly in place and to support indicated loads.
  - 1. Toeplate Height: 4 inches, unless otherwise indicated.

## **2.6 METAL BAR GRATINGS**

- A. Welded Steel Grating:
  - 1. Bearing Bar Spacing: As indicated on drawings.
  - 2. Bearing Bar Depth: As indicated on drawings.
  - 3. Bearing Bar Thickness: As required to comply with structural performance requirements.
  - 4. Crossbar Spacing: As required to comply with structural performance requirements.
  - 5. Grating Mark: As indicated.
  - 6. Traffic Surface: As indicated.
  - 7. Steel Finish: As indicated by Architect.
- B. Removable Grating Sections: Fabricate with banding bars attached by welding to entire perimeter of each section. Include anchors and fasteners of type indicated or, if not indicated, as recommended by manufacturer for attaching to supports.
  - 1. Provide not less than 4 saddle clips for each grating section composed of rectangular bearing bars 3/16 inch or less in thickness and spaced 15/16 inch or more o.c., with each clip designed and fabricated to fit over 2 bearing bars.
  - 2. Furnish threaded bolts with nuts and washers, self-drilling fasteners with washers, or galvanized malleable-iron flange clamp with galvanized bolt for securing grating to supports.
    - a. Available Product: Subject to compliance with requirements, a product that may be incorporated into the Work includes, but is not limited to, "Grate-Fast" by Lindapter North America, Inc.
- C. Fabricate cutouts in grating sections for penetrations indicated. Arrange cutouts to permit grating removal without disturbing items penetrating gratings.
  - 1. Edge-band openings in grating that interrupt four or more bearing bars with bars of same size and material as bearing bars.
- D. Do not notch bearing bars at supports to maintain elevation.

## **2.7 STEEL FINISHES**

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

- B. Finish gratings, frames, and supports after assembly.
- C. Galvanizing: For those items indicated for galvanizing, apply zinc coating by the hot-dip process complying with ASTM A 123/A 123M.
- D. Apply shop primer to uncoated surfaces of gratings, frames, and supports, except those with galvanized finishes and those to be embedded in concrete or masonry, unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION, GENERAL**

- A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing gratings. Set units accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.
- B. Fit exposed connections accurately together to form hairline joints.
  - 1. 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 the surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

### **3.2 INSTALLING METAL BAR GRATINGS**

- A. General: Install gratings to comply with recommendations of referenced metal bar grating standards that apply to grating types and bar sizes indicated, including installation clearances and standard anchoring details.
- B. Attach removable units to supporting members with type and size of clips and fasteners indicated or, if not indicated, as recommended by grating manufacturer for type of installation conditions shown.
- C. Attach nonremovable units to supporting members by welding where both materials are same; otherwise, fasten by bolting as indicated above.

### **3.3 ADJUSTING AND CLEANING**

- A. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 09 painting Sections.
- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

## **END OF SECTION 05530**

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

**SECTION 05720 - ORNAMENTAL  
HANDRAILS AND RAILINGS**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

- A. This Section includes aluminum, glass and wood ornamental handrails and railings where shown on the drawings.
- B. Related Sections include the following:
  - 1. Division 5, Section 05500 - METAL FABRICATIONS for handrails and railings associated with metal stairs.

**1.3 PERFORMANCE REQUIREMENTS**

- A. General: In engineering handrails and railings to withstand structural loads indicated, determine allowable design working stresses of materials based on the following:
  - 1. Aluminum: AA 30, "Specifications for Aluminum Structures."
- B. Structural Performance of Handrails and Railings: Provide handrails and railings capable of withstanding the following structural loads without exceeding allowable design working stress of materials for handrails, railings, anchors, and connections:
  - 1. Top Rail of Guards: Capable of withstanding the following loads applied as indicated:
    - a. Concentrated load of 200 lbf applied at any point and in any direction.
    - b. Uniform load of 50 lbf / ft. applied horizontally and concurrently with uniform load of 100 lbf / ft. applied vertically downward.
    - c. Concentrated and uniform loads above need not be assumed to act concurrently.
  - 2. Handrails Not Serving As Top Rails: Capable of withstanding the following loads applied as indicated:
    - a. Concentrated load of 200 lbf applied at any point and in any direction.
    - b. Uniform load of 50 lbf / ft. applied in any direction.
    - c. Concentrated and uniform loads above need not be assumed to act concurrently.
  - 3. Infill Area of Guards: Capable of withstanding a horizontal concentrated load of 200 lbf applied to 1 sq. ft. at any point in system, including panels, intermediate rails, balusters, or other elements composing infill area.
    - a. Load above need not be assumed to act concurrently with loads on top rails in determining stress on guard.

- C. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

#### 1.4 SUBMITTALS

- A. Product Data: For manufacturer's product lines of handrails and railings assembled from standard components.
  - 1. Include Product Data for grout, anchoring cement, and paint products.
- B. Shop Drawings: Show fabrication and installation of handrails and railings. Include plans, elevations, sections, details, and attachments to other Work.
  - 1. For installed handrails and railings indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- C. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available for products with factory-applied color finishes.
- D. Samples for Verification: For each type of exposed finish required, prepared on components indicated below and of same thickness and metal indicated for the Work. If finishes involve normal color and texture variations, include sample sets showing the full range of variations expected.
  - 1. 6-inch-long sections of each different linear railing member, including handrails, top rails, posts, and balusters.
  - 2. Fittings and brackets.
  - 3. Assembled Samples of railings, made from full-size components, including top rail, post, handrail, and infill. Show method of finishing members at intersections. Samples need not be full height.
- E. Product Test Reports: Indicating products comply with requirements, based on comprehensive testing of current products.

#### 1.5 QUALITY ASSURANCE

- A. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of handrails and railings that are similar to those indicated for this Project in material, design, and extent.
- B. Testing Agency Qualifications: An independent testing agency with the experience and capability to conduct the testing indicated, as documented according to ASTM E 548.
- C. Source Limitations: Obtain each type of railing through one source from a single manufacturer.
- D. Mockups: Before installing handrails and railings, build mockups to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mockups to comply with the following requirements, using materials indicated for the completed Work:
  - 1. Build mockups in the location indicated or, if not indicated, as directed by Architect.
  - 2. Build mockups as shown on Drawings.

3. Build mockups for each form and finish of railing consisting of two posts, top rail, infill area, and anchorage system components that are full height and are not less than 24 inches in length.
4. Notify Architect seven days in advance of dates and times when mockups will be constructed.
5. Obtain Architect's approval of mockups before fabricating ornamental handrails and railings.
6. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
7. Demolish and remove mockups when directed.
8. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

## 1.6 STORAGE

- A. Store handrails and railings in a dry, well-ventilated, weathertight place.

## 1.7 PROJECT CONDITIONS

- A. Field Measurements: Verify handrail and railing dimensions by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

## 1.8 COORDINATION

- A. Coordinate installation of anchorages for handrails and railings. Furnish Setting Drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

## 1.9 SCHEDULING

- A. Schedule installation so handrails and railings are mounted only on completed walls. Do not support temporarily by any means that do not satisfy structural performance requirements.

# PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. Bloomcraft.
  2. Wylie Systems.
  3. Sterling Dula Architectural Products.

## 2.2 METALS

- A. General: Provide metal free from pitting, seam marks, roller marks, stains, discolorations, and other imperfections where exposed to view on finished units.

- B. Aluminum: Alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than strength and durability properties of alloy and temper designated below for each aluminum form required.
  - 1. Extruded Bar and Tube: ASTM B 221, alloy 6063-T5/T52.
  - 2. Extruded Structural Pipe and Tube: ASTM B 429, alloy 6063-T6.
  - 3. Drawn Seamless Tube: ASTM B 210, alloy 6063-T832.
  - 4. Plate and Sheet: ASTM B 209, alloy 6061-T6.
  - 5. Die and Hand Forgings: ASTM B 247, alloy 6061-T6.
  - 6. Castings: ASTM B 26/B 26M, alloy A356-T6.
- C. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails, unless otherwise indicated.
  - 1. Provide formed steel brackets with predrilled hole for bolted anchorage and with snap-on cover that matches rail finish and conceals bracket base and bolt head.

## 2.3 GLASS PRODUCTS AND GLAZING MATERIALS

- A. Tempered Glass: ASTM C 1048, Kind FT (fully tempered), Condition A (uncoated), Type 1 (transparent glass, flat), Quality q3 (glazing select). Provide products complying with requirements indicated below for class, thickness, and manufacturing process that have been tested for surface and edge compression according to ASTM C 1048 and for impact strength according to 16 CFR, Part 1201 for Category II materials.
  - 1. Tinted Glass: Class 2 (tinted, heat absorbing, and light reducing), manufacturer's standard tint color indicated below:
    - a. Green, etched as shown on drawings.
  - 2. Thickness: 3/8 inch.
  - 3. Manufacturing Process: Manufacture fully tempered glass by vertical (tong-held) or horizontal (roller-hearth) process, at manufacturer's option.
- B. Glazing Cement and Accessories: Provide glazing cement and related accessories recommended or supplied by railing manufacturer for bonding glass to metal subrails.

## 2.4 MISCELLANEOUS MATERIALS

- A. Wood Handrails and Rails: Hardwood handrails and rails of species and profile indicated; bonded to aluminum subrail.
  - 1. Species and Profile: Cherry, in profiles shown on drawings, stained and finished to match other wood work on project.

## 2.5 FASTENERS

- A. Fasteners for Anchoring Handrails and Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring handrails and railings to other types of construction indicated and capable of withstanding design loads.
  - 1. For aluminum handrails and railings, use fasteners fabricated from Type 304 or Type 316 stainless steel.
- B. Fasteners for Interconnecting Handrail and Railing Components: Use fasteners fabricated from same basic metal as fastened metal, unless otherwise indicated. Do not use metals that are corrosive or incompatible with materials joined.

1. Provide concealed fasteners for interconnecting railing components and for attaching them to other Work, unless otherwise indicated.
- C. Cast-in-Place and Postinstalled Anchors: Anchors of type indicated below, fabricated from corrosion-resistant materials with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and equal to four times the load imposed when installed in concrete, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.
  1. Cast-in-place anchors.
  2. Chemical anchors.
  3. Expansion anchors.

## 2.6 GROUT AND ANCHORING CEMENT

- A. Nonshrink, Nonmetallic Grout: Premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- B. Interior Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound. Use for interior applications only.

## 2.7 FABRICATION

- A. Assemble handrails and railings in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.
- B. Form changes in direction of railing members as follows:
  1. As detailed.
- C. Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain profile of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of handrail and railing components.
- D. Mechanical Connections: Fabricate handrails and railings by connecting members with railing manufacturer's standard concealed mechanical fasteners and fittings, unless otherwise indicated. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.
  1. Fabricate splice joints for field connection using epoxy structural adhesive where this is manufacturer's standard splicing method.
- E. Brackets, Flanges, Fittings, and Anchors: Provide manufacturer's standard wall brackets, flanges, miscellaneous fittings, and anchors to connect handrail and railing members to other construction.
- F. Provide inserts and other anchorage devices to connect handrails and railings to concrete. Fabricate anchorage devices capable of withstanding loads imposed by handrails and railings. Coordinate anchorage devices with supporting structure.

- G. Shear and punch metals cleanly and accurately. Remove burrs from exposed cut edges.
- H. Ease exposed edges to a radius of approximately 1/32 inch, unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing the Work.
- I. Cut, reinforce, drill, and tap components, as indicated, to receive finish hardware, screws, and similar items.
- J. Provide weep holes or another means to drain entrapped water in hollow sections of railing members that are exposed to exterior or to moisture from condensation or other sources.
- K. Fabricate joints that will be exposed to weather in a watertight manner.
- L. Close exposed ends of railing members with prefabricated end fittings.

## 2.8 GLAZING PANEL FABRICATION

- A. Glass Panels: Cut tempered glass to final size and shape before heat treatment; provide for proper edge clearance and bite on glass. Provide thickness indicated, but not less than that required to support structural loads.
  - 1. Factory-bond glass to aluminum base and top-rail channels in railing manufacturer's plant using glazing cement to comply with manufacturer's written specifications.
- B. Straight Panels: Provide tempered glass panels for straight sections.

## 2.9 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipment.
- C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

## 2.10 ALUMINUM FINISHES

- A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
- B. Powder-Coated Finish: Apply manufacturer's standard polyester powder coating complying with AAMA 605.2.
  - 1. Color and Gloss: As selected by Architect.

## PART 3 - EXECUTION



### 3.1 INSTALLATION, GENERAL

- A. Fit exposed connections together to form tight, hairline joints.
- B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing handrails and railings. Set handrails and railings accurately in location, alignment, and elevation, measured from established lines and levels and free from rack.
  - 1. Do not weld, cut, or abrade surfaces of railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
  - 2. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
  - 3. Align rails so variations from level for horizontal members and from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.
- C. Corrosion Protection: Coat concealed surfaces of aluminum and copper alloys that will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.
- D. Adjust handrails and railings before anchoring to ensure alignment at abutting joints. Space posts at interval indicated, but not less than that required by structural loads.
- E. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing handrails and railings and for properly transferring loads to in-place construction.

### 3.2 RAILING CONNECTIONS

- A. Nonwelded Connections: Use mechanical or adhesive joints for permanently connecting railing components. Use wood blocks and padding to prevent damage to railing members and fittings. Seal recessed holes of exposed locking screws using plastic cement filler colored to match finish of handrails and railings.

### 3.3 ANCHORING POSTS

- A. Cover anchorage joint with a flange of same metal as post, attached to post by set screws.
- B. Leave anchorage joint exposed, wipe off surplus anchoring material, and leave 1/8-inch build-up, sloped away from post.
- C. Anchor posts to metal surfaces with flanges, angle or floor type as required by conditions, connected to posts and to metal supporting members as follows:
  - 1. For aluminum railings, attach posts as indicated using fittings designed and engineered for this purpose.

### 3.4 ANCHORING RAIL ENDS

- A. Anchor rail ends to metal surfaces with flanges bolted to metal surfaces.
  - 1. Connect flanges to rail ends using nonwelded connections.

### 3.5 INSTALLING GLASS PANELS

- A. Post-Supported Glass Handrails and Railings: Install assembly to comply with railing manufacturer's written instructions. Erect posts and other metal railing components, then set factory-cut glass panels. Do not cut, drill, or alter glass panels in field. Protect edges from damage.

### 3.6 CLEANING

- A. Clean aluminum by washing thoroughly with clean water and soap and rinsing with clean water.
- B. Clean and polish glass.

### 3.7 PROTECTION

- A. Protect finishes of handrails and railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at the time of Substantial Completion.
- B. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in field to shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION 05720

**NEW PASSENGER TERMINAL  
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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. Rooftop equipment bases and support curbs.
  - 2. Wood furring, grounds, nailers, and blocking.
- B. Related Sections: The following sections contain requirements that relate to this section:
  - 1. Division 6, Section 06402 - INTERIOR ARCHITECTURAL WOODWORK for interior woodwork specially fabricated for this project.

**1.3 DEFINITIONS**

- A. Rough Carpentry: Carpentry work not specified in other sections and generally not exposed, unless otherwise specified.

**1.4 SUBMITTALS**

- A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.
- B. Product Data for the following products:
  - 1. Insulating sheathing.
  - 2. Construction adhesives.
- C. 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.
- D. Wood treatment data as follows, including chemical treatment manufacturer's instructions for handling, storing, installing, and finishing treated materials:
  - 1. For each type of preservative-treated wood product, include certification by treating plant stating type of preservative solution and pressure process used, net amount of preservative retained, and compliance with applicable standards.
  - 2. For waterborne-treated products, include statement that moisture content of treated materials was reduced to levels indicated before shipment to Project site.
  - 3. Warranty of chemical treatment manufacturer for each type of treatment.

## 1.5 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. Lumber Standards: Comply with DOC PS 20, "American Softwood Lumber Standard," and with applicable grading rules of inspection agencies certified by American Lumber Standard Committee's (ALSC) Board of Review.
- 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 AWPA C9 (plywood). Mark each treated item with the Quality Mark Requirements of an inspection agency approved by ALSC's Board of Review.

1. Do not use chemicals containing chromium or arsenic.
- B. Pressure treat aboveground items with waterborne preservatives to a minimum retention of 0.25 lb/cu. ft. After treatment, kiln-dry lumber and plywood to a maximum moisture content of 19 and 15 percent, respectively. Treat indicated items and the following:
1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
  2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
  3. Wood framing members less than 18 inches above grade.
  4. Wood floor plates installed over concrete slabs directly in contact with earth.
- C. Pressure treat wood members in contact with ground or freshwater with waterborne preservatives to a minimum retention of 0.40 lb/cu. ft.
- D. Complete fabrication of treated items before treatment, where possible. If cut after treatment, apply field treatment complying with AWPA M4 to cut surfaces. Inspect each piece of lumber or plywood after drying and discard damaged or defective pieces.
- E. 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 PLYWOOD, GENERAL

- A. Plywood Panel Standard: Provide plywood panels complying with DOC PS 1, "U.S. Product Standard for Construction and Industrial Plywood."
- B. Trademark: Factory mark plywood panels with APA trademark evidencing compliance with grade requirements.

## 2.6 PLYWOOD PANELS FOR BACKING

- A. Plywood Backing Panels: For mounting electrical or telephone equipment, provide plywood panels with grade C-D Plugged Exposure 1 in thickness indicated or, if not otherwise indicated, not less than 15/32 inch thick. Provide fire-retardant paint coating equivalent to PPG "Speedhide Latex Fire Retardant Paint" or Flame Control Coatings, Inc. "No. 20-20 Flat Latex Intumescent Fire Retardant Paint". Follow manufacturer's instructions and recommendations for application and dry film thickness. Coat both sides and all edges.

## 2.7 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, Wire, Brads, and Staples: FS FF-N-105.
- C. Power-Driven Fasteners: CABO National Evaluation Report 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.

## 2.8 MISCELLANEOUS MATERIALS

- A. Water-Repellent Preservative: NWWDA-tested and -accepted formulation containing 3-iodo-2-propynyl butyl carbonate (IPBC) as its active ingredient.

# PART 3 - EXECUTION

## 3.1 INSTALLATION, GENERAL

- A. 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.
- B. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted.
- C. 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.
- D. Apply field treatment complying with AWPA M4 to cut surfaces of preservative-treated lumber and plywood.
- E. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
  - 1. CABO NER-272 for power-driven staples, P-nails, and allied 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.
- F. 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.
  - G. Countersink nail heads on exposed carpentry work and fill holes.

### 3.2 WOOD GROUNDS, NAILERS, BLOCKING, AND SLEEPERS

- A. Install wood grounds, nailers, blocking, and sleepers where shown and where required for screening 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. Build into masonry during installation of masonry work. Where possible, anchor to formwork before concrete placement.

### 3.3 INSTALLATION OF PLYWOOD PANELS

- A. General: Comply with applicable recommendations contained in APA Form No. E30, "APA Design / Construction Guide: Residential & Commercial," for types of plywood panels and applications indicated.
  1. Comply with "Code Plus" provisions of above-referenced guide.
- B. Fastening Methods: Fasten panels as indicated below:
  1. Plywood Backing Panels: Nail or screw to supports.

END OF SECTION 06100

**NEW PASSENGER TERMINAL  
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**SECTION 06220 - INTERIOR  
PREFINISHED  
WALL SURFACING**

**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. Section includes decorative interior wall surfacing systems and trim, casework paneling, cubicle panels and toilet partition panels.
- B. Related sections include the following:
  - 1. Division 9, Section 09260 - GYPSUM BOARD ASSEMBLIES.

**1.3 REFERENCES**

- A. AWI Quality Standards (Architectural Woodwork Institute).
- B. ASTM E84 (Method of test for surface burning characteristics of building materials).
- C. BHMA (Builder's Hardware Manufacturer's Association).

**1.4 SUBMITTALS**

- A. Provide manufacturer's product data sheets indicating compliance with specified performance characteristics and physical properties for approval.
- B. Provide manufacturer's recommended maintenance procedures to the Owner.
- C. Shop Drawings: Submit shop drawings showing layout, profiles and product components, including edge conditions, panel joints, anchorage, accessories, finish colors, patterns and textures.
- D. Samples: Submit three (3) 12" x 12" samples with finished edges for each type color, pattern and/or texture

**1.5 DELIVERY, STORAGE AND HANDLING**

- A. All products are to be packaged at the factory in heavy cardboard cartons. All shipments to the job site shall be made on wooden pallets.
- B. All products shall be stored flat in a cool, dry place in accordance with temperature and humidity conditions recommended by manufacturer. Do not stack cartons directly on concrete floors.



## PART 2 - PRODUCTS

### 2.1 MANUFACTURER

- A. Approved Manufacturers:
  - 1. Trespa North America.
  - 2. Nevamar.
  - 3. Marlite.
  - 4. Flakeboard Co. Ltd.
- B. Other manufacturers and systems meeting the intent of this specification may be submitted for consideration.

### 2.2 MATERIALS

- 1. Solid phenolic panels. 3/4-inch thick or as indicated; colors and patterns to match Architect's samples. Provide color on 2 sides where indicated.
- 2. Wood veneer panels: 3/4-inch thick, square cut wood fiber substrate with manufacturer's standard veneer stained and finished to match Architect's sample.

### 2.3 ACCESSORIES

- A. Provide manufacturer's standard trim and anchorage where indicated in the drawings.

### 2.4 FABRICATION

- A. All surface systems panels, hardware and accessories shall be factory finished and ready to install.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Open cartons and carefully inspect all panels.

### 3.2 PREPARATION

- A. Structural walls should be finished, with building completely closed. Walls shall be thoroughly dry before starting installation. A vapor barrier should be used on exterior walls behind backing to discourage warping.
- B. Panels must be applied over a smooth solid, flat backing such as plywood or drywall. All drywall joints should be taped and finished. Walls should be primed before installation begins.
- C. Protect existing surfaces with drop cloths.

### 3.3 CONDITIONING

- A. All surface systems panels should be allowed to equalize to the moisture and temperature in the room environment prior to installation. This is accomplished by standing panels around the room in which they are to be installed for at least

48 hours before application. Room temperature should be approximately 70 degrees F.

3.4 INSTALLATION

A. Install all systems in accordance with the manufacturer's installation instructions.

3.5 CLEANING

A. Clean panels, trim and hardware according to manufacturer's recommendations.

END OF SECTION 06220

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

**SECTION 06402 – INTERIOR  
ARCHITECTURAL  
WOODWORK**

**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. Unit Kitchens (kitchenettes).
  - 2. Closet Shelving and Rod.
- B. Related Sections include the following:
  - 1. Division 5, Section 05700 - ORNAMENTAL METALS for metal trim, sheet, etc., associated with architectural woodwork.
  - 2. Division 6, Section 06100 - ROUGH CARPENTRY for wood furring, blocking, shims, and hanging strips required for installing woodwork and concealed within other construction before woodwork installation.

**1.3 DEFINITIONS**

- A. Interior architectural woodwork includes wood furring, blocking, shims, and hanging strips for installing woodwork items, unless concealed within other construction before woodwork installation.

**1.4 SUBMITTALS**

- A. Product Data: For each type of product indicated, including cabinet hardware and accessories, and finishing materials and processes.
- B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
  - 1. Show details full size.
  - 2. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
  - 3. Show locations and sizes of cutouts and holes for items installed in architectural woodwork.
- C. Samples for Initial Selection: Manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available for each type of material indicated.
  - 1. Plastic laminates.
- D. Samples for Verification: For the following:
  - 1. Lumber with or for transparent finish, 50 sq. in. for each species and cut, finished on 1 side and 1 edge.
  - 2. Plastic-laminate-clad panel products, 8 by 10 inches, for each type, color, pattern, and surface finish.

3. Corner pieces as follows:
    - a. Cabinet front frame joints between stiles and rail, as well as exposed end pieces, 18 inches high by 18 inches wide by 6 inches deep.
    - b. Miter joints for standing trim.
  4. Exposed cabinet hardware and accessories, one unit for each type.
- E. Product Certificates: Signed by manufacturers of woodwork certifying that products furnished comply with requirements.
- F. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

## 1.5 QUALITY ASSURANCE

- A. Fabricator Qualifications: A firm experienced in producing architectural woodwork similar to that indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- B. Source Limitations: Engage a qualified woodworking firm to assume undivided responsibility for production and installation of interior architectural woodwork.
- C. Quality Standard: Unless otherwise indicated, comply with AWI's "Architectural Woodwork Quality Standards" for grades of interior architectural woodwork, construction, finishes, and other requirements.
  1. Provide AWI Quality Certification Program labels indicating that woodwork complies with requirements of grades specified.
- D. Mockups: Before fabricating and installing interior architectural woodwork, build mockups for each form of construction and finish required to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mockups to comply with the following requirements, using materials indicated for the completed Work:
  1. Build mockups in the location and of the size indicated or, if not indicated, as directed by Architect.
  2. Notify Architect seven days in advance of dates and times when mockups will be fabricated and installed.
  3. Demonstrate the proposed range of aesthetic effects and workmanship.
  4. Obtain Architect's approval of mockups before starting interior architectural woodwork fabrication.
  5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
  6. Demolish and remove mockups when directed.
  7. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- E. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1, Section 01200 - PROJECT MEETINGS.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver woodwork until painting and similar operations that could damage woodwork have been completed in installation areas. If woodwork must be stored in other than installation areas, store only in areas where environmental conditions

comply with requirements specified in "Project Conditions" Article.

## 1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.
- B. Field Measurements: Where woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
  - 1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being enclosed and indicate measurements on Shop Drawings.

## 1.8 COORDINATION

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that interior architectural woodwork can be supported and installed as indicated.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. General: Provide materials that comply with requirements of the AWI quality standard for each type of woodwork and quality grade specified, unless otherwise indicated.
- B. Wood Products: Comply with the following:
  - 1. Hardboard: AHA A135.4.
  - 2. Medium-Density Fiberboard: ANSI A208.2, Grade MD.
  - 3. Particleboard: ANSI A208.1, Grade M-2.
  - 4. Softwood Plywood: DOC PS 1, Medium Density Overlay.
  - 5. Hardwood Plywood and Face Veneers: HPVA HP-1.
- C. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated, or if not indicated, as required by woodwork quality standard.
  - 1. Manufacturer: Subject to compliance with requirements, provide high-pressure decorative laminates by one of the following:
    - a. Formica Corporation.
    - b. International Paper; Decorative Products Div.
    - c. Laminart.
    - d. Pioneer Plastics Corp.
    - e. Westinghouse Electric Corp.; Specialty Products Div.
    - f. Wilsonart International; Div. of Premark International, Inc.
    - g. Phenolic laminate backer sheets as manufactured by the approved laminate supplier.
- D. Adhesive for Bonding Plastic Laminate: Unpigmented contact cement.
  - 1. Adhesive for Bonding Edges: Hot-melt adhesive or adhesive specified above for faces.

## 2.2 CABINET HARDWARE AND ACCESSORIES

- A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets, except for items specified in Division 8, Section 08710 - FINISH HARDWARE.
- B. Hardware Standard: Comply with BHMA A156.9 for items indicated by referencing BHMA numbers or items referenced to this standard.
- C. Catches: Magnetic catches, BHMA A156.9, B03141.
- D. Grommets for Cable Passage through Countertops: 1-1/4-inch OD, black, molded-plastic grommets and matching plastic caps with slot for wire passage.
- E. Paper Slots: 12 inches long by 1-3/4 inches wide by 1 inch deep; black, molded-plastic, paper-slot liner with 1/4-inch lip.
- F. Exposed Hardware Finish:
  - 1. Stainless Steel: ASTM A240, Type 304.
- G. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in ASTM A240 No. 4, satin brush finish, Type 304.

## 2.3 INSTALLATION MATERIALS

- A. Furring, Blocking, Shims, and Hanging Strips: Refer to Division 6, Section 06100 - ROUGH CARPENTRY.
- B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

## 2.4 FABRICATION, GENERAL

- A. Interior Woodwork Grade: Provide Premium grade interior woodwork complying with the referenced quality standard for public areas, Custom grade for non-public areas.
- B. Wood Moisture Content: Comply with requirements of referenced quality standard for wood moisture content in relation to ambient relative humidity during fabrication and in installation areas.
- C. Fabricate woodwork to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:
  - 1. Corners of Cabinets and Edges of Solid-Wood (Lumber) Members and Rails: 1/16 inch.
- D. Complete fabrication, including assembly, finishing, and hardware application, to maximum extent possible, before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
  - 1. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening

devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements indicated on Shop Drawings before disassembling for shipment.

- E. Shop cut openings, to maximum extent possible, to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.
  - 1. Seal edges of openings in countertops with a coat of varnish.
- F. Laminate fabrications to be completed in accordance with decorative plastic laminate association (DLPA), ANSI-A-161.2-1979 and "Architectural wood work quality standards, guide specification and quality certification program" guidelines of the architectural woodwork institutted (AWI) where applicable. All laminate fabrications shall be "balanced construction" in accordance with AWI guidelines.
- G. Install glass to comply with applicable requirements in Division 8, Section 08800 - GLAZING and in GANA's "Glazing Manual." For glass in wood frames, secure glass with removable stops.

## 2.5 PLASTIC-LAMINATE CABINETS

- A. Quality Standard: Comply with AWI Section 400 requirements for laminate cabinets.
- B. AWI Type of Cabinet Construction: Flush overlay.
- C. Laminate Cladding for Exposed Surfaces: High-pressure decorative laminate complying with the following requirements:
  - 1. Horizontal Surfaces Other Than Tops: HGS.
  - 2. Postformed Surfaces: HGP.
  - 3. Vertical Surfaces: HGS.
  - 4. Edges: HGS.
- D. Materials for Semiexposed Surfaces: Provide surface materials indicated below:
  - 1. Surfaces Other Than Drawer Bodies: High-pressure decorative laminate, Grade VGS.
  - 2. Drawer Sides and Backs: Solid-hardwood lumber.
  - 3. Drawer Bottoms: Hardwood plywood.
- E. Concealed surfaces: manufacturer's phenolic laminate backer sheets
- F. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
  - 1. Provide Architect's selections from laminate manufacturer's full range of colors and finishes.

## 2.6 PLASTIC-LAMINATE COUNTERTOPS

- A. Quality Standard: Comply with AWI Section 400 requirements for high-pressure decorative laminate countertops.
- B. High-Pressure Decorative Laminate Grade: HGS.

- C. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
  - 1. Provide Architect's selections from manufacturer's full range of colors and finishes.
- D. Edge Treatment: Same as laminate cladding on horizontal surfaces.
- E. Core Material: Particleboard.
- F. Core Material at Sinks: Exterior-grade plywood.
- G. Concealed surfaces

## 2.7 SOLID-SURFACING-MATERIAL COUNTERTOPS

- A. Quality Standard: Comply with AWI Section 400 requirements for countertops.
- B. Solid-Surfacing-Material Thickness: 1/2 inch.
- C. Colors, Patterns, and Finishes: Provide materials and products that result in colors of solid-surfacing material complying with the following requirements:
  - 1. Provide Architect's selections from manufacturer's full range of colors and finishes.
- D. Fabricate tops in one piece with shop-applied backsplashes and edges, unless otherwise indicated. Comply with solid-surfacing-material manufacturer's written recommendations for adhesives, sealers, fabrication, and finishing.
- E. Install integral sink bowls in countertops in shop.
- F. Drill holes in countertops for plumbing fittings and soap dispensers in shop.

## 2.8 SHOP FINISHING

- A. Quality Standard: Comply with AWI Section 1500, unless otherwise indicated.
  - 1. Grade: Provide finishes of same grades as items to be finished.
- B. General: Finish architectural woodwork at fabrication shop as specified in this Section. Defer only final touchup, cleaning, and polishing until after installation.
- C. Preparations for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing architectural woodwork, as applicable to each unit of work.
  - 1. Backpriming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of woodwork. Apply two coats to back of paneling and to end-grain surfaces. Concealed surfaces of plastic-laminate-clad woodwork do not require backpriming when surfaced with plastic laminate, backing paper, or thermoset decorative overlay.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Condition woodwork to average prevailing humidity conditions in installation areas before installation.



- B. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

### 3.2 INSTALLATION

- A. Quality Standard: Install woodwork to comply with AWI Section 1700 for the same grade specified in Part 2 of this Section for type of woodwork involved.
- B. Install woodwork level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb (including tops) to a tolerance of 1/8 inch in 96 inches.
- C. Scribe and cut woodwork to fit adjoining work, and refinish cut surfaces and repair damaged finish at cuts.
- D. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails for exposed fastening, countersunk and filled flush with woodwork and matching final finish if transparent finish is indicated.
- E. Standing and Running Trim: Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to greatest extent possible. Do not use pieces less than 36 inches long, except where shorter single-length pieces are necessary. Scarf running joints and stagger in adjacent and related members.
  - 1. Fill gaps, if any, between top of base and wall with plastic wood filler, sand smooth, and finish same as wood base, if finished.
  - 2. Install wall railings on indicated metal brackets securely fastened to wall framing.
  - 3. Install standing and running trim with no more variation from a straight line than 1/8 inch in 96 inches.
- F. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
  - 1. Install cabinets with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
  - 2. Maintain veneer sequence matching of cabinets with transparent finish.
  - 3. Fasten wall cabinets through back, near top and bottom, at ends and not more than 16 inches o.c. with No. 10 wafer-head screws sized for 1-inch penetration into wood framing, blocking, or hanging strips or No. 10 wafer-head sheet metal screws through metal backing or metal framing behind wall finish.
- G. Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.
  - 1. Align adjacent solid-surfacing-material countertops and form seams to comply with manufacturer's written recommendations using adhesive in color to match countertop. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
  - 2. Install countertops with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.

3. Secure backsplashes to tops with concealed metal brackets at 16 inches o.c. and to walls with adhesive.
  4. Calk space between backsplash and wall with sealant specified in Division 7, Section 07920 - JOINT SEALANTS.
- H. Paneling: Anchor paneling to supporting substrate with concealed panel-hanger clips. Do not use face fastening, unless otherwise indicated.
1. Install flush paneling with no more than 1/16 inch in 96-inch vertical cup or bow and 1/8 inch in 96-inch horizontal variation from a true plane.
- I. Complete the finishing work specified in this Section to extent not completed at shop or before installation of woodwork. Fill nail holes with matching filler where exposed. Apply specified finish coats, including stains and paste fillers if any, to exposed surfaces where only sealer/prime coats were applied in shop.

### 3.3 ADJUSTING AND CLEANING

- A. Repair damaged and defective woodwork, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.
- B. Clean, lubricate, and adjust hardware.
- C. Clean woodwork on exposed and semiexposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION 06402

**PART 1 GENERAL**

**1.1 WORK INCLUDES**

- A. Solid polymer fabrications as shown on the Drawings and specified herein.

**1.2 SUBMITTALS**

- A. Shop Drawings: Indicate dimensions, component sizes, fabrication details, attachment provisions and coordination requirements with adjacent work.
- B. Samples: Submit minimum 6"x6" samples. Indicate full range of color and pattern variation. Approved samples will be retained as a standard for work.
- C. Product Data: Indicate product description, fabrication information and compliance with specified performance requirements.
- D. Maintenance Data: Submit manufacturer's care and maintenance data, including repair and cleaning instructions. Include in project close-out documents.

**1.3 SUSTAINABLE DESIGN SUBMITTALS**

- A. Section 01811 - Sustainable Design Requirements: Requirements for sustainable design submittals.
- B. Manufacturer's Certificate: Certify products meet or exceed specified sustainable design requirements.
  - 1. Materials Resources Certificates:
    - a. Certify recycled material content for recycled content products.
    - b. Certify source for local and regional materials and distance from Project site.
  - 2. Indoor Air Quality Certificates:
    - a. Certify volatile organic compound content for each interior adhesive and sealant and related primer.
- C. Product Cost Data: Submit cost of products to verify compliance with Project sustainable design requirements. Exclude cost of labor and equipment to install products.

1. Provide cost data for the following products:
  - a. Products with recycled material content.
  - b. Local and regional products.

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

- A. Deliver no components to project site until areas are ready for installation. Store indoors.
- B. Handle materials to prevent damage to finished surfaces. Provide protective coverings to prevent physical damage or staining following installation for duration of project.

#### **1.5 QUALITY CRITERIA**

- A. Applicable standards: Standards of the following, as referenced herein:
  1. American National Standards Institute (ANSI).
  2. American Society for Testing and Materials (ASTM).
  3. National Electrical Manufacturers Association (NEMA).
- B. Allowable tolerances:
  1. Variation in component size: +/- 1/8".
  2. Location of openings: +/- from indicated location.
- C. Sustainable Design Requirements:
  1. Recycled Content Materials: Furnish materials with recycled content.
  2. Regional Materials: Furnish materials extracted, processed, and manufactured within 500 miles of Project site.

#### **1.6 WARRANTY**

- A. Provide manufacturer's warranty. The manufacturer shall warrant that the manufacturer shall at its option repair or replace, without charge, such product if it fails due to manufacturing defect during the first 10 years after initial installation. This shall include reasonable labor charges needed to repair or replace the product covered hereunder.

### **PART 2 PRODUCTS**

#### **2.1 ACCEPTABLE MANUFACTURERS**

- A. Product: Corian as manufactured by Du Pont Company, Corian Products, Wilmington, Delaware 19898.
- B. Other acceptable manufacturers offering equivalent products:
  1. Avonite as manufactured by Avonite, Inc., Belen, New Mexico.
  2. Nuvel as manufactured by General Electric Company and distributed by Formica Corporation, Cincinnati, Ohio.

- 3. Swanstone as manufactured by the Swan Corporation, One City Centre, St. Louis, MO 63101.
  - 4. Gibraltar as manufactured by Ralph Wilson Plastics Co., 600 South General Bruce Drive, PO Box 6110, Temple, Texas 76503.
- C. Substitutions: Under the provisions of Section 01600 - Materials and Equipment.

## **2.2 MATERIAL**

- A. Window Sills: 3/4" thick Corian, adhesively joined with no exposed seams, having edge details as indicated on the Drawings; color as selected by the Architect.

## **2.3 ACCESSORY PRODUCTS**

- A. Joint Adhesive: Manufacturer's standard two-part adhesive kit to create inconspicuous, non-porous joints.
- B. Panel Adhesive: Manufacturer's standard neoprene-based panel adhesive meeting ANSI A136.1-1967 and UL listed.
- C. Sealant: Manufacturer's standard mildew-resistant, FDA/UL recognized silicone sealant in colors matching component.

## **2.4 FABRICATION**

- A. Factory fabricate components to greatest extent practicable to sizes and shapes indicated, in accordance with approved shop drawings.
- B. Form joints between components using manufacturer's standard joint adhesive; without conspicuous joints.
- C. Cut and finish component edges with clean, sharp returns. Route radii and contours to template. Repair or reject defective and inaccurate work.

# **PART 3 EXECUTION**

## **3.1 INSTALLATION**

- A. Install components plumb and level, scribed to adjacent finishes, in accordance with approved shop drawings and product installation data.
- B. Form field joints using manufacturer's recommended adhesive, with joints inconspicuous in finished work. Keep components and hands clean when making joints.

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**SECTION 06611 – SOLID POLYMER  
FABRICATIONS**

- C. Remove adhesive, sealants and other stains. Replace stained components.

**END OF SECTION**

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**SECTION 07210 – THERMAL  
INSULATION**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. This Section includes the following:
  - 1. Perimeter wall insulation (supporting backfill).
  - 2. Concealed building insulation.
  - 3. Vapor retarders.
- B. Related Sections include the following:
  - 1. Division 04 Section "Unit Masonry" for insulation installed in cavity walls and masonry cells.
  - 2. Division 07 Section "Self-Adhering Sheet Waterproofing" for insulation and insulated drainage panels installed with waterproofing.
  - 3. Division 07 Sections "Ethylene-Polyene-Diene-Monomer (EPDM Roofing)" and "Thermoplastic Membrane Roofing" for insulation specified as part of roofing construction.
  - 4. Division 07 Section "Fire-Resistive Joint Systems" for insulation installed as part of a perimeter fire-resistive joint system.

**1.2 DEFINITIONS**

- A. Mineral-Fiber Insulation: Insulation composed of rock-wool fibers, slag-wool fibers, or glass fibers; produced in boards and blanket with latter formed into batts (flat-cut lengths) or rolls.

**1.3 PERFORMANCE REQUIREMENTS**

- A. Plenum Rating: Provide glass-fiber insulation where indicated in ceiling plenums whose test performance is rated as follows for use in plenums as determined by testing identical products per "Erosion Test" and "Mold Growth and Humidity Test" described in UL 181, or on comparable tests from another standard acceptable to authorities having jurisdiction.
  - 1. Erosion Test Results: Insulation shows no visible evidence of cracking, flaking, peeling, or delamination of interior surface of duct assembly, after testing for four (4) hours at 2500-fpm (13-m/s) air velocity.
  - 2. Mold Growth and Humidity Test Results: Insulation shows no evidence of mold growth, delamination, or other deterioration due to the effects of high humidity, after inoculation with *Chaetomium globosum* on all surfaces and storing for 60 days at 100 percent relative humidity in the dark.

**1.4 SUBMITTALS**

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

## 1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of building insulation through one source from a single manufacturer.
- B. Fire-Test-Response Characteristics: Provide insulation and related materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.
  - 1. Surface-Burning Characteristics: ASTM E84.
  - 2. Fire-Resistance Ratings: ASTM E119.
  - 3. Combustion Characteristics: ASTM E136.

## 1.6 DELIVERY, STORAGE AND HANDLING

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

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
  - 1. Products: Subject to compliance with requirements, provide one of the products specified.
  - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

### 2.2 FOAM-PLASTIC BOARD INSULATION

- A. Extruded-Polystyrene Board Insulation: ASTM C 578, of type and density indicated below, with maximum flame-spread and smoke-developed indexes of 74 and 450, respectively:
  - 1. Manufacturers:
    - a. DiversiFoam Products.
    - b. Dow Chemical Company.
    - c. Owens Corning.
    - d. Pactiv Building Products Division.
  - 2. Type IV, 1.60 lb / cu. ft. (26 kg/cu. m), unless otherwise indicated.



## 2.3 GLASS-FIBER BLANKET INSULATION

- A. Manufacturers:
  - 1. Certain Teed Corporation.
  - 2. Guardian Fiberglass, Inc.
  - 3. Johns Manville.
  - 4. Knauf Fiber Glass.
  - 5. Owens Corning.
- B. Unfaced, Glass-Fiber Blanket Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.
- C. Where glass-fiber blanket insulation is indicated by the following thicknesses, provide blankets in batt or roll form with thermal resistances indicated:
  - 1. 3-5/8 inches (92 mm) thick with a thermal resistance of 11 deg F x h x sq. ft. / Btu at 75 deg F (1.9 K x sq. m/W at 24 deg C).
  - 2. 5-1/2 inches (140 mm) thick with a thermal resistance of 19 deg F x h x sq. ft. / Btu at 75 deg F (3.3 K x sq. m/W at 24 deg C).

## 2.4 VAPOR RETARDERS

- A. Fire-Retardant, Reinforced-Polyethylene Vapor Retarders: Two (2) outer layers of polyethylene film laminated to an inner reinforcing layer consisting of either nonwoven grid of nylon cord or polyester scrim and weighing not less than 22 lb. / 1000 sq. ft. (10kg/100 sq. m), with maximum permeance rating of 0.1317 per (7.56 ng/Pa x s x sq. m) and with flame-spread and smoke-developed indexes of not more than 5 and 60, respectively.
  - 1. Products:
    - a. Raven Industries Inc.; DURA-SKRIM 2FR.
    - b. Reef Industries, Inc.; Griffolyn T-55 FR.
- B. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.

## 2.5 AUXILIARY INSULATING MATERIALS

- A. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by insulation manufacturer for sealing joints and penetrations in vapor-retarder facings.
- B. Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation securely to substrates indicated without damaging insulation and substrates.

## 2.6 INSULATION FASTENERS

- A. Adhesively Attached, Spindle-Type Anchors: Plate welded to projecting spindle; capable of holding insulation of thickness indicated securely in position indicated with self-locking washer in place; and complying with the following requirements:
  - 1. Products"
    - a. AGM Industries, Inc.; Series R RACTOO Insul-Hangers.
    - b. Eckel Industries of Canada; Stic-Klip Type N Fasteners.

- c. Gemco; Spindle Type.
- 2. Plate: Perforated galvanized carbon-steel sheet, 0.030 inch (.0762 mm) thick by 2 inches (50 mm) square.
- 3. Spindle: Copper-coated, low carbon steel; fully annealed; 0.105 inch (2.67 mm) in diameter; length to suit depth of insulation indicated.
- B. Anchor Adhesive: Product with demonstrated capability to bond insulation anchors securely to substrates indicated without damaging insulation, fasteners, and substrates:
  - 1. Products:
    - a. AGM Industries, Inc.; TACTT Adhesive.
    - b. Eckel Industries of Canada; Stic-Klip Type S Adhesive.
    - c. Gemco; Tuff Bond Hanger Adhesive.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements of Sections in which substrates and related work are specified and for other conditions affecting performance.
  - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

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

### 3.3 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instruction applicable to products and application indicated.
- B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed at any time to ice, rain and snow.
- C. Extend insulation in thickness indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- D. Water-Piping Coordination: If water piping is located within insulated exterior walls, coordinate location of piping to ensure that it is placed on warm side of insulation and insulation encapsulates piping.
- E. For performed insulating units, provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to product thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.

### 3.4 INSTALLATION OF BELOW-GRADE INSULATION

- A. On vertical foundation wall surfaces, set insulation units using manufacturer recommended adhesive according to manufacturer's written instructions.
  - 1. If not otherwise indicated, extend insulation a minimum of twenty-four (24) inches below exterior grade line.

### 3.5 INSTALLATION OF GENERAL BUILDING INSULATION

- A. Proceed with demolition of structural framing members systematically, from higher to lower level. Complete building demolition operations above each floor or tier before disturbing supporting members on the next lower level.
- B. Seal joints between foam-plastic insulation units by applying adhesive, mastic, or sealant to edges of each unit to form a tight seal as units are shoved into place. Fill voids in completed installation with adhesive, mastic, or sealant as recommended in insulation manufacturer.
- C. Install mineral-fiber insulation in cavities formed by framing members according to the following requirements
  - 1. Remove below-grade construction, including basements, foundation walls, and footings, to depths indicated.
  - 2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
  - 3. Maintain 3-inch (76-mm) clearance of insulation around recessed lighting fixtures.
  - 4. For wood-framed construction, install mineral-fiber blankets according to ASTM c 1320 and as follows:
    - a. With faced blankets having stapling flanges, secure insulation by inset, stapling flanges to sides of framing members.
    - b. With faced blankets having stapling flanges, lap blanket flange over flange of adjacent blanket to maintain continuity of vapor retarded once finish material is installed over it.

### 3.6 INSTALLATION OF VAPOR RETARDERS

- A. General: Extend vapor retarder to extremities of areas to be protected from vapor transmission. Secure in place with adhesives or other anchorage system as indicated. Extend vapor retarder to cover miscellaneous voids in insulated substrates, including those filled with loose-fiber insulation.
- B. Firmly attach vapor retarders to metal framing and solid substrates with vapor-retarder fasteners as recommended by vapor-retarder manufacture.
- C. Seal joints caused by pipes, conduit, electrical boxes, and similar items penetrating vapor retarders with vapor-retarder tape to create an airtight seal between penetrating objects and vapor retarder.
- D. Repair tears or punctures in vapor retarders immediately before concealment by other work. Cover with vapor-retarder tape or another layer of vapor retarder.

### 3.7 PROTECTION

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

END OF SECTION 07210

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**SECTION 07260 - REINFORCED  
UNDERSLAB  
VAPOR RETARDERS**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

- A. General: Provide all labor, materials, equipment, related services and supervision required, including manufacturing, fabrication, erection and installation for reinforced underslab vapor retarders in accordance with the requirements of the Contract Documents.
- B. The extent of reinforced underslab vapor retarders is shown on the drawings.
- C. Reinforced underslab vapor retarders shall be provided on grade under all interior building concrete floor slabs unless otherwise specified or indicated.
- D. Related Sections: The following sections contain requirements that relate to this section.
  - 1. Division 3, Section 03330 - CAST-IN-PLACE CONCRETE for slabs on grade.

**1.3 SUBMITTALS**

- A. Manufacturer's Data: Include specifications, installation instructions and general recommendations from the manufacturer for the types of products required. Include manufacturer's certification or other data substantiating that the materials comply with the requirements.
- B. Shop Drawings: Typical large scale details for seams, penetrations, repairs and terminations.
- C. Samples for verification purposes, minimum 6 inches by 6 inches, wrapped with clear plastic, including all facing materials and labeled of the following:
  - 1. Reinforced vapor retarder.
  - 2. Tape.
  - 3. Penetration boots.

**1.4 QUALITY ASSURANCE**

- A. Contractor's Quality Assurance Responsibilities: Contractor is solely responsible for quality control of the work.
- B. Manufacturer's Qualifications: Firms shall be engaged in the manufacture of reinforced underslab vapor retarders of types and sizes required, and whose products have been in satisfactory use in similar service for not less than 10 years.

- C. Installer's Qualifications: Firms shall have at least 5 years of successful installation experience with projects utilizing products required for this project.
- D. Regulatory Requirements: Comply with applicable requirements of the laws, codes, ordinances and regulations of Federal, State and Municipal authorities having jurisdiction. Obtain necessary approvals from all such authorities.
  - 1. Research reports or evaluation reports of the model code organization acceptable to authorities having jurisdiction that evidence compliance of plastic foam insulations with building code in effect for Project.
- E. Single-Source Responsibility: Obtain each type of reinforced underslab vapor retarders from a single manufacturer.

## 1.5 DELIVERY, STORAGE, AND HANDLING

- A. General: Deliver and store materials in manufacturer's original packaging labeled to show name, brand, type, and grade. Store materials in protected dry location off ground in accordance with manufacturer's instructions. Do not open packaging nor remove labels until time for installation.
- B. Protection from Deterioration: Do not allow vapor retarder materials to become wet, soiled, or covered with ice or snow. Protect vapor retarder materials from exposure to high temperatures, excessive exposure to sunlight, and contact with hot surfaces in excess of the safe temperature indicated by the manufacturer.

## 1.6 PROJECT CONDITIONS

- A. Weather Conditions: Do not proceed with the work during inclement weather nor when weather forecasts are unfavorable, unless the work will proceed in accordance with the manufacturer's requirements and instructions and any agreements or restrictions of the Pre-Installation Conference.

# PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

- A. Manufacturer's Basis of Design: The named manufacturer and associated products are the basis of design for the project. Other manufacturer's whose products may be incorporated into the work, subject to compliance with requirements, are also listed. The Contractor is responsible for any modifications to the work resulting from the use of materials other than the basis of design at no additional cost to the Owner.
  - 1. "Griffolyn Type T-85", Griffolyn/Reef Industries, Inc.
- A. The following manufacturers with equal products are acceptable:
  - 1. "Dura-Skrim 12BBR", Raven, Industries.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Examine the substrate and the conditions under which the work is to be performed, and do not proceed with the work until unsatisfactory conditions have been corrected.
- B. Proceed with work only after substrate construction is complete, all projections through vapor retarders have been installed and flashed and immediate installation of concrete work over the vapor retarder can be performed.

### 3.2 PREPARATION

- A. General: Clean the substrates to remove loose particles and deleterious matter which would impair the work. Remove projections or high spots, which would interfere with proper application of the reinforced underslab vapor retarder.

### 3.3 INSTALLATION

- A. Install reinforced vapor retarders in accordance with ASTM E 1643 and manufacturer's instructions and continuously at locations under slabs. Ensure there are no discontinuities in vapor retarder at seams and penetrations.
- B. Where slabs intersect walls, extend vapor retarder up walls 2 inches above the thickness of slabs. At thickened edge slabs, extend vapor retarders under thickened edge and up to grade. Extend coverage to extremities of areas to receive vapor retarders and attach with adhesive, or with tape.
- C. Install vapor retarders in largest practical widths.
- D. Join sections of vapor retarder and seal penetrations in vapor retarder with mastic tape. Vapor retarder surfaces to receive mastic tape must be clean and dry.
- E. Verify there is no moisture entrapment by vapor retarder due to rainfall or groundwater intrusion.
- F. Repair holes in vapor retarder with self-adhesive repair tape.
- G. Seal around pipes and other penetrations in vapor retarder with pipe boots in accordance with manufacturer's instructions.

### 3.2 PROTECTION OF MOISTURE BARRIERS

- A. Protect reinforced vapor retarders from damage during installation of reinforcing steel and utilities and during placement of concrete slab or granular materials.
- B. Protect vapor retarder from puncture, damage and deterioration.

END OF SECTION 07260

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

**SECTION 07413 – INSULATED CORE  
METAL WALL PANELS**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

- A. Section Includes:
  - 1. Foamed-insulation-core metal wall panels.
- B. Related Sections:
  - 1. Division 1 Section "Sustainable Design Requirements" for related LEED general requirements.
  - 2. Division 5 Section "Cold-Formed Metal Framing" for cold-formed metal framing supporting metal wall panels.
  - 3. Division 7 air barrier section for transition and flashing components of air/moisture barrier.
  - 4. Division 7 Section "Sheet Metal Flashing and Trim" for sheet metal copings, flashing reglets and roof drainage items.
  - 5. Division 7 Section "Joint Sealants" for field-applied joint sealants.

**1.3 DEFINITIONS**

- A. Metal Wall Panel Assembly: Insulated-core metal wall panels, attachment system components, miscellaneous metal framing, and accessories necessary for a complete weathertight wall system.

**1.4 PERFORMANCE REQUIREMENTS**

- A. General Performance: Metal wall panel assemblies shall comply with performance requirements without failure due to defective manufacture, fabrication, installation, or other defects in construction.
- B. Delegated Design: Design metal wall panel assembly, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- C. Air Infiltration: Air leakage through assembly of not more than 0.06 cfm/sq. ft. of wall area when tested according to ASTM E 283 at the following test-pressure difference:
  - 1. Test-Pressure Difference: 6.24 lbf/sq. ft.
- D. Water Penetration under Static Pressure: No uncontrolled water penetration when tested according to ASTM E 331 at the following test-pressure difference:
  - 1. Test-Pressure Difference: 15.0 lbf/sq. ft.
  - 2. Water Leakage: Uncontrolled water infiltrating the system or appearing on systems normally exposed interior surfaces from sources other than



condensation. Water controlled by flashing and gutters that is drained back to the exterior and cannot damage adjacent materials or finishes is not water leakage.

- E. Water Penetration under Dynamic Pressure: No uncontrolled water penetration when tested according to AAMA 501.1 at the following test-pressure difference:
  - 1. Test-Pressure Difference: 15.0 lbf/sq. ft.
  - 2. Water Leakage: Uncontrolled water infiltrating the system or appearing on systems normally exposed interior surfaces from sources other than condensation. Water controlled by flashing and gutters that is drained back to the exterior and cannot damage adjacent materials or finishes is not water leakage.
- F. Structural Performance: Metal wall panel assemblies shall withstand the effects the following loads and stresses within limits and under conditions indicated, based on testing according to ASTM E 72:
  - 1. Wind Loads: Determine loads based on the following minimum design wind pressures:
    - a. Uniform pressure of 20 lbf/sq. ft., acting inward or outward.
  - 2. Deflection Limits: Metal wall panel assemblies shall withstand wind loads with horizontal deflections no greater than 1/175 of the span.
- G. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
  - 1. Temperature Change (Range): 120 deg F, material surfaces.
- H. Thermal Performance: Provide insulated metal wall panel assemblies with thermal-resistance value (R-value) indicated when tested according to ASTM C 518.

## 1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of wall panel and accessory.
- B. Shop Drawings: Show fabrication and installation layouts of metal wall panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details. Distinguish between factory-, shop-, and field-assembled work.
  - 1. Accessories: Include details of the following items, at a scale of not less than 1-1/2 inches per 12 inches:
    - a. Anchorage systems.
- C. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.
  - 1. Metal Wall Panels: 12 inches long by actual panel width. Include fasteners, battens, closures, and other metal wall panel accessories.
  - 2. Trim and Closures: 12 inches long. Include fasteners and other exposed accessories.
  - 3. Accessories: 12-inch-long Samples for each type of accessory.

- D. Delegated-Design Submittal: For metal wall panel assembly indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

## 1.6 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Exterior elevations, drawn to scale, and coordinating penetrations and wall-mounted items. Show the following:
  - 1. Wall panels and attachments.
  - 2. Girts and Stud framing.
  - 3. Wall-mounted items including doors, windows, louvers, and lighting fixtures.
  - 4. Penetrations of wall by pipes and utilities.
- B. Qualification Data: For Installer.
- C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each product.
- D. Field quality-control reports.
- E. Warranties: Sample of special warranties.

## 1.7 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For insulated-core metal wall panels to include in maintenance manuals.

## 1.8 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers trained and approved by manufacturer.
- B. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.
- C. Source Limitations: Obtain each type of metal wall panel from single source from a single manufacturer.
- D. Fire-Test-Response Characteristics: Provide metal wall panels and system components with the following fire-test-response characteristics as determined by testing identical panels and system components per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify products with appropriate markings of applicable testing agency.
  - 1. Fire-Resistance Characteristics: Provide materials and construction tested for fire resistance per ASTM E 119.
  - 2. Intermediate-Scale Multistory Fire Test: Tested mockup, representative of completed multistory wall assembly of which wall panel is a part, complies with NFPA 285 for test method and required fire-test-response characteristics of exterior non-load-bearing wall panel assemblies.
  - 3. Radiant Heat Exposure: No ignition when tested according to NFPA 268.
  - 4. Potential Heat: Acceptable level when tested according to NFPA 259.

5. Surface-Burning Characteristics: Provide wall panels with flame-spread index of 25 or less and smoke-developed index of 450 or less, per ASTM E 84.
- E. Preinstallation Conference: Conduct conference at Project site.
1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, metal wall panel Installer, metal wall panel manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects metal wall panels including installers of doors, windows, and louvers.
  2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
  3. Review methods and procedures related to metal wall panel installation, including manufacturer's written instructions.
  4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
  5. Review flashings, special siding details, wall penetrations, openings, and condition of other construction that will affect metal wall panels.
  6. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
  7. Review temporary protection requirements for metal wall panel assembly during and after installation.
  8. Review wall panel observation and repair procedures after metal wall panel installation.

#### 1.9 DELIVERY, STORAGE, AND HANDLING

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

#### 1.10 PROJECT CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal wall panels to be performed according to manufacturers' written instructions and warranty requirements.
- B. Field Measurements: Verify locations of structural members and wall opening dimensions by field measurements before metal wall panel fabrication, and indicate measurements on Shop Drawings.

## 1.11 COORDINATION

- A. Coordinate metal wall panel assemblies with rain drainage work, flashing, trim, and construction of girts, studs, soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

## 1.12 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal wall panel assemblies that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Structural failures, including rupturing, cracking, or puncturing.
    - b. Deterioration of metals and other materials beyond normal weathering.
  - 2. Warranty Period: Five (5) years from date of Substantial Completion.
  - 3. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
    - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
    - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
    - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
  - 4. Finish Warranty Period: Ten (10) years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 PANEL MATERIALS

- A. Metallic-Coated Steel Sheet: Restricted flatness steel sheet metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
  - 1. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 coating designation; structural quality.
  - 2. Surface: Smooth, flat finish.
  - 3. Exposed Coil-Coated Finish:
    - a. Metallic Fluoropolymer: AAMA 621. Three-coat fluoropolymer finish with suspended metallic flakes containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
  - 4. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.
- B. Panel Sealants:
  - 1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.
  - 2. Joint Sealant: ASTM C 920; elastomeric polyurethane, polysulfide, or silicone sealant; of type, grade, class, and use classifications required to

seal joints in metal wall panels and remain weathertight; and as recommended in writing by metal wall panel manufacturer.

## 2.2 INSULATION FOR PANEL CORES

- A. Polyisocyanurate Insulation: Closed cell, modified polyisocyanurate foam using a non-CFC blowing agent, foamed-in-place type, with maximum flame-spread index of 25 and smoke-developed index of 450.
  - 1. Closed-Cell Content: 90 percent when tested according to ASTM D 2856.

## 2.3 MISCELLANEOUS METAL FRAMING

- A. Miscellaneous Metal Framing, General: ASTM C 645, cold-formed metallic-coated steel sheet, or coating with equivalent corrosion resistance unless otherwise indicated.
- B. Subgirts: Manufacturer's standard C- or Z-shaped sections, 0.064-inch nominal thickness.
- C. Zee Clips: 0.064-inch nominal thickness.
- D. Base or Sill Angles / Channels: 0.064-inch nominal thickness.
- E. Hat-Shaped, Rigid Furring Channels:
  - 1. Nominal Thickness: As required to meet performance requirements.
  - 2. Depth: As indicated.
- F. Cold-Rolled Furring Channels: Minimum 1/2-inch-wide flange.
  - 1. Nominal Thickness: As required to meet performance requirements
  - 2. Depth: As indicated.
  - 3. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with 0.040-inch nominal thickness.
  - 4. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch-diameter wire, or double strand of 0.048-inch-diameter wire.
- G. Fasteners for Miscellaneous Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten miscellaneous metal framing members to substrates.

## 2.4 MISCELLANEOUS MATERIALS

- A. Panel Fasteners: Self-tapping screws; bolts and nuts; self-locking rivets and bolts; end-welded studs; and other suitable fasteners designed to withstand design loads. Provide exposed fasteners with heads matching color of metal wall panels by means of plastic caps or factory-applied coating. Provide EPDM, PVC, or neoprene sealing washers.

## 2.5 FOAMED-INSULATION-CORE METAL WALL PANELS

- A. Concealed-Fastener, Foamed-Insulation-Core Metal Wall Panels. Formed with tongue-and-groove panel edges; designed for sequential installation by interlocking panel edges and mechanically attaching panels to supports using concealed clips or fasteners.
  - 1. Products: Subject to compliance with requirements,

- a. CENTRIA Architectural Systems.
- b. Coldmatic Building Systems.
- c. Galvamet Inc.
- d. Insulated Panel Systems, Div. of NCI Building Systems.
- e. Metecno-Aluma Shield, Metecno Panel Systems, Inc.
- f. Metl-Span.
- g. Steelox Systems, L.L.C.
- 2. Facings: Fabricate panel with exterior and interior facings of same material and thickness.
  - a. Material: Zinc-coated (galvanized) steel sheet, 0.024-inch or 0.036-inch nominal thickness, as indicated.
  - b. Exterior Facing Finish: 3-coat metallic fluoropolymer.
    - 1) Color: Match Architect's samples.
  - c. Interior Facing Finish: Manufacturer's standard siliconized polyester.
  - d. Exterior Surface: Smooth, flat.
- 3. Panel Coverage: 16 inches nominal.
- 4. Panel Thickness: 4 inches nominal.
- 5. Thermal-Resistance Value (R-Value):

## 2.6 ACCESSORIES

- A. Wall Panel Accessories: Provide components required for a complete metal wall panel assembly including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal wall panels unless otherwise indicated.
  - 1. Closures: Provide closures at eaves and rakes, fabricated of same metal as metal wall panels.
  - 2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
  - 3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch-thick, flexible closure strips; cut or premolded to match metal wall panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
- B. Flashing and Trim: Formed from 0.018-inch-minimum thickness, zinc-coated (galvanized) steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating. Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal wall panels.

## 2.7 FABRICATION

- A. General: Fabricate and finish metal wall panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.
- B. Fabricate metal wall panels in a manner that eliminates condensation on interior side of panel and with joints between panels designed to form weathertight seals.

- C. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.
- D. Fabricate metal wall panel joints with factory-installed captive gaskets or separator strips that provide a tight seal and prevent metal-to-metal contact, in a manner that will minimize noise from movements within panel assembly.
- E. Sheet Metal Accessories: Fabricate flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions, metal, and other characteristics of item indicated.
  - 1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
  - 2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
  - 3. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
  - 4. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.
  - 5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
  - 6. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended by metal wall panel manufacturer.
    - a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal wall panel manufacturer for application but not less than thickness of metal being secured.

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

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal wall panel supports, and other conditions affecting performance of work.
  - 1. Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been

installed within alignment tolerances required by metal wall panel manufacturer.

2. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
- B. Examine roughing-in for components and systems penetrating metal wall panels to verify actual locations of penetrations relative to seam locations of metal wall panels before metal wall panel installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Miscellaneous Framing: Install subgirts, base angles, sills, furring, and other miscellaneous wall panel support members and anchorages according to ASTM C 754 and metal wall panel manufacturer's written recommendations.

### 3.3 METAL WALL PANEL INSTALLATION, GENERAL

- A. General: Install metal wall panels according to manufacturer's written instructions in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to girts and subgirts unless otherwise indicated. Anchor metal wall panels and other components of the Work securely in place, with provisions for thermal and structural movement.
1. Commence metal wall panel installation and install minimum of 300 sq. ft. in presence of factory-authorized representative.
  2. Shim or otherwise plumb substrates receiving metal wall panels.
  3. Flash and seal metal wall panels with weather closures at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until weather barrier and flashings that will be concealed by metal wall panels are installed.
  4. Install screw fasteners in predrilled holes.
  5. Locate and space fastenings in uniform vertical and horizontal alignment.
  6. Install flashing and trim as metal wall panel work proceeds.
  7. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
  8. Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete, and elsewhere as indicated or, if not indicated, as necessary for waterproofing.
  9. Align bottom of metal wall panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
  10. Provide weathertight escutcheons for pipe and conduit penetrating exterior walls.
- B. Fasteners:
1. Steel Wall Panels: Use stainless-steel fasteners for surfaces exposed to the exterior; use galvanized steel fasteners for surfaces exposed to the interior.
  2. Aluminum Wall Panels: Use aluminum or stainless-steel fasteners for surfaces exposed to the exterior; use aluminum or galvanized steel fasteners for surfaces exposed to the interior.



3. Copper Wall Panels: Use copper, stainless-steel, or hardware-bronze fasteners.
  4. Stainless-Steel Wall Panels: Use stainless-steel fasteners.
- C. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action as recommended by metal wall panel manufacturer.
- D. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weathertight performance of metal wall panel assemblies. Provide types of gaskets, fillers, and sealants indicated or, if not indicated, types recommended by metal wall panel manufacturer.
1. Seal metal wall panel end laps with double beads of tape or sealant, full width of panel. Seal side joints where recommended by metal wall panel manufacturer.
  2. Prepare joints and apply sealants to comply with requirements in Division 7 Section "Joint Sealants."

### 3.4 INSULATED-CORE METAL WALL PANEL INSTALLATION

- A. General: Apply continuous ribbon of sealant to panel joint on concealed side of insulated-core metal wall panels as vapor seal; apply sealant to panel joint on exposed side of panels for weather seal.
1. Fasten insulated-core metal wall panels to supports with fasteners at each lapped joint at location and spacing and with fasteners recommended by manufacturer.
  2. Lap ribbed or fluted sheets one full rib corrugation. Apply panels and associated items for neat and weathertight enclosure. Avoid "panel creep" or application not true to line.
  3. Provide metal-backed washers under heads of exposed fasteners on weather side of insulated metal wall panels.
  4. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.
  5. Provide sealant tape at lapped joints of insulated metal wall panels and between panels and protruding equipment, vents, and accessories.
  6. Apply a continuous ribbon of sealant tape to panel side laps and elsewhere as needed to make panels weathertight.
- B. Foamed-Insulation-Core Metal Wall Panels: Fasten metal wall panels to supports with concealed clips at each joint at location and spacing and with fasteners recommended by manufacturer. Fully engage tongue and groove of adjacent panels.
1. Install clips to supports with self-tapping fasteners.
- C. Laminated-Insulation-Core Metal Wall Panels:
1. Wrapped-Edge Panels: Mechanically attach wall panels to supports using staggered, concealed side clips engaging wrapped panel edges. Install clips to supports with self-tapping fasteners. Seal joints with manufacturer's standard gaskets.

### 3.5 ACCESSORY INSTALLATION

- A. General: Install accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.
  - 1. Install components required for a complete metal wall panel assembly including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
- B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
  - 1. Install exposed flashing and trim that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.
  - 2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

### 3.6 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Water-Spray Test: After completing the installation of 75-foot-by-2-story minimum area of metal wall panel assembly, test assembly for water penetration according to AAMA 501.2 in a 2-bay area directed by Architect.
- C. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect and test completed metal wall panel installation, including accessories.
- D. Remove and replace metal wall panels where tests and inspections indicate that they do not comply with specified requirements.
- E. Additional tests and inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

### 3.7 CLEANING AND PROTECTION

- A. Remove temporary protective coverings and strippable films, if any, as metal wall panels are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of metal wall panel installation, clean finished surfaces as recommended by metal wall panel manufacturer. Maintain in a clean condition during construction.

- B. After metal wall panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.
- C. Replace metal wall panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07413

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

**SECTION 07543 - THERMOPLASTIC  
POLYOLEFIN (TPO) ROOFING**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Adhered TPO membrane roofing system.
  - 2. Vapor retarder.
  - 3. Roof insulation.
- B. Related Sections:
  - 1. Division 06 Section "Miscellaneous 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 "Manufactured Roof Specialties" for proprietary manufactured roof specialties.
  - 4. Division 07 Section "Joint Sealants" for joint sealants, joint fillers and joint preparation.

**1.2 DEFINITIONS**

- A. TPO: Thermoplastic polyolefin.
- B. 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.

**1.3 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.

**1.4 SUBMITTALS**

- A. Product Data: for each type of product indicated.
- B. 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. Insulation fastening patterns for corner, perimeter and field-of-roof locations.
- C. Maintenance Data: For roofing system to include in maintenance manuals.
- D. Warranties: Sample of special warranties.

## 1.5 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 approve 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.

## 1.6 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.

## 1.7 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.

## 1.8 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.
  1. Special warranty includes membrane roofing, base flashings, roof insulation, fasteners, over Board (when required by roof system manufacturer), roofing accessories, roof expansion joints, and other components of membrane roofing system.
  2. Warranty Period: Fifteen (15) years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 TPO MEMBRANE ROOFING

- A. Fabric-Reinforced Thermoplastic Polyolefin Sheet: ASTM D 6878, internally fabric or scrim reinforced, uniform, flexible TPO Sheet
  1. Manufacturers: Subject to compliance with requirements:
    - a. Carlisle SynTec Incorporated.
    - b. Firestone Building Products Company.
    - c. GenFlex Roofing Systems.
    - d. Versico Incorporated.
    - e. Sika Sarnafil, Inc.

2. Thickness: 45 mil (1.1 mm), nominal.
3. Exposed Face Color: White.

## 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.
- B. Sheet Flashing: Manufacturer's standard unreinforced thermoplastic polyolefin sheets flashing, 55 mils (1.4 mm) thick, minimum, of same color as sheet membrane.
- C. Bonding Adhesive: Manufacturer's standard, water based.
- D. Slip Sheet: Manufacturer's standard, of thickness required for application.
- E. Metal Termination Bars: Manufacturer's standard, predrilled stainless-steel or aluminum bars, approximately 1 by 1/8 inch (25 by 3 mm) thick; with anchors.
- F. 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.
- G. Miscellaneous Accessories: Provide pourable sealers, performed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, lap sealants, termination reglets and other accessories.

## 2.3 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 permance rating of 0.0507 perm (2.9 ng/Pa x s x sq. m).
  1. Products: Subject to compliance with requirements, provide one of 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.

## 2.4 ROOF INSULATION

- A. General: Preformed roof insulation boards manufactured or approved by TPO 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. Provide pre-formed saddles, crickets, tapered edge strips and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

## 2.5 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.

## 2.6 WALKWAYS

- A. Flexible Walkways: Factory-formed, nonporous, heavy-duty, slip-resisting, surface-textured walkway pads or rolls, approximately 3/16 inch (5 mm) thick, and acceptable to membrane roofing system manufacturer.

## 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, provide products by one of the following:
    - a. Commercial Products Group; PortalsPlus C-412.
    - b. Equal as approved by Architect.

# 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.
- D. Install acoustical roof deck rib insulation strips, specified in Division 05 Section "Steel Decking," according to acoustical roof deck manufacturer's written instructions, immediately before installation of overlying construction and to remain dry.

### 3.3 VAPOR-RETARDER INSTALLATION

- A. Laminate Sheet: Install laminate-sheet vapor retarder in a single layer over area to receive vapor retarder, side and end lapping each sheet a minimum 2 inches (50 mm) and 6 inches (150 mm), respectively. Bond vapor retarder to substrate as follows:
  1. Apply adhesive at rate recommended by vapor-retarder manufacture. Seal laps with adhesive.
- B. Completely seal vapor retarder at terminations, obstruction, and penetrations to prevent air movement into membrane roofing system.

### 3.4 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.
  1. 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.

- E. Trim surface of insulation where necessary at roof drains so complete surface is flush and does not restrict flow of water.
- F. 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.
  - 1. Cut and fit insulation within ¼ inch (6 mm) of nailers, projections and penetrations.
- G. Mechanically Fastened and Adhered Insulation: Install each layer of insulations and secure first layer of insulation to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type.
  - 1. Fasten first layer of insulation to resist uplift pressure at corners, perimeter and field of roof.
  - 2. Set each subsequent layer of insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.

### 3.5 ADHERED MEMBRANE ROOFING INSTALLATION

- A. Adhere membrane roofing over area to receive roofing and install according to membrane roofing system manufacturer's written instructions.
- 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. Seams: Clean seam areas, overlap membrane roofing, and hot-air weld side and end laps of membrane roofing and sheet flashings according to manufacturer's written instructions to ensure a watertight seam installation.
  - 1. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of sheet membrane.
  - 2. Verify field strength of seams a minimum of twice daily and repair seam sample areas.
  - 3. Repair tears, voids, and lapped seams in roofing that does not comply with requirements.

- H. Spread sealant bed over deck drain flange at roof drains and securely seal membrane roofing in place with clamping ring.
- I. Install membrane roofing and auxiliary materials to tie in to existing roofing to maintain weather-tightness of transition and to not void warranty for existing membrane roofing system.
- J. Roof Expansion Joints: Install as shown on drawings and as additionally required by membrane roofing system manufacturer.

### 3.6 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 seam areas, overlap and firmly roll sheet flashing into the adhesive. Hot-air weld side and end laps to ensure a watertight seam installation.
- E. Terminate and seal top of sheet flashing and mechanically anchor to substrate through termination bars.

### 3.7 WALKWAY INSTALLATION

- A. Flexible Walkways: Install walkways products in locations indicated. Heat weld to substrate or adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions.

### 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 07543

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

**SECTION 07610 – SHEET METAL  
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) Standing-seam metal roofing, on-site, roll formed.
- B. Related Sections:
  - 1) Division 7 Section "Building Insulation" for roof insulation and sheet vapor retarders separate from self-adhering underlayments.
  - 2) Division 7 Section "Metal Roof Panels" for factory-formed metal soffit panels.
  - 3) Division 7 Section "Sheet Metal Flashing and Trim" for gutters, downspouts, fasciae, copings, and flashings that are not part of sheet metal roofing.
  - 4) Division 7 Section "Roof Accessories" for manufactured roof accessories.
  - 5) Division 7 Section "Joint Sealants" for field-applied sealants adjoining sheet metal roofing.

**1.3 PERFORMANCE REQUIREMENTS**

- A. General Performance: Sheet metal roofing system including, but not limited to, metal roof panels, cleats, clips, anchors and fasteners, sheet metal flashing integral with sheet metal roofing, fascia panels, trim, underlayment, and accessories shall comply with requirements indicated without failure due to defective manufacture, fabrication, installation, or other defects in construction. Sheet metal roofing shall remain watertight.
- B. Thermal Movements: Provide sheet metal roofing that allows for thermal movements from ambient and surface temperature changes. 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 (67 deg C), ambient; 180 deg F (100 deg C) material surfaces.
- C. Solar Reflectance Index: Not less than 78 when calculated according to ASTM E 1980 based on testing identical products by a qualified testing agency.

**1.4 ACTION SUBMITTALS**

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

- B. LEED Submittals:
  - 1) Product Test Reports for Credit SS 7.2: For roof panels, documentation indicating that panels comply with Solar Reflectance Index requirement.
- C. Shop Drawings: Show fabrication and installation layouts of sheet metal roofing, including plans, elevations, expansion joint locations, and keyed details. Distinguish between shop- and field-assembled work. Include the following:
  - 1) Details for forming sheet metal roofing, including seams and dimensions.
  - 2) Details for joining and securing sheet metal roofing, including layout of fasteners, cleats, clips, and other attachments. Include pattern of seams.
  - 3) Details of termination points and assemblies, including fixed points.
  - 4) Details of expansion joints, including showing direction of expansion and contraction.
  - 5) Details of roof penetrations.
  - 6) Details of edge conditions, including eaves, ridges, valleys, rakes, crickets, and counterflashings.
  - 7) Details of special conditions.
  - 8) Details of connections to adjoining work.
  - 9) Detail the following accessory items, at a scale of not less than 3 inches per 12 inches:
    - a) Flashing and trim.
    - b) Gutters and downspouts as they relate to adjacent sheet metal roofing.
    - c) Roof curbs.
    - d) Snow guards.
- D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:
  - 1) Sheet Metal Roofing: 12 inches (300 mm) long by actual width of unit, including finished seam and in required profile. Include fasteners and other attachments.
  - 2) Trim and Metal Closures: 12 inches (300 mm) long and in required profile. Include fasteners and other exposed accessories.
  - 3) Snow Guards: Full-size Sample.
  - 4) Other Accessories: 12-inch- (300-mm-) long Samples for each type of other accessory.

## 1.5 INFORMATIONAL SUBMITTALS

- A. Portable Roll-Forming Equipment Certificate: Issued by UL for equipment manufacturer's portable roll-forming equipment capable of producing panels that comply with UL requirements. Show expiration date no earlier than two months after scheduled completion of sheet metal roofing.
  - 1) Submit certificates indicating recertification of equipment whose certification has expired during the construction period.
- B. Qualification Data: For qualified Installer.
- C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each product.
- D. Warranties: Sample of special warranties.

## 1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For roofing sheet metals and accessories to include in maintenance manuals.

## 1.7 QUALITY ASSURANCE

- A. Custom-Fabricated Sheet Metal Roofing Fabricator Qualifications: Shop that employs skilled workers who custom fabricate sheet metal roofing similar to that required for this Project and whose products have a record of successful in-service performance.
- B. Roll-Formed Sheet Metal Roofing Fabricator Qualifications: Fabricator authorized by portable roll-forming equipment manufacturer to fabricate and install sheet metal roofing units required for this Project, and who maintains current UL certification of its portable roll-forming equipment.
- C. UL-Certified, Portable Roll-Forming Equipment: UL-certified, portable roll-forming equipment capable of producing roofing panels for sheet metal roofing assemblies that comply with UL 580 for **[Class 30] [Class 60] [Class 90]** wind-uplift resistance. Maintain UL certification of portable roll-forming equipment for duration of sheet metal roofing work.
- D. Sheet Metal Roofing Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" unless more stringent requirements are specified or shown on Drawings.
- E. Preliminary Roofing Conference: Before starting roof construction, conduct conference at Project site. Comply with requirements for preinstallation conferences in Division 1 Section "Project Management and Coordination."
  - 1) Review methods and procedures related to roof construction and sheet metal roofing including, but not limited to, items listed for the Preinstallation Conference.
- F. Preinstallation Conference: Conduct conference at Project site.
  - 1) Meet with Owner, Architect, Owner's insurer if applicable, sheet metal roofing Installer, portable roll-forming equipment manufacturer's representative for sheet metal roofing and installers whose work interfaces with or affects sheet metal roofing including installers of roof accessories and roof-mounted equipment.
  - 2) Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
  - 3) Review methods and procedures related to sheet metal roofing installation, including portable roll-forming equipment manufacturer's written instructions.
  - 4) Examine conditions of substrate for compliance with requirements, including flatness and attachment to structural members.
  - 5) Review structural loading limitations of roof deck during and after roofing installation.
  - 6) Review flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect sheet metal roofing.
  - 7) Review governing regulations and requirements for insurance, certificates, and testing and inspecting if applicable.

- 8) Review temporary protection requirements for sheet metal roofing during and after roofing installation.
- 9) Review roof observation and repair procedures after sheet metal roofing installation.
- 10) Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

## 1.8 DELIVERY, STORAGE, AND HANDLING

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

## 1.9 COORDINATION

- A. Coordinate installation of roof curbs, equipment supports, and roof penetrations, which are specified in other Sections.
- B. Coordinate sheet metal roofing with rain drainage work, flashing, trim, and construction of parapets, walls, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

## 1.10 WARRANTY

- A. Special Warranty: Warranty form at the end of this Section in which Installer agrees to repair or replace components of sheet metal roofing that fail in materials or workmanship within specified warranty period.
  - 1) Failures include, but are not limited to, the following:
    - a) Structural failures, including but not limited to rupturing, cracking, or puncturing.
    - b) Wrinkling or buckling.
    - c) Loose parts.
    - d) Failure to remain weathertight, including uncontrolled water leakage.
    - e) Deterioration of metals, metal finishes, and other materials beyond normal weathering, including non-uniformity of color or finish.
    - f) Galvanic action between sheet metal roofing and dissimilar materials.
  - 2) Warranty Period: Five (5) years from date of Substantial Completion.
- B. Special Warranty on Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace sheet metal roofing that shows evidence of deterioration of factory-applied finishes within specified warranty period.
  - 1) Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
    - a) Color fading more than 5 Hunter units when tested according to ASTM D 2244.
    - b) Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.



- c) Cracking, checking, peeling, or failure of paint to adhere to bare metal.
- 2) Finish Warranty Period: Ten (10) years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 ROOFING SHEET METALS

- A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying a strippable, temporary protective film before shipping.
- B. Aluminum Sheet: ASTM B 209 (ASTM B 209M), alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required.
  - 1) Thickness: **0.032 inch (0.81 mm)** unless otherwise indicated.
  - 2) As-Milled Finish: Mill finish.
  - 3) Surface: Smooth, flat.
  - 4) Exposed Coil-Coated Finish:
- C. Metallic Fluoropolymer: AAMA 620. Three-coat fluoropolymer finish with suspended metallic flakes containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
  - 1) Color: Match Architect's samples.
  - 2) Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester-backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil (0.013 mm).
- D. Zinc-Tin Alloy-Coated Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304, dead-soft, fully annealed stainless-steel sheet, coated on both sides with a zinc-tin alloy (50 percent zinc, 50 percent tin), with factory-applied gray preweathering.
  - 1) Products: Subject to compliance with requirements:
- E. Follansbee Steel; TCS II.
  - 1) Thickness: **0.015-inch (0.38-mm)** minimum uncoated thickness, with 0.787-mil (0.020-mm) coating thickness applied to each side.

### 2.2 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for a complete roofing system and as recommended by fabricator for sheet metal roofing.
- B. Snap-On Seams: Provide snap-on seams integrated with panel-edge profile as recommended by portable roll-forming equipment manufacturer to produce sheet metal roofing assemblies that comply with UL 580 for wind-uplift resistance classification specified in "Quality Assurance" Article.

- C. Fasteners: Wood screws, annular-threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads.
  - 1) General:
    - a) Exposed Fasteners: Heads matching color of sheet metal roofing using plastic caps or factory-applied coating.
    - b) Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
    - c) Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.
  - 2) Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
  - 3) Fasteners for Zinc-Tin Alloy-Coated Stainless-Steel Sheet: Series 300 stainless steel.
- D. Solder:
  - 1) For Zinc-Tin Alloy-Coated Stainless Steel: ASTM B 32, 100 percent tin.
- E. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch (13 mm) wide and 1/8 inch (3 mm) thick.
- F. Elastomeric Sealant: ASTM C 920, elastomeric polymer sealant as recommended by portable roll-forming equipment manufacturer for installation indicated; low modulus; of type, grade, class, and use classifications required to seal joints in sheet metal roofing and remain watertight.
- G. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.
- H. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.

## 2.3 ACCESSORIES

- A. Sheet Metal Accessories: Provide components required for a complete sheet metal roofing assembly including trim, copings, fasciae, corner units, clips, flashings, sealants, gaskets, fillers, metal closures, closure strips, and similar items. Match material and finish of sheet metal roofing unless otherwise indicated.
  - 1) Provide accessories as recommended by portable roll-forming equipment manufacturer to produce sheet metal roofing assemblies that comply with UL 580 for wind-uplift resistance classification specified in "Quality Assurance" Article.
  - 2) Cleats: For mechanically seaming into joints and formed from the following materials:
    - a) Aluminum Roofing: **0.0250-inch-** thick stainless steel.
    - b) Zinc-Tin Alloy-Coated Stainless-Steel Roofing: Manufacturer's preformed cleats or cleats fabricated from manufacturer's thickest flat-stock sheet.
    - c) Zinc Roofing: Manufacturer's preformed stainless-steel cleats.
  - 3) Clips: Minimum 0.0625-inch- (1.6-mm-) thick, stainless-steel panel clips designed to withstand negative-load requirements.

- 4) Backing Plates: Plates at roofing splices, fabricated from material recommended by SMACNA.
- 5) Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin foam or closed-cell laminated polyethylene; minimum 1-inch-(25-mm-) thick, flexible-closure strips; cut or premolded to match sheet metal roofing profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
- 6) Flashing and Trim: Formed from same material and with same finish as sheet metal roofing, minimum **[0.018 inch (0.46 mm)] <Insert thickness>** thick.

## 2.4 SNOW GUARDS

- A. Snow Guards, General: Prefabricated, noncorrosive units designed to be installed without penetrating sheet metal roofing; complete with predrilled holes, clamps, or hooks for anchoring.
- B. Surface-Mounted, Metal, Stop-Type Snow Guards: Cast-aluminum stops designed for attachment to panel surface of sheet metal roofing using construction adhesive, silicone or polyurethane sealant, or adhesive tape.

## 2.5 FABRICATION

- A. General: Custom fabricate sheet metal roofing to comply with details shown and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions (panel width and seam height), geometry, metal thickness, and other characteristics of installation indicated. Fabricate sheet metal roofing and accessories at the shop to greatest extent possible.
  - 1) Standing-Seam Roofing: Form standing-seam panels with finished seam height **of 1-1/2 inches (38 mm)**.
  - 2) General: Fabricate roll-formed sheet metal roofing panels with UL-certified, portable roll-forming equipment capable of producing roofing panels for sheet metal roofing assemblies that comply with UL 580 for wind-uplift resistance classification specified in "Quality Assurance" Article. Fabricate roll-formed sheet metal according to equipment manufacturer's written instructions and to comply with details shown.
- B. Fabrication Tolerances: Fabricate sheet metal roofing that is capable of installation to a tolerance of 1/4 inch in 20 feet (6 mm in 6 m) on slope and location lines as indicated and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.
- C. Form exposed sheet metal work to fit substrates without excessive oil canning, buckling, and tool marks; true to line and levels indicated; and with exposed edges folded back to form hems.
  - 1) Lay out sheet metal roofing so transverse seams, if required, are made in direction of flow with higher panels overlapping lower panels.
  - 2) Offset transverse seams from each other **12 inches (300 mm)** minimum.
  - 3) Fold and cleat eaves and transverse seams in the shop.
  - 4) Form and fabricate sheets, seams, strips, cleats, valleys, ridges, edge treatments, integral flashings, and other components of metal roofing to profiles, patterns, and drainage arrangements shown on Drawings and as required for leakproof construction.

- D. Expansion Provisions: Fabricate sheet metal roofing to allow for expansion in running work sufficient to prevent leakage, damage, and deterioration of the Work. Where lapped expansion provisions cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with butyl sealant concealed within joints.
- E. Sealant Joints: Where movable, nonexpansion-type joints are indicated or required to produce weathertight seams, form metal to provide for proper installation of elastomeric sealant in compliance with SMACNA standards.
- F. Metal Protection: Where dissimilar metals will contact each other, protect against galvanic action by painting contact surfaces with bituminous coating, by applying self-adhering sheet underlayment to each contact surface, or by other permanent separation as recommended by fabricator of sheet metal roofing or manufacturers of the metals in contact.
- G. Sheet Metal Accessories: Custom fabricate flashings and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated. Obtain field measurements for accurate fit before shop fabrication.
  - 1) Form exposed sheet metal accessories without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.
  - 2) Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
  - 3) Fabricate cleats and attachment devices of sizes as recommended by SMACNA's "Architectural Sheet Metal Manual" for application, but not less than thickness of metal being secured.
- H. Do not use graphite pencils to mark metal surfaces.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, substrate, and other conditions affecting performance of the Work.
  - 1) Examine solid roof sheathing to verify that sheathing joints are supported by framing or blocking, that tops of fasteners are flush with surface, and that installation is within flatness tolerances required for finished roofing installation.
  - 2) Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and completely anchored, and that provision has been made for drainage, flashings, and penetrations through sheet metal roofing.
- B. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- C. Examine roughing-in for components and systems penetrating sheet metal roofing to verify actual locations of penetrations relative to seam locations of sheet metal roofing before installation.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 UNDERLAYMENT INSTALLATION

- A. Polyethylene Sheet: Install polyethylene sheet on roof sheathing under sheet metal roofing. Use adhesive for anchorage to minimize use of mechanical fasteners under sheet metal roofing. Apply at locations indicated on Drawings, in shingle fashion to shed water, with lapped and taped joints of not less than 2 inches (50 mm).
- B. Felt Underlayment: Install felt underlayment on roof sheathing under sheet metal roofing. Use adhesive for temporary anchorage to minimize use of mechanical fasteners under sheet metal roofing. Apply at locations indicated, in shingle fashion to shed water, with lapped joints of not less than 2 inches (50 mm).
  - 1) Apply from eave to ridge.
  - 2) Apply on roof not covered by self-adhering sheet underlayment. Lap edges of self-adhering sheet underlayment not less than 3 inches (75 mm), in shingle fashion to shed water.
- C. Self-Adhering Sheet Underlayment: Install self-adhering sheet underlayment, wrinkle free, on roof sheathing under sheet metal roofing. 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 **[over entire roof] [at locations indicated]**, in shingle fashion to shed water, with end laps of not less than 6 inches (150 mm) staggered 24 inches (600 mm) between courses. Overlap side edges not less than 3-1/2 inches (90 mm). Roll laps with roller. Cover underlayment within fourteen (14) days.
  - 1) Roof perimeter for a distance up from eaves of **36 inches (900 mm)** beyond interior wall line.
  - 2) Valleys, from lowest to highest point, for a distance on each side of **18 inches (460 mm)**. Overlap ends of sheets not less than 6 inches (150 mm).
  - 3) Rake edges for a distance of **18 inches (460 mm)**.
  - 4) Roof to wall intersections for a distance from wall of **18 inches (460 mm)**.
- D. Install flashings to cover underlayment to comply with requirements in Division 7 Section "Sheet Metal Flashing and Trim."
- E. Apply slip sheet before installing sheet metal roofing.

### 3.3 INSTALLATION, GENERAL

- A. General: Anchor sheet metal roofing and other components of the Work securely in place, with provisions for thermal and structural movement. Install fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for a complete roofing system and as recommended by fabricator for sheet metal roofing.
  - 1) Field cutting of sheet metal roofing by torch is not permitted.
  - 2) Flash and seal sheet metal roofing with closure strips at eaves, rakes, and perimeter of all openings. Fasten with self-tapping screws.
  - 3) Locate and space fastenings in uniform vertical and horizontal alignment. Predrill panels for fasteners.
  - 4) Locate roofing splices over, but not attached to, structural supports. Stagger roofing splices and end laps to avoid a four-panel lap splice condition. Install backing plates at roofing splices.

- 5) Install sealant tape where indicated.
  - 6) Lap metal flashing over sheet metal roofing to allow moisture to run over and off the material.
  - 7) Do not use graphite pencils to mark metal surfaces.
- B. Thermal Movement. Rigidly fasten metal roof panels to structure at only one location for each panel. Allow remainder of panel to move freely for thermal expansion and contraction.
- 1) Point of Fixity: Fasten each panel along a single line of fixing.
  - 2) Avoid attaching accessories through roof panels in a manner that will inhibit thermal movement.
- C. Fasteners: Use fasteners of sizes not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.
- D. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating, by applying self-adhering sheet underlayment to each contact surface, or by other permanent separation as recommended by SMACNA.
- 1) Coat back side of uncoated aluminum and stainless-steel sheet metal roofing with bituminous coating where roofing will contact wood, ferrous metal, or cementitious construction.
- E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.
- F. Fasciae: Align bottom of sheet metal roofing and fasten with blind rivets, bolts, or self-tapping screws. Flash and seal sheet metal roofing with closure strips where fasciae meet soffits, along lower panel edges, and at perimeter of all openings.

### 3.4 CUSTOM-FABRICATED SHEET METAL ROOFING INSTALLATION

- A. Fabricate and install work with lines and corners of exposed units true and accurate. Form exposed faces flat and free of buckles, excessive waves, and avoidable tool marks, considering temper and reflectivity of metal. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant. Fold back sheet metal to form a hem on concealed side of exposed edges unless otherwise indicated.
- 1) Install cleats to hold sheet metal panels in position. Attach each cleat with two fasteners to prevent rotation.
  - 2) Fasten cleats not more than 12 inches (300 mm) o.c. Bend tabs over fastener head.
  - 3) Provide expansion-type cleats and clips for roof panels that exceed 30 feet (9.1 m) in length.
- B. Seal joints as shown and as required for watertight construction. For roofing with 3:12 slopes or less, use cleats at transverse seams.
- 1) Where sealant-filled joints are used, embed hooked flanges of joint members not less than 1 inch (25 mm) into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is moderate, between 40 and 70 deg F (4 and 21 deg C), set joint members for 50 percent movement each way. Adjust setting

- proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F (4 deg C).
- 2) Prepare joints and apply sealants to comply with requirements in Division 7 Section "Joint Sealants."
- C. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets to be soldered to a width of 1-1/2 inches (38 mm), except reduce pre-tinning where pre-tinned surface would show in completed Work.
- 1) Do not solder aluminum sheet.
  - 2) Do not pre-tin zinc-tin alloy-coated stainless steel.
  - 3) Do not use torches for soldering. Heat surfaces to receive solder and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.
- D. Rivets: Rivet joints in uncoated aluminum where indicated and where necessary for strength.
- E. Standing-Seam Roofing: Attach standing-seam metal panels to substrate with cleats, double fastened at **12 inches (305 mm)** o.c. Install panels reaching from eave to ridge before moving to adjacent panels. Before panels are interlocked, apply continuous bead of sealant to top of flange of lower panel. Lock standing seams by folding over twice so cleat and panel edges are completely engaged.
- 1) Lock each panel to panel below with sealed transverse seam.
  - 2) Loose-lock panels at eave edges to continuous cleats and flanges at roof edge at gutters.
  - 3) Loose-lock panels at eave edges to continuous edge flashing exposed 24 inches (610 mm) from roof edge. Attach edge flashing to face of roof edge with continuous cleat fastened to roof substrate at **12 inches (305 mm)** o.c. Lock panels to edge flashing.

### 3.5 ON-SITE, ROLL-FORMED SHEET METAL ROOFING INSTALLATION

- A. General: Install on-site, roll-formed sheet metal roofing fabricated from UL-certified equipment to comply with equipment manufacturer's written instructions for UL wind-uplift resistance class indicated. Provide sheet metal roofing of full length from eave to ridge unless otherwise restricted by on-site or shipping limitations.
- B. Standing-Seam Sheet Metal Roofing: Fasten sheet metal roofing to supports with concealed clips at each standing-seam joint at location, at spacing, and with fasteners recommended by manufacturer of portable roll-forming equipment.
- 1) Install clips to substrate with self-tapping fasteners.
  - 2) Install pressure plates at locations indicated in equipment manufacturer's written installation instructions.
  - 3) Before panels are joined, apply continuous bead of sealant to top of flange of lower panel.
  - 4) Seamed Joint: Crimp standing seams with manufacturer-approved motorized seamer tool so cleat, sheet metal roofing, and field-applied sealant are completely engaged.
- C. Seal joints as shown and as required for watertight construction. For roofing with 3:12 slopes or less, use cleats at transverse seams.
- 1) Where sealant-filled joints are used, embed hooked flanges of joint members not less than 1 inch (25 mm) into sealant. Form joints to

completely conceal sealant. When ambient temperature at time of installation is moderate, between 40 and 70 deg F (4 and 21 deg C), set joint members for 50 percent movement either way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F (4 deg C).

- 2) Prepare joints and apply sealants to comply with requirements in Division 7 Section "Joint Sealants."

### 3.6 ACCESSORY INSTALLATION

- A. General: Install accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.
  - 1) Install components required for a complete sheet metal roofing assembly including trim, copings, seam covers, flashings, sealants, gaskets, fillers, metal closures, closure strips, and similar items.
  - 2) Install accessories integral to sheet metal roofing that are specified in Division 7 Section "Sheet Metal Flashing and Trim" to comply with that Section's requirements.
- B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
  - 1) Install flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers.
  - 2) Install continuous strip of self-adhering underlayment at edge of continuous flashing overlapping self-adhering underlayment, where "continuous seal strip" is indicated in SMACNA's "Architectural Sheet Metal Manual," and where indicated on Drawings.
  - 3) Install exposed flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.
  - 4) Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (600 mm) of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, and filled with butyl sealant concealed within joints.
- C. Pipe Flashing: Form flashing around pipe penetration and sheet metal roofing. Fasten and seal to sheet metal roofing as recommended by SMACNA.
- D. Roof Curbs: Install curbs at locations indicated on Drawings. Install flashing around bases where they meet sheet metal roofing.
- E. Stop-Type Snow Guards: Attach snow guards to sheet metal roofing with adhesive or adhesive tape, as recommended by manufacturer. Do not use fasteners that will penetrate sheet metal roofing.



- 1) Provide snow guards at locations indicated on Drawings.

### 3.7 ERECTION TOLERANCES

- A. Installation Tolerances: Shim and align sheet metal roofing within installed tolerance of 1/4 inch in 20 feet (6 mm in 6 m) on slope and location lines as indicated and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.

### 3.8 CLEANING AND PROTECTION

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

### 3.9 ROOFING INSTALLER'S WARRANTY

- A. WHEREAS **<Insert name>** of **<Insert address>**, herein called the "Roofing Installer," has performed roofing and associated work ("work") on the following project:
  - 1) Owner: **<Insert name of Owner>**.
  - 2) Address: **<Insert address>**.
  - 3) Building Name/Type: **<Insert information>**.
  - 4) Address: **<Insert address>**.
  - 5) Area of Work: **<Insert information>**.
  - 6) Acceptance Date: **<Insert date>**.
  - 7) Warranty Period: **<Insert time>**.
  - 8) **Expiration** Date: **<Insert date>**.
- B. AND WHEREAS Roofing Installer has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said work against leaks and faulty or defective materials and workmanship for designated Warranty Period,
- C. NOW THEREFORE Roofing Installer hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period he will, at his own cost and expense, make or cause to be made such repairs to or replacements of said work as are necessary to correct faulty and defective work and as are necessary to maintain said work in a watertight condition.
- D. This Warranty is made subject to the following terms and conditions:
  - 1) Specifically excluded from this Warranty are damages to work and other parts of the building, and to building contents, caused by:

- a) Lightning;
  - b) Peak gust wind speed exceeding <Insert wind speed> mph (m/sec);
  - c) Fire;
  - d) Failure of roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition;
  - e) Faulty construction of parapet walls, copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the work;
  - f) Vapor condensation on bottom of roofing; and
  - g) Activity on roofing by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or unauthorized by Owner.
- 2) When work has been damaged by any of foregoing causes, Warranty shall be null and void until such damage has been repaired by Roofing Installer and until cost and expense thereof have been paid by Owner or by another responsible party so designated.
  - 3) Roofing Installer is responsible for damage to work covered by this Warranty but is not liable for consequential damages to building or building contents resulting from leaks or faults or defects of work.
  - 4) During Warranty Period, if Owner allows alteration of work by anyone other than Roofing Installer, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty shall become null and void on date of said alterations, but only to the extent said alterations affect work covered by this Warranty. If Owner engages Roofing Installer to perform said alterations, Warranty shall not become null and void unless Roofing Installer, before starting said work, shall have notified Owner in writing, showing reasonable cause for claim, that said alterations would likely damage or deteriorate work, thereby reasonably justifying a limitation or termination of this Warranty.
  - 5) During Warranty Period, if original use of roof is changed and it becomes used for, but was not originally specified for, a promenade, work deck, spray-cooled surface, flooded basin, or other use or service more severe than originally specified, this Warranty shall become null and void on date of said change, but only to the extent said change affects work covered by this Warranty.
  - 6) Owner shall promptly notify Roofing Installer of observed, known, or suspected leaks, defects, or deterioration and shall afford reasonable opportunity for Roofing Installer to inspect work and to examine evidence of such leaks, defects, or deterioration.
  - 7) This Warranty is recognized to be the only warranty of Roofing Installer on said work and shall not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing failure. Specifically, this Warranty shall not operate to relieve Roofing Installer of responsibility for performance of original work according to requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.

E. IN WITNESS THEREOF, this instrument has been duly executed this <Insert day> day of <Insert month>, <Insert year>.

- 1) Authorized Signature: <Insert signature>.
- 2) Name: <Insert name>.

3) Title: <Insert title>.

END OF SECTION 07610

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

**SECTION 07620  
SHEET METAL FLASHING  
AND TRIM**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. This Section includes the following sheet metal flashing and trim:
  - 1. Formed roof drainage system including gutters and downspouts (leaders).
  - 2. Formed roof flashing and trim.
  - 3. Formed equipment support flashing.
- B. Related Sections include the following:
  - 1. Division 6 Section "Rough Carpentry" for wood nailers, curbs, and blocking.
  - 2. Division 7 Section "Thermoplastic Polyolefin (TPO) Roofing" for installing sheet metal flashing and trim integral with roofing membrane.
  - 3. Division 7 Section "Joint Sealants" for field-applied sheet metal flashing and trim sealants.

**1.2 PERFORMANCE REQUIREMENTS**

- A. General: Install sheet metal flashing and trim to withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failing, rattling, leaking, and fastener disengagement.
- B. Fabricate and install flashing capable of resisting the wind forces according to requirements of the International Building Code for 120 mph wind.
- C. Thermal Movements: Provide sheet metal flashing and trim that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of sheet metal and trim thermal movements. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
  - 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

- D. Water Infiltration: Provide sheet metal flashing and trim that do not allow water infiltration to building interior.

### 1.3 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: Show layouts of sheet metal flashing and trim, including plans and elevations. Distinguish between shop- and field-assembled work. Include the following:
  - 1. Identify material, thickness, weight, and finish for each item and location in Project.
  - 2. Details for forming sheet metal flashing and trim, including profiles, shapes, seams, and dimensions.
  - 3. Details for fastening, joining, supporting, and anchoring sheet metal flashing and trim, including fasteners, clips, cleats, and attachments to adjoining work.
  - 4. Details of expansion-joint covers, including showing direction of expansion and contraction.
- C. Samples for Initial Selection: For each type of sheet metal flashing and trim indicated with factory-applied color finishes.
  - 1. Include similar Samples of trim and accessories involving color selection.
- D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:
  - 1. Sheet Metal Flashing: 12 inches long. Include fasteners, cleats, clips, closures, and other attachments.
  - 2. Trim: 12 inches long. Include fasteners and other exposed accessories.
  - 3. Accessories: Full-size Sample.

### 1.4 QUALITY ASSURANCE

- A. Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual." Conform to dimensions and profiles shown unless more stringent requirements are indicated.
  - 1. Meet with Owner, Architect, Owner's insurer if applicable, Installer, and installers whose work interfaces with or affects sheet metal flashing and trim including installers of roofing materials, roof accessories, unit skylights, and roof-mounted equipment.

2. Review methods and procedures related to sheet metal flashing and trim.
3. Examine substrate conditions for compliance with requirements, including flatness and attachment to structural members.
4. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

## 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver sheet metal flashing materials and fabrications undamaged. Protect sheet metal flashing and trim materials and fabrications during transportation and handling.
- B. Unload, store, and install sheet metal flashing materials and fabrications in a manner to prevent bending, warping, twisting, and surface damage.
- C. Stack materials on platforms or pallets, covered with suitable weathertight and ventilated covering. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage.

## 1.6 COORDINATION

- A. Coordinate installation of sheet metal flashing and trim with interfacing and adjoining construction to provide a leakproof, secure, and noncorrosive installation.

# PART 2 - PRODUCTS

## 2.1 SHEET METALS

- A. Aluminum Sheet: **ASTM B 209 (ASTM B 209M)**, Alloy 3003, 3004, 3105, or 5005, Temper suitable for forming and structural performance required, but not less than H14, finished as follows:
  1. Mill Finish: One-side bright. Use at concealed locations.
  2. Factory Prime Coating: Where painting after installation is indicated, provide pretreatment and white or light-colored, factory-applied, baked-on epoxy primer coat; with a minimum dry film thickness of **0.2 mil**.
  3. High-Performance Organic Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

- a. Fluoropolymer 2-Coat System: Manufacturer's standard 2-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA 2605.
    - 1) Color: As selected by Architect from manufacturer's full range.
- B. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304.
  - 1. Finish: No. 2D (dull, cold rolled).
- C. Lead Sheet: ASTM B 749, Type L51121, copper-bearing lead sheet.

## 2.2 UNDERLAYMENT MATERIALS

- A. Composite Sheet: 40-mil thick, self-adhering, polymer modified bitumen bonded to polyethylene sheet complying with ASTM D 1970.

## 2.3 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation.
- B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads.
  - 1. Exposed Fasteners: Heads matching color of sheet metal by means of plastic caps or factory-applied coating.
  - 2. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws, gasketed, with hex washer head.
  - 3. Blind Fasteners: High-strength aluminum or stainless-steel rivets.
  - 4. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.
- C. Solder for Lead: ASTM B 32, Grade Sn50, 50 percent tin and 50 percent lead.
- D. Sealing Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealing tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape.
- E. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane or silicone polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

- F. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant, polyisobutylene plasticized, heavy bodied for hooked-type expansion joints with limited movement.
- G. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.
- H. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil (0.4-mm) dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.
- I. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

## 2.4 FABRICATION, GENERAL

- A. General: Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated. Shop fabricate items where practicable. Obtain field measurements for accurate fit before shop fabrication.
- B. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
- C. Fabricate sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.
  - 1. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
  - 2. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
- D. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA recommendations.
- E. Expansion Provisions: Where lapped or bayonet-type expansion provisions in the Work cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with butyl sealant concealed within joints.
- F. Conceal fasteners and expansion provisions where possible on exposed-to-view sheet metal flashing and trim, unless otherwise indicated.



- G. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
  - 1. Thickness: As recommended by SMACNA's "Architectural Sheet Metal Manual" and FMG Loss Prevention Data Sheet 1-49 for application but not less than thickness of metal being secured.

## 2.5 ROOF DRAINAGE SHEET METAL FABRICATIONS

- A. Hanging Gutters: Fabricate to cross section indicated, complete with end pieces, outlet tubes, and other accessories as required. Fabricate in minimum 96-inch-long sections. Furnish flat-stock gutter spacers and gutter brackets fabricated from same metal as gutters, of size recommended by SMACNA but not less than twice the gutter thickness. Fabricate expansion joints, expansion-joint covers, gutter bead reinforcing bars, and gutter accessories from same metal as gutters.
  - 1. Gutter Style: As indicated.
  - 2. Expansion Joints: Butt type.
  - 3. Accessories: Bronze wire ball downspout strainer.
  - 4. Fabricate gutters from the following material:
    - a. Aluminum: 0.050 inch thick.
- B. Downspouts: Fabricate rectangular downspouts complete with mitered elbows. Furnish with metal hangers, from same material as downspouts, and anchors.
  - 1. Manufactured Hanger Style: Strap type to match gutter and downspouts.
  - 2. Fabricate downspouts from the following material:
    - a. Aluminum: 0.040 inch thick.
- C. Parapet Scuppers: Fabricate scuppers of dimensions required with closure flange trim to exterior, 4-inch-wide wall flanges to interior, and base extending 4 inches beyond cant or tapered strip into field of roof. Fasten gravel guard angles to base of scupper.
  - 1. Fabricate parapet scuppers from the following material:
    - a. Aluminum: 0.0320 inch thick.
- D. Conductor Heads: Fabricate conductor heads with flanged back and stiffened top edge and of dimensions and shape indicated complete with outlet tubes, exterior flange trim, and built-in overflows.
  - 1. Fabricate conductor heads from the following material:
    - a. Aluminum: 0.0320 inch thick.

## 2.6 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

- A. Copings: Fabricate in minimum **96-inch**-long, but not exceeding **10-foot**-long, sections. Fabricate joint plates of same thickness as copings. Furnish with continuous cleats to support edge of external leg and drill elongated holes for fasteners on interior leg. Miter corners, seal, and solder or weld watertight.
  - 1. Joint Style: Butt, with **12-inch**-wide concealed backup plate.
  - 2. Fabricate copings from the following material:
    - a. Aluminum: **0.050 inch** thick.
- B. Roof to Wall Transition Expansion-Joint Cover: Fabricate from the following material:
  - 1. Aluminum: **0.050 inch** thick.
- C. Roof-Penetration Flashing: Fabricate from the following material:
  - 1. Lead: **4.0 lb/sq. ft.**, hard tempered.
- D. Roof-Drain Flashing: Fabricate from the following material:
  - 1. Lead: **4.0 lb/sq. ft.**, hard tempered.

## 2.7 MISCELLANEOUS SHEET METAL FABRICATIONS

- A. Equipment Support Flashing: Fabricate from the following material:
  - 1. Stainless Steel: **0.0187 inch** thick.

## 2.8 FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions and other conditions affecting performance of work.
  - 1. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
  - 2. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION, GENERAL

- A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
  - 1. Torch cutting of sheet metal flashing and trim is not permitted.
- B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by fabricator or manufacturers of dissimilar metals.
  - 1. Coat side of uncoated aluminum, stainless-steel, and lead sheet metal flashing and trim with bituminous coating where flashing and trim will contact wood, ferrous metal, or cementitious construction.
  - 2. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet or install a course of polyethylene underlayment.
  - 3. Bed flanges in thick coat of asphalt roofing cement where required for waterproof performance.
- C. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.
- D. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and butyl sealant.
- E. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.

1. Space cleats not more than **12 inches** apart. Anchor each cleat with two fasteners. Bend tabs over fasteners.
- F. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of **10 feet (3 m)** with no joints allowed within **24 inches (600 mm)** of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than **1 inch** deep, filled with butyl sealant concealed within joints.
- G. Fasteners: Use fasteners of sizes that will penetrate substrate not less than **1-1/4 inches** for nails and not less than **3/4 inch** for wood screws.
1. Aluminum: Use aluminum or stainless-steel fasteners.
  2. Stainless Steel: Use stainless-steel fasteners.
- H. Seal joints with butyl sealant as required for watertight construction.
1. Where sealant-filled joints are used, embed hooked flanges of joint members not less than **1 inch** into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is moderate, between **40 and 70 deg F**, set joint members for 50 percent movement either way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below **40 deg F**.
  2. Prepare joints and apply sealants to comply with requirements in Division 7 Section "Joint Sealants."
- I. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pretin edges of sheets to be soldered to a width of **1-1/2 inches** except where pretinned surface would show in finished Work.
1. Do not solder aluminum sheet.
  2. Pretinning is not required for lead.
  3. Stainless-Steel Soldering: Pretin edges of uncoated sheets to be soldered using solder recommended for stainless steel and phosphoric acid flux. Promptly wash off acid flux residue from metal after soldering.
  4. Where surfaces to be soldered are lead coated, do not tin edges, but wire brush lead coating before soldering.
  5. Do not use open-flame torches for soldering. Heat surfaces to receive solder and flow solder into joints. Fill joints completely. Completely remove flux and spatter from exposed surfaces.

### 3.3 ROOF DRAINAGE SYSTEM INSTALLATION

- A. General: Install sheet metal roof drainage items to produce complete roof drainage system according to SMACNA recommendations and as

indicated. Coordinate installation of roof perimeter flashing with installation of roof drainage system.

- B. Hanging Gutters: Join sections with riveted and soldered joints or with lapped joints sealed with butyl sealant. Provide for thermal expansion. Attach gutters at eave or fascia to firmly anchored straps spaced not more than **36 inches** apart. Provide end closures and seal watertight with sealant. Slope to downspouts.
  - 1. Fasten gutter spacers to front and back of gutter.
  - 2. Loosely lock straps to front gutter bead and anchor to roof deck.
  - 3. Anchor and loosely lock back edge of gutter to continuous cleat.
  - 4. Anchor back of gutter that extends onto roof deck with cleats spaced not more than **24 inches** apart.
  - 5. Anchor gutter with spikes and ferrules spaced not more than **24 inches** apart.
  - 6. Install gutter with expansion joints at locations indicated but not exceeding **50 feet** apart. Install expansion joint caps.
  - 7. Install continuous gutter screens on gutters with noncorrosive fasteners, hinged to swing open for cleaning gutters.
- C. Downspouts: Join sections with **1-1/2-inch** telescoping joints. Provide fasteners designed to hold downspouts securely **1 inch** away from walls; locate fasteners at top and bottom and at approximately **60 inches** o.c. in between.
  - 1. Connect downspouts to underground drainage system indicated or provide elbows at base of downspout to direct water away from building
- D. Parapet Scuppers: Install scuppers where indicated through parapet. Continuously support scupper, set to correct elevation, and seal flanges to interior wall face, over cants or tapered edge strips, and under roofing membrane.
  - 1. Anchor scupper closure trim flange to exterior wall and seal or solder to scupper.

### 3.4 ROOF FLASHING INSTALLATION

- A. General: Install sheet metal roof flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, set units true to line, and level as indicated. Install work with laps, joints, and seams that will be permanently watertight.
- B. Copings: Anchor to resist uplift and outward forces according to recommendations in FMG Loss Prevention Data Sheet 1-49 for specified wind zone and as indicated.

1. Interlock exterior bottom edge of coping with continuous cleats anchored to substrate at 24-inch centers.
  2. Anchor interior leg of coping with screw fasteners and washers at 24-inch centers.
- C. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for butyl sealant, extending a minimum of 4 inches over base flashing. Install stainless-steel draw band and tighten.
- D. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Install flashing as follows:
1. Turn lead flashing down inside vent piping, being careful not to block vent piping with flashing.
  2. Seal with butyl sealant and clamp flashing to pipes penetrating roof except for lead flashing on vent piping.

### 3.5 MISCELLANEOUS FLASHING INSTALLATION

- A. Equipment Support Flashing: Coordinate installation of equipment support flashing with installation of roofing and equipment. Weld or seal flashing with butyl sealant to equipment support member.

### 3.6 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- B. Clean and neutralize flux materials. Clean off excess solder and sealants.
- C. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain in a clean condition during construction.
- D. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07620

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

**SECTION 07920 – JOINT SEALANTS**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. This Section includes joint sealants for the following applications, including those specified by reference to this Section:
1. Exterior joints in the following vertical surfaces and horizontal nontraffic surfaces:
    - a. Construction joints in cast-in-place concrete.
    - b. Joints between plant-precast architectural concrete units.
    - c. Control and expansion joints in unit masonry.
    - d. Joints between different materials where a seal against weather and where required for appearance.
    - e. Perimeter joints between materials listed above and frames of doors and windows.
    - f. Control and expansion joints in ceilings and other overhead surfaces.
    - g. Other joints as indicated.
  2. Exterior joints in the following horizontal traffic surfaces:
    - a. Isolation and contraction joints in cast-in-place concrete slabs.
    - b. Other joints as indicated.
  3. Interior joints in the following vertical surfaces and horizontal nontraffic surfaces:
    - a. Perimeter joints of exterior openings where indicated.
    - b. Tile control and expansion joints.
    - c. Vertical joints on exposed surfaces of interior unit masonry walls.
    - d. Perimeter joints between interior wall surfaces and frames of interior doors, windows and elevator entrances.
    - e. Joints between plumbing fixtures and adjoining walls, floors, and counters.
    - f. Other joints as indicated.
  4. Interior joints in the following horizontal traffic surfaces:
    - a. Isolation joints in cast-in-place concrete slabs.
    - b. Control and expansion joints in tile flooring.
    - c. Other joints as indicated.

B. Related Sections include the following:

1. Division 4 Section "Unit Masonry Assemblies" for masonry control and expansion joint fillers and gaskets.
2. Division 8 Section "Glazing" for glazing sealants.
3. Division 9 Section "Gypsum Board Assemblies" for sealing perimeter joints of gypsum board partitions to reduce sound transmission.
4. Division 9 Section "Ceramic Tile" for sealing tile joints.
5. Division 9 Section "Acoustical Panel Ceilings" for sealing edge moldings at perimeters of acoustical ceilings.

## 1.2 PERFORMANCE REQUIREMENTS

- A. Provide elastomeric joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.
- B. Provide joint sealants for interior applications that establish and maintain airtight and water-resistant continuous joint seals without staining or deteriorating joint substrates.

## 1.3 SUBMITTALS

- A. Product Data: For each joint-sealant product indicated.
- B. 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.
- C. Samples for Verification: For each type and color of joint sealant required, provide Samples with joint sealants in **1/2-inch**-wide joints formed between two **6-inch**-long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.
- D. Product Certificates: For each type of joint sealant and accessory, signed by product manufacturer.
- E. Qualification Data: For Installer.
- F. Preconstruction Field Test Reports: Indicate which sealants and joint preparation methods resulted in optimum adhesion to joint substrates based on preconstruction testing specified in "Quality Assurance" Article.
- G. 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.
- H. Product Test Reports: Based on comprehensive testing of product formulations performed by a qualified testing agency, indicating that sealants comply with requirements.
- I. Warranties: Special warranties specified in this Section.

#### 1.4 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. Preconstruction Compatibility and Adhesion Testing: Obtain from joint-sealant manufacturer, testing reports indicating optimum compatibility and adhesion of sealants proposed with substrates to be encountered and certify product suitability.
- D. Product Testing: Obtain test results for "Product Test Reports" Paragraph in "Submittals" Article from a qualified testing agency based on testing current sealant formulations within a 36-month period preceding the commencement of the Work.
  - 1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated, as documented according to ASTM E 548.
  - 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.
- E. Preconstruction Field-Adhesion Testing: Before installing elastomeric sealants, field test their adhesion to Project joint substrates as follows:
  - 1. Locate test joints where indicated on Project or, if not indicated, as directed by Architect.
  - 2. Conduct field tests for each application indicated below:
    - a. Each type of elastomeric sealant and joint substrate indicated.
    - b. Each type of nonelastomeric sealant and joint substrate indicated.
  - 3. Notify Architect seven days in advance of dates and times when test joints will be erected.

- a. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193.
  - 1) For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
- 4. Report whether sealant in joint 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. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.
- 5. Evaluation of Preconstruction Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.

## 1.5 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.

## 1.6 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 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide one of the products listed in other Part 2 articles.

### 2.2 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. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

### 2.3 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.

## 2.4 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.

## 2.5 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.

## 2.6 JOINT-SEALANT BACKING

- A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin), B (bicellular material with a surface skin) or any of the preceding types, as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:
- C. Elastomeric Tubing Sealant Backings: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D 1056, nonabsorbent to water and gas, and capable of remaining resilient at temperatures down to **minus 26 deg F**. Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and to otherwise contribute to optimum sealant performance.
- D. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

## 2.7 MISCELLANEOUS MATERIALS

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

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

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

### 3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
  - 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
  - 2. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:
    - a. Concrete.
    - b. Masonry.
    - c. Unglazed surfaces of ceramic tile.
  - 3. Remove laitance and form-release agents from concrete.
  - 4. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:
    - a. Metal.
    - b. Glass.
    - c. Glazed surfaces of ceramic tile.
- B. Joint Priming: Prime joint substrates, where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.



### 3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Acoustical Sealant Application Standard: Comply with recommendations in ASTM C 919 for use of joint sealants in acoustical applications as applicable to materials, applications, and conditions indicated.
- D. Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
  - 1. Do not leave gaps between ends of sealant backings.
  - 2. Do not stretch, twist, puncture, or tear sealant backings.
  - 3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
- E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
  - 1. Place sealants so they directly contact and fully wet joint substrates.
  - 2. Completely fill recesses in each joint configuration.
  - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
  - 1. Remove excess sealant from surfaces adjacent to joints.
  - 2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
  - 3. Provide concave joint configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.
  - 4. Provide flush joint configuration where indicated per Figure 5B in ASTM C 1193.
  - 5. Provide recessed joint configuration of recess depth and at locations indicated per Figure 5C in ASTM C 1193.
    - a. Use masking tape to protect surfaces adjacent to recessed tooled joints.

### 3.4 FIELD QUALITY CONTROL

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

### 3.5 CLEANING

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

### 3.6 PROTECTION

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

END OF SECTION 07920

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

**SECTION 08110 – STEEL DOORS  
AND FRAMES**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

- A. Section Includes:
  - 1. Standard hollow metal doors and frames.
- B. Related Sections
  - 1. Division 4 Section "Unit Masonry Assemblies" for embedding anchors for hollow metal work into masonry construction.
  - 2. Division 8 Section "Stainless-Steel Doors and Frames" for hollow metal doors and frames manufactured from stainless steel.
  - 3. Division 8 Section "Steel Detention Doors and Frames" for hollow metal doors and frames for detention facilities.
  - 4. Division 8 Section "Sound-Control Door Assemblies" for packaged, acoustical hollow metal door and frame assemblies with STC ratings of 35 or more.
  - 5. Division 8 Section "Door Hardware (Scheduled by Describing Products)" for door hardware for hollow metal doors.
  - 6. Division 9 Sections "Exterior Painting" and "Interior Painting" for field painting hollow metal doors and frames.
  - 7. Division 16 Sections for electrical connections including conduit and wiring for door controls and operators.

**1.3 DEFINITIONS**

- A. Minimum Thickness: Minimum thickness of base metal without coatings.
- B. Standard Hollow Metal Work: Hollow metal work fabricated according to ANSI/SDI A250.8.

**1.4 SUBMITTALS**

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, fire-resistance rating, temperature-rise ratings, and finishes.
- B. Shop Drawings: Include the following:
  - 1. Elevations of each door design.
  - 2. Details of doors, including vertical and horizontal edge details and metal thicknesses.
  - 3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.

4. Locations of reinforcement and preparations for hardware.
  5. Details of each different wall opening condition.
  6. Details of anchorages, joints, field splices, and connections.
  7. Details of accessories.
  8. Details of moldings, removable stops, and glazing.
  9. Details of conduit and preparations for power, signal, and control systems.
- C. Samples for Verification:
1. For each type of exposed finish required, prepared on Samples of not less than 3 by 5 inches (75 by 125 mm).
  2. For the following items, prepared on Samples about 12 by 12 inches (305 by 305 mm) to demonstrate compliance with requirements for quality of materials and construction:
    - a. Doors: Show vertical-edge, top, and bottom construction; core construction; and hinge and other applied hardware reinforcement. Include separate section showing glazing if applicable.
    - b. Frames: Show profile, corner joint, floor and wall anchors, and silencers. Include separate section showing fixed hollow metal panels and glazing if applicable.
- D. Other Action Submittals:
1. Schedule: Provide a schedule of hollow metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with door hardware schedule.
- E. Oversize Construction Certification: For assemblies required to be fire rated and exceeding limitations of labeled assemblies.
- F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each type of hollow metal door and frame assembly.

## 1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain hollow metal work from single source from single manufacturer.
- B. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at as close to neutral pressure as possible according to NFPA 252 or UL 10B.
1. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.
  2. Temperature-Rise Limit: At vertical exit enclosures and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F (250 deg C) above ambient after 30 minutes of standard fire-test exposure.

- C. Fire-Rated, Borrowed-Light Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled, by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257 or UL 9. Label each individual glazed lite.
- D. Smoke-Control Door Assemblies: Comply with [FPA 105 or UL 1784.
- E. Preinstallation Conference: Conduct conference at Project site.
- F. Design pressure certification up to +/- 80 psf.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.
  - 1. Provide additional protection to prevent damage to finish of factory-finished units.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch- (102-mm-) high wood blocking. Do not store in a manner that traps excess humidity.
  - 1. Provide minimum 1/4-inch (6-mm) space between each stacked door to permit air circulation.

## 1.7 PROJECT CONDITIONS

- A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

## 1.8 COORDINATION

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

# PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Ceco Door Products; an Assa Abloy Group company.
  - 2. Curries Company; an Assa Abloy Group company.
  - 3. Steelcraft; an Ingersoll-Rand company.

## 2.2 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G90 (Z180) metallic coating.
- D. Frame Anchors: ASTM A 591/A 591M, Commercial Steel (CS), 40Z (12G) coating designation; mill phosphatized.
  - 1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.
- E. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.
- F. Powder-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow metal frames of type indicated.
- G. Grout: ASTM C 476, except with a maximum slump of 4 inches (102 mm), as measured according to ASTM C 143/C 143M.
- H. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool with 6- to 12-lb/cu. ft. (96- to 192-kg/cu. m) density; with maximum flame-spread and smoke-development indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.
- I. Glazing: Comply with requirements in Division 8 Section "Glazing."
- J. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil (0.4-mm) dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

## 2.3 STANDARD HOLLOW METAL DOORS

- A. General: Provide doors of design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces unless otherwise indicated. Comply with ANSI/SDI A250.8.
  - 1. Design: Flush panel.
  - 2. Core Construction: Manufacturer's standard, polystyrene or, polyurethane, core.
    - a. Fire Door Core: As required to provide fire-protection and temperature-rise ratings indicated.
    - b. Thermal-Rated (Insulated) Doors: Where indicated, provide doors fabricated with thermal-resistance value (R-value) of not less than 6.0 deg F x h x sq. ft. / Btu (1.057 K x sq. m/W when tested according to ASTM C 1363).

- 1) Locations: Exterior doors and interior doors where indicated.
  3. Vertical Edges for Single-Acting Doors: Beveled edge.
    - a. Beveled Edge: 1/8 inch in 2 inches (3 mm in 50 mm).
  4. Vertical Edges for Double-Acting Doors: Round vertical edges with 2-1/8-inch (54-mm) radius.
  5. Top and Bottom Edges: Closed with flush or inverted 0.042-inch-(1.0-mm-) thick, end closures or channels of same material as face sheets.
  6. Tolerances: Comply with SDI 117, "Manufacturing Tolerances for Standard Steel Doors and Frames."
- B. Exterior Doors: Face sheets fabricated from metallic-coated steel sheet. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:
1. Level 3 and Physical Performance Level A (Extra Heavy Duty), Model 2 (Seamless).
- C. Interior Doors: Face sheets fabricated from cold-rolled steel sheet unless metallic-coated sheet is indicated. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:
1. Level 2 and Physical Performance Level B (Heavy Duty), Model 2 (Seamless).
- D. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.
- E. Fabricate concealed stiffeners and hardware reinforcement from either cold- or hot-rolled steel sheet.
- F. Pre conduit frames and doors with UL rated Electro Lynx conduit and back boxes as required for electro mechanical hardware specified in Section 08710.

## 2.4 STANDARD HOLLOW METAL FRAMES

- A. General: Comply with ANSI/SDI A250.8 and with details indicated for type and profile.
- B. Exterior Frames: Fabricated from metallic-coated steel sheet.
1. Fabricate frames with mitered or coped corners.
  2. Fabricate frames as full profile welded unless otherwise indicated.
  3. Frames for Level 3 Steel Doors: 0.067-inch- (1.6-mm-) thick steel sheet.
- C. Interior Frames: Fabricated from cold-rolled steel sheet unless metallic-coated sheet is indicated.
1. Fabricate frames with mitered or coped corners.
  2. Fabricate frames as face welded unless otherwise indicated.
  3. Frames for Level 2 Steel Doors: 0.053-inch- (1.3-mm-) thick steel sheet.
  4. Frames for Wood Doors: 0.053-inch- (1.3-mm-) thick steel sheet.
  5. Frames for Borrowed Lights: Same as adjacent door frame.
  6. Frames for all door openings over 3'6": 0.067-inch- (1.6-mm-) thick steel sheet.



- D. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcement plates from same material as frames.
- E. Pre conduit frames and doors with UL rated Electro Lynx conduit and back boxes as required for electro mechanical hardware specified in Section 08710.

## 2.5 FRAME ANCHORS

- A. Jamb Anchors:
  - 1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch (1.0 mm) thick, with corrugated or perforated straps not less than 2 inches (50 mm) wide by 10 inches (250 mm) long; or wire anchors not less than 0.177 inch (4.5 mm) thick.
  - 2. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch (1.0 mm) thick.
  - 3. Compression Type for Drywall Slip-on Frames: Adjustable compression anchors.
  - 4. Postinstalled Expansion Type for In-Place Concrete or Masonry: Minimum 3/8-inch- (9.5-mm-) diameter bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.
- B. Floor Anchors: Formed from same material as frames, not less than 0.042 inch (1.0 mm) thick, and as follows:
  - 1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.
  - 2. Separate Topping Concrete Slabs: Adjustable-type anchors with extension clips, allowing not less than 2-inch (50-mm) height adjustment. Terminate bottom of frames at finish floor surface.

## 2.6 HOLLOW METAL PANELS

- A. Provide hollow metal panels of same materials, construction, and finish as specified for adjoining hollow metal work.

## 2.7 STOPS AND MOLDINGS

- A. Moldings for Glazed Lites in Doors: Minimum 0.032 inch (0.8 mm) thick, fabricated from same material as door face sheet in which they are installed.
- B. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch (16 mm) high unless otherwise indicated.
- C. Loose Stops for Glazed Lites in Frames: Minimum 0.032 inch (0.8 mm) thick, fabricated from same material as frames in which they are installed.

## 2.8 LOUVERS

- A. Provide louvers for interior doors, where indicated, that comply with SDI 111C, with blades or baffles formed of 0.020-inch- (0.5-mm-) thick, cold-rolled steel sheet set into 0.032-inch- (0.8-mm-) thick steel frame.
  - 1. Sightproof Louver: Stationary louvers constructed with inverted V-shaped or Y-shaped blades.

2. Lightproof Louver: Stationary louvers constructed with baffles to prevent light from passing from one side to the other, any angle.
3. Fire-Rated Automatic Louvers: Louvers constructed with movable blades closed by actuating fusible link, and listed and labeled for use in fire-rated door assemblies of type and fire-resistance rating indicated by same testing and inspecting agency that established fire-resistance rating of door assembly.

## 2.9 ACCESSORIES

- A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.
- B. Ceiling Struts: Minimum 1/4-inch-thick by 1-inch- (6.4-mm-thick by 25.4-mm-) wide steel.
- C. Grout Guards: Formed from same material as frames, not less than 0.016 inch (0.4 mm) thick.

## 2.10 FABRICATION

- A. Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.
- B. Tolerances: Fabricate hollow metal work to tolerances indicated in SDI 117.
- C. Hollow Metal Doors:
  1. Exterior Doors: Provide weep-hole openings in bottom of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
  2. All steel doors and frames receiving electro-mechanical hardware shall be factory pre wired with UL approved conduit and junction boxes with ElectroLynx quick connect system Option 3 or approved equal.
  3. Glazed Lites: Factory cut openings in doors.
  4. Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch (19 mm) beyond edge of door on which astragal is mounted.
- D. Hollow Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
  1. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
  2. All steel doors and frames receiving electro-mechanical hardware shall be factory pre wired with UL approved conduit and junction boxes with ElectroLynx quick connect system Option 3 or approved equal.
  3. Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.

4. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
  5. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
  6. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
  7. Jamb Anchors: Provide number and spacing of anchors as follows:
  8. Masonry Type: Locate anchors not more than 18 inches (457 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c. and as follows:
    - 1) Two anchors per jamb up to 60 inches (1524 mm) high.
    - 2) Three anchors per jamb from 60 to 90 inches (1524 to 2286 mm) high.
    - 3) Four anchors per jamb from 90 to 120 inches (2286 to 3048 mm) high.
    - 4) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches (610 mm) or fraction thereof above 120 inches (3048 mm) high.
      - a) Stud-Wall Type: Locate anchors not more than 18 inches (457 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c. and as follows:
        - 5) Three anchors per jamb up to 60 inches (1524 mm) high.
        - 6) Four anchors per jamb from 60 to 90 inches (1524 to 2286 mm) high.
        - 7) Five anchors per jamb from 90 to 96 inches (2286 to 2438 mm) high.
        - 8) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches (610 mm) or fraction thereof above 96 inches (2438 mm) high.
      - 9) Two anchors per head for frames above 42 inches (1066 mm) wide and mounted in metal-stud partitions.
        - a) Compression Type: Not less than two anchors in each jamb.
        - b) Postinstalled Expansion Type: Locate anchors not more than 6 inches (152 mm) from top and bottom of frame. Space anchors not more than 26 inches (660 mm) o.c.
  9. Door Silencers: Except on weather-stripped doors, drill stops to receive door silencers as follows. Keep holes clear during construction.
    - a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
    - b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.
- E. Fabricate concealed stiffeners, edge channels, and hardware reinforcement from either cold- or hot-rolled steel sheet.
- F. Hardware Preparation: Factory prepare hollow metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Division 8 Section "Door Hardware."
1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
  2. Reinforce doors and frames to receive nontemplated, mortised and surface-mounted door hardware.

3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
  4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 16 Sections.
- G. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints.
1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow metal work.
  2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
  3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
  4. Provide loose stops and moldings on inside of hollow metal work.
  5. Coordinate rabbet width between fixed and removable stops with type of glazing and type of installation indicated.

## 2.11 STEEL FINISHES

- A. Prime Finish: Apply manufacturer's standard primer immediately after cleaning and pretreating.
1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

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

### 3.2 PREPARATION

- A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.
- B. Prior to installation, adjust and securely brace welded hollow metal frames for squareness, alignment, twist, and plumbness to the following tolerances:

1. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
  2. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
  3. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
  4. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a perpendicular line from head to floor.
- C. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

### 3.3 INSTALLATION

- A. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.
- B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with ANSI/SDI A250.11.
1. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
    - a. At fire-protection-rated openings, install frames according to NFPA 80.
    - b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
    - c. Install frames with removable glazing stops located on secure side of opening.
    - d. Install door silencers in frames before grouting.
    - e. Remove temporary braces necessary for installation only after frames have been properly set and secured.
    - f. Check plumbness, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
    - g. Field apply bituminous coating to backs of frames that are filled with grout containing antifreezing agents.
  2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.
    - a. Floor anchors may be set with powder-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
  3. Metal-Stud Partitions: Solidly pack mineral-fiber insulation behind frames.
  4. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
  5. Concrete Walls: Solidly fill space between frames and concrete with grout. Take precautions, including bracing frames, to ensure that frames are not deformed or damaged by grout forces.
  6. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
  7. In-Place Gypsum Board Partitions: Secure frames in place with postinstalled expansion anchors through floor anchors at each jamb.

- Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
8. Ceiling Struts: Extend struts vertically from top of frame at each jamb to overhead structural supports or substrates above frame unless frame is anchored to masonry or to other structural support at each jamb. Bend top of struts to provide flush contact for securing to supporting construction. Provide adjustable wedged or bolted anchorage to frame jamb members.
  9. Installation Tolerances: Adjust hollow metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
    - a. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
    - b. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
    - c. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
    - d. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs at floor.
- C. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.
1. Non-Fire-Rated Standard Steel Doors:
    - a. Jambs and Head: 1/8 inch (3 mm) plus or minus 1/16 inch (1.6 mm).
    - b. Between Edges of Pairs of Doors: 1/8 inch (3 mm) plus or minus 1/16 inch (1.6 mm).
    - c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch (9.5 mm).
    - d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch (19 mm).
  2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
  3. Smoke-Control Doors: Install doors according to [NFPA 105] [UBC Standard 7-2].
- D. Glazing: Comply with installation requirements in Division 8 Section "Glazing" and with hollow metal manufacturer's written instructions.
1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches (230 mm) o.c. and not more than 2 inches (50 mm) o.c. from each corner.

### 3.4 ADJUSTING AND CLEANING

- A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.
- B. Remove grout and other bonding material from hollow metal work immediately after installation.

- C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.
- D. Metallic-Coated Surfaces: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

END OF SECTION 08110

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

**SECTION 08311 – ACCESS DOORS  
AND FRAMES**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

- A. This Section includes the following:
  - 1. Access doors and frames for walls and ceilings.
- B. Related Sections include the following:
  - 1. Division 3 Section "Cast-in-Place Concrete" for blocking out openings for access doors and frames in concrete.
  - 2. Division 4 Section "Unit Masonry Assemblies" for anchoring and grouting access door frames set in masonry construction.
  - 3. Division 8 Section "Door Hardware" for mortise or rim cylinder locks and master keying.
  - 4. Division 15 Section "Duct Accessories" for heating and air-conditioning duct access doors.

**1.3 SUBMITTALS**

- A. Product Data: For each type of access door and frame indicated. Include construction details, fire ratings, materials, individual components and profiles, and finishes.
- B. Shop Drawings: Show fabrication and installation details of access doors and frames for each type of substrate. Include plans, elevations, sections, details, and attachments to other work.
- C. Samples: For each door face material, at least 3 by 5 inches (75 by 125 mm) in size, in specified finish.



- D. Access Door and Frame Schedule: Provide complete access door and frame schedule, including types, locations, sizes, latching or locking provisions, and other data pertinent to installation.
- E. Ceiling Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted items including access doors and frames, lighting fixtures, diffusers, grilles, speakers, sprinklers, and special trim are shown and coordinated with each other.

#### 1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of access door and frame through one source from a single manufacturer.
- B. Fire-Rated Access Doors and Frames: Units complying with NFPA 80 that are identical to access door and frame assemblies tested for fire-test-response characteristics per the following test method and that are listed and labeled by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
  - 1. NFPA 252 or UL 10B for vertical access doors and frames.
  - 2. ASTM E 119 or UL 263 for horizontal access doors and frames.
- C. Size Variations: Obtain Architect's acceptance of manufacturer's standard-size units, which may vary slightly from sizes indicated.

#### 1.5 COORDINATION

- A. Verification: Determine specific locations and sizes for access doors needed to gain access to concealed plumbing, mechanical, or other concealed work, and indicate in the schedule specified in "Submittals" Article.

### PART 2 - PRODUCTS

#### 2.1 STEEL MATERIALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
  - 1. ASTM A 123/A 123M, for galvanizing steel and iron products.
  - 2. ASTM A 153/A 153M, for galvanizing steel and iron hardware.
- B. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.

1. ASTM A 123/A 123M, for galvanizing steel and iron products
  2. ASTM A 153/A 153M, for galvanizing steel and iron hardware.
- C. Steel Sheet: Uncoated or electrolytic zinc-coated, ASTM A 591/A 591M with cold-rolled steel sheet substrate complying with ASTM A 1008/A 1008M, Commercial Steel (CS), exposed.
- D. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS) with **A60 (ZF180)** zinc-iron-alloy (galvannealed) coating or **G60 (Z180)** mill-phosphatized zinc coating; stretcher-leveled standard of flatness; with minimum thickness indicated representing specified thickness according to ASTM A 924/A 924M.
- E. Steel Finishes: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Provide either a baked enamel or powder-coat finish as specified below.
1. Surface Preparation for Steel Sheet: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, or other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or SSPC-SP 8, "Pickling."
  2. Surface Preparation for Metallic-Coated Steel Sheet: Clean surfaces with nonpetroleum solvent so surfaces are free of oil and other contaminants. After cleaning, apply a conversion coating suited to the organic coating to be applied over it. Clean welds, mechanical connections, and abraded areas, and apply galvanizing repair paint specified below to comply with ASTM A 780.
    - a. Galvanizing Repair Paint: High-zinc-dust-content paint for reglazing welds in steel, complying with SSPC-Paint 20.
  3. Factory-Primed Finish: Apply shop primer immediately after cleaning and pretreating.
  4. Baked-Enamel Finish: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-enamel finish consisting of prime coat and thermosetting topcoat. Comply with paint manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of **2 mils (0.05 mm)**.
  5. Powder-Coat Finish: Immediately after cleaning and pretreating, apply manufacturer's standard thermosetting polyester or acrylic urethane powder coating with cured-film thickness not less than **1.5 mils (0.04 mm)**. Prepare, treat, and coat metal to comply with resin manufacturer's written instructions.
- F. Drywall Beads: Edge trim formed from **0.0299-inch (0.76-mm)** zinc-coated steel sheet formed to receive joint compound and in size to suit thickness of gypsum board.

## 2.2 ACCESS DOORS AND FRAMES FOR WALLS AND CEILINGS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Acudor Products, Inc.
  - 2. Babcock-Davis; A Cierra Products Co.
  - 3. Elmdor/Stoneman; Div. of Acorn Engineering Co.
  - 4. Jensen Industries.
  - 5. J. L. Industries, Inc.
  - 6. Karp Associates, Inc.
  - 7. Larsen's Manufacturing Company.
  - 8. MIFAB, Inc.
  - 9. Milcor Inc.
  - 10. Nystrom, Inc.
- C. Flush Access Doors and Frames with Exposed Trim: Fabricated from steel or metallic-coated steel sheet. Use at locations in concrete and CMU construction.
  - 1. Locations: Wall and ceiling surfaces.
  - 2. Door: Minimum 0.060-inch- (1.5-mm-) thick sheet metal, set flush with exposed face flange of frame.
  - 3. Frame: Minimum 0.060-inch- (1.5-mm-) thick sheet metal with 1-1/4-inch- (32-mm-) wide, surface-mounted trim.
  - 4. Hinges: Spring-loaded, concealed-pin type or Continuous piano.
  - 5. Latch: Cam latch operated by hex head wrench or flush key with interior release.
  - 6. Lock: Cylinder for access doors requiring secure access to communications and other critical systems.
- D. Flush Access Doors and Trimless Frames: Fabricated from metallic-coated steel sheet. Use at locations in GWB and acoustical panel construction.
  - 1. Locations: Wall and ceiling surfaces.
  - 2. Door: Minimum 0.060-inch- (1.5-mm-) thick sheet metal, set flush with surrounding finish surfaces.
  - 3. Frame: Minimum 0.060-inch- (1.5-mm-) thick sheet metal with drywall bead flange.
  - 4. Hinges: Spring-loaded, concealed-pin type or Continuous piano.
  - 5. Latch: Cam latch operated by hex head wrench or flush key with interior release.
  - 6. Lock: Cylinder for access doors requiring secure access to communications and other critical systems..

- E. Exterior Flush Access Doors and Frames with Exposed Trim: Weatherproof with extruded door gasket.
1. Locations: Wall and ceiling surfaces.
  2. Door: Minimum 0.040-inch- (1.0-mm-) thick, metallic-coated steel sheet; flush panel construction with manufacturer's standard 2-inch- (50-mm-) thick fiberglass insulation.
  3. Frame: Minimum 0.060-inch- (1.5-mm-) thick extruded aluminum.
  4. Hinges: Continuous piano, zinc plated.
  5. Lock: Dual-action handles with key lock.
- F. Fire-Rated, Insulated, Flush Access Doors and Frames with Exposed Trim: Fabricated from metallic-coated steel sheet.
1. Locations: Wall and ceiling surfaces.
  2. Fire-Resistance Rating: Not less than that of adjacent construction.
  3. Temperature Rise Rating: 250 deg F (139 deg C) at the end of 30 minutes.
  4. Door: Flush panel with a core of mineral-fiber insulation enclosed in sheet metal with a minimum thickness of 0.036 inch (0.9 mm).
  5. Frame: Minimum 0.060-inch- (1.5-mm-) thick sheet metal with 1-inch- (25-mm-) wide, surface-mounted trim.
  6. Hinges: Concealed-pin type.
  7. Automatic Closer: Spring type.
  8. Lock: Self-latching device with cylinder lock.
- G. Fire Rated, Uninsulated, Flush Access Doors and Frames with Exposed Trim: Fabricated from metallic-coated steel sheet.
1. Locations: Wall surfaces.
  2. Fire-Resistance Rating: Not less than that of adjacent construction.
  3. Door: Minimum 0.060-inch- (1.5-mm-) thick sheet metal, flush construction.
  4. Frame: Minimum 0.060-inch- (1.5-mm-) thick sheet metal with 1-1/4-inch- (32-mm-) wide, surface-mounted trim.
  5. Hinges: Concealed-pin type.
  6. Automatic Closer: Spring type.
  7. Lock: Self-latching device with mortise cylinder lock.
- H. Maximum-Security, Flush Access Doors and Frames with Exposed Trim: Fabricated from metallic-coated steel sheet and angles.
1. Locations: Wall and ceiling surfaces.
  2. Door: Minimum 0.180-inch- (4.55-mm-) thick sheet metal, flush construction.
  3. Frame: Minimum 3/16-by-2-by-2-by-3-inch (4.7-by-50-by-50-by-76-mm) angle welded with joints ground smooth.
  4. Hinges: Heavy-duty steel welded to door and frame.

5. Lock: Heavy-duty detention deadbolt.
  - a. Lock Preparation: Prepare door panel to accept cylinder specified in Division 8 Section "Door Hardware."
- I. Fire-Rated, Insulated, Medium-Security, Flush Access Doors and Frames with Exposed Trim: Fabricated from metallic-coated steel sheet.
  1. Locations: Wall surfaces.
  2. Fire-Resistance Rating: Not less than that of adjacent construction.
  3. Temperature Rise Rating: 250 deg F (139 deg C) at the end of 30 minutes.
  4. Door: Flush panel with a core of 2-inch- (50-mm-) thick, mineral-fiber insulation enclosed in sheet metal with a minimum thickness of 0.075 inch (1.9 mm).
  5. Frame: Minimum 0.060-inch- (1.5-mm-) thick sheet metal with 1-1/4-inch- (32-mm-) wide, surface-mounted trim.
  6. Hinges: Concealed-pin type or continuous piano.
  7. Automatic Closer: Spring type.
  8. Lock: Self-latching device with detention lock.
    - a. Lock Preparation: Prepare door panel to accept cylinder specified in Division 8 Section "Door Hardware."

## 2.3 FABRICATION

- A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.
- B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.
- C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access panels to types of supports indicated.
  1. Exposed Flanges: Nominal 1 to 1-1/2 inches (25 to 38 mm) wide around perimeter of frame.
  2. For trimless frames with drywall bead, provide edge trim for gypsum board securely attached to perimeter of frames.
  3. Provide mounting holes in frames for attachment of units to metal framing.
  4. Provide mounting holes in frame for attachment of masonry anchors. Furnish adjustable metal masonry anchors.

- D. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.
  - 1. For cylinder lock, furnish two keys per lock and key all locks alike.
  - 2. For recessed panel doors, provide access sleeves for each locking device. Furnish plastic grommets and install in holes cut through finish.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Comply with manufacturer's written instructions for installing access doors and frames.
- B. Set frames accurately in position and attach securely to supports with plane of face panels aligned with adjacent finish surfaces.
- C. Install doors flush with adjacent finish surfaces or recessed to receive finish material.

### 3.2 ADJUSTING AND CLEANING

- A. Adjust doors and hardware after installation for proper operation.
- B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

END OF SECTION 08311

**NEW PASSENGER TERMINAL  
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**SECTION 08331 - OVERHEAD  
COILING DOORS**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

- A. This Section includes the following types of electric-motor-operated overhead coiling doors:
  - 1. Insulated service doors.
  - 2. Fire-rated service doors.
- B. Related Sections include the following:
  - 1. Division 5 Section "Metal Fabrications" for miscellaneous steel supports.
  - 2. Division 8 Section "Door Hardware" for lock cylinders and keying.
  - 3. Division 16 Sections for electrical service and connections for powered operators and accessories.

**1.3 DEFINITIONS**

- A. Operation Cycle: One cycle of a door is complete when it is moved from the closed position to the fully open position and returned to the closed position.

**1.4 PERFORMANCE REQUIREMENTS**

- A. Structural Performance: Provide overhead coiling doors capable of withstanding the effects of gravity loads and the following loads and stresses without evidencing permanent deformation of door components:
  - 1. Wind Load: Uniform pressure (velocity pressure) of 30 lbf/sq. ft., acting inward and outward.
- B. Operation-Cycle Requirements: Provide overhead coiling door components and operators capable of operating for not less than 20,000 cycles and for 10 cycles per day.

1. Include tamperproof cycle counter.

## 1.5 SUBMITTALS

- A. Product Data: For each type and size of overhead coiling door and accessory. Include the following:
  1. Summary of forces and loads on walls and jambs.
  2. Fire-Rated Doors: Include description of fire-release system including testing and resetting instructions.
- B. Shop Drawings: For special components and installations not dimensioned or detailed in manufacturer's product data.
- C. Samples for Initial Selection: Manufacturer's color charts showing full range of colors available for units with factory-applied finishes.
- D. Samples for Verification: Of each type of exposed finish required, prepared on Samples of size indicated below.
  1. Curtain Slats: 12 inches (305 mm) long.
  2. Bottom Bar: 6 inches (150 mm) long.
  3. Guides: 6 inches (150 mm) long.
  4. Brackets: 6 inches (150 mm) square.
  5. Hood: 6 inches (150 mm) square.
- E. Qualification Data: For Installer.

## 1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for both installation and maintenance of units required for this Project.
- B. Source Limitations: Obtain overhead coiling doors through one source from a single manufacturer.
  1. Obtain operators and controls from overhead coiling door manufacturer.
- C. Fire-Test-Response Characteristics: Provide assemblies complying with NFPA 80 that are identical to door and frame assemblies tested for fire-test-response characteristics per UL 10b and NFPA 252, and that are listed and labeled for fire ratings indicated by UL, FMG, ITS, or another testing and inspecting agency acceptable to authorities having jurisdiction.



- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturer: Subject to compliance with requirements, provide products by one of the following:
1. Atlas Door; Div. of Clopay Building Products Company, Inc.
  2. Cookson Company.
  3. Cornell Iron Works Inc.
  4. Mahon Door Corporation.
  5. McKeon Rolling Steel Door Company, Inc.
  6. Overhead Door Corp.
  7. Raynor.
  8. Wayne-Dalton Corp.

### 2.2 DOOR CURTAIN MATERIALS AND CONSTRUCTION

- A. Door Curtains: Fabricate overhead coiling door curtain of interlocking slats, designed to withstand wind loading indicated, in a continuous length for width of door without splices. Unless otherwise indicated, provide slats of thickness and mechanical properties recommended by door manufacturer for performance, size, and type of door indicated, and as follows:
1. Steel Door Curtain Slats: Zinc-coated (galvanized), cold-rolled structural steel (SS) sheet; complying with ASTM A 653/A 653M, G90 (Z275) coating designation.
    - a. Minimum Base-Metal (Uncoated) Thickness: 0.0209 inch (0.55 mm).
    - b. Flat profile slats.
  2. Insulation: Fill slat with manufacturer's standard rigid cellular polystyrene or polyurethane-foam-type thermal insulation complying with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, according to ASTM E 84. Enclose insulation completely within metal slat faces.
  3. Inside Curtain Slat Face: To match material of outside metal curtain slat.
- B. Endlocks and Windlocks for Service Doors: Malleable-iron casings galvanized after fabrication, secured to curtain slats with galvanized rivets or high-strength

nylon. Provide locks on not less than alternate curtain slats for curtain alignment and resistance against lateral movement.

- C. Bottom Bar for Service Doors: Consisting of 2 angles, each not less than 1-1/2 by 1-1/2 by 1/8 inch (38 by 38 by 3 mm) thick; galvanized, stainless-steel, or aluminum extrusions to suit type of curtain slats.
- D. Curtain Jamb Guides for Service Doors: Fabricate curtain jamb guides of steel angles or channels and angles, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Build up units with not less than 3/16-inch- (5-mm-) thick galvanized steel sections complying with ASTM A 36/A 36M and ASTM A 123/A 123M. Slot bolt holes for guide adjustment. Provide removable stops on guides to prevent overtravel of curtain, and a continuous bar for holding windlocks.

## 2.3 HOODS AND ACCESSORIES

- A. Hood: Form to act as weatherseal and entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Provide closed ends for surface-mounted hoods and provide fascia for any portion of between-jamb mounting projecting beyond wall face. Provide intermediate support brackets as required to prevent sagging.
  - 1. Fabricate hoods for steel doors of minimum 0.028-inch- (0.7-mm-) thick, hot-dip galvanized steel sheet with G90 (Z275) zinc coating, complying with ASTM A 653/A 653M.
  - 2. Include automatic drop baffle to guard against passage of smoke or flame.
  - 3. Shape: Round.
- B. Smoke Seals: Provide UL-listed and -tested smoke-seal perimeter gaskets.
- C. Weatherseals: Provide replaceable, adjustable, continuous, compressible weather-stripping gaskets fitted to bottom and top of exterior doors, unless otherwise indicated. At door head, use 1/8-inch- (3-mm-) thick, replaceable, continuous sheet secured to inside of hood.
  - 1. Provide motor-operated doors with combination bottom weatherseal and sensor edge.
  - 2. In addition, provide replaceable, adjustable, continuous, flexible, 1/8-inch- (3-mm-) thick seals of flexible vinyl, rubber, or neoprene at door jambs for a weathertight installation.
- D. Fabricate locking device assembly with lock, spring-loaded dead bolt, operating handle, cam plate, and adjustable locking bar to engage through slots in tracks.

1. Locking Bars: Full-disc cremone type, both jamb sides operable from inside only.
  2. Lock cylinder is specified in Division 8 Section "Door Hardware."
- E. If door unit is power operated, provide safety interlock switch to disengage power supply when door is locked.
- F. Provide automatic-closing device that is inoperative during normal door operations, with oscillating or viscous-speed governor unit complying with requirements of NFPA 80 and with an easily tested and reset release mechanism, and designed to be activated by the following:
1. Replaceable fusible links with temperature rise and melting point of **165 deg F (74 deg C)**; interconnected and mounted on both sides of door opening.
  2. Manufacturer's standard UL-labeled heat detector and door-holder-release devices.
  3. Building fire alarm and detection system and door-holder-release devices.

## 2.4 COUNTERBALANCING MECHANISM

- A. General: Counterbalance doors by means of adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to door curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.
- B. Counterbalance Barrel: Fabricate spring barrel of hot-formed, structural-quality, welded or seamless carbon-steel pipe, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of slats and to limit barrel deflection to not more than **0.03 in./ft. (2.5 mm/m)** of span under full load.
- C. Provide spring balance of one or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Provide cast-steel barrel plugs to secure ends of springs to barrel and shaft.
- D. Fabricate torsion rod for counterbalance shaft of cold-rolled steel, sized to hold fixed spring ends and carry torsional load.
- E. Brackets: Provide mounting brackets of manufacturer's standard design, either cast iron or cold-rolled steel plate.

## 2.5 ELECTRIC DOOR OPERATORS

- A. General: Provide electric door operator assembly of size and capacity recommended and provided by door manufacturer for door and operation-cycle

requirements specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, remote-control stations, control devices, integral gearing for locking door, and accessories required for proper operation.

- B. Comply with NFPA 70.
- C. Disconnect Device: Provide hand-operated disconnect or mechanism for automatically engaging chain and sprocket operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Mount disconnect and operator so they are accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.
- D. Design operator so motor may be removed without disturbing limit-switch adjustment and without affecting emergency auxiliary operator.
- E. Provide control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6, with NFPA 70 Class 2 control circuit, maximum 24-V, ac or dc.
- F. Door-Operator Type: Provide wall-, hood-, or bracket-mounted, jackshaft-type door operator unit consisting of electric motor, enclosed gear-head-reduction drive, and chain and sprocket secondary drive.
- G. Electric Motors: Provide high-starting torque, reversible, continuous-duty, Class A insulated, electric motors complying with NEMA MG 1; with overload protection; sized to start, accelerate, and operate door in either direction from any position, at not less than  $\frac{2}{3}$  fps (0.2 m/s) and not more than 1 fps (0.3 m/s), without exceeding nameplate ratings or service factor.
  - 1. Type: Polyphase, medium-induction type.
  - 2. Service Factor: According to NEMA MG 1, unless otherwise indicated.
  - 3. Coordinate wiring requirements and electrical characteristics of motors with building electrical system.
  - 4. Provide open dripproof-type motor, and controller with NEMA ICS 6, Type 1 enclosure.
- H. Remote-Control Station: Provide momentary-contact, three-button control station with push-button controls labeled "Open," "Close," and "Stop."
  - 1. Provide interior units, full-guarded, surface-mounted, heavy-duty type, with general-purpose NEMA ICS 6, Type 1 enclosure.
- I. Obstruction Detection Device: Provide each motorized door with indicated external automatic safety sensor capable of protecting full width of door opening. Activation of sensor immediately stops and reverses downward door travel.

1. Photoelectric Sensor: Manufacturer's standard system designed to detect an obstruction in door opening without contact between door and obstruction.
  - a. Self-Monitoring Type: Designed to interface with door operator control circuit to detect damage to or disconnection of sensing device. When self-monitoring feature is activated, door closes only with sustained pressure on close button.
- J. Limit Switches: Provide adjustable switches, interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.

## 2.6 FINISHES, GENERAL

- A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

## 2.7 STEEL AND GALVANIZED STEEL FINISHES

- A. Powder-Coat Finish: Manufacturer's standard powder-coat finish consisting of primer and topcoat according to coating manufacturer's written instructions for cleaning, pretreatment, application, thermosetting, and minimum dry film thickness.
  1. Color and Gloss: As selected by Architect from manufacturer's full range.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. General: Install coiling doors and operating equipment complete with necessary hardware, jamb and head molding strips, anchors, inserts, hangers, and equipment supports.
  1. Install fire-rated doors to comply with NFPA 80.

### 3.2 ADJUSTING

- A. Lubricate bearings and sliding parts; adjust doors to operate easily, free of warp, twist, or distortion and with weathertight fit around entire perimeter.

### 3.3 STARTUP SERVICES

- A. Engage a factory-authorized service representative to perform startup service.
  - 1. Complete installation and startup checks according to manufacturer's written instructions.
  - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
    - a. Test door closing when activated by detector or alarm-connected fire-release system. Reset door-closing mechanism after successful test.

### 3.4 DEMONSTRATION

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

END OF SECTION 08331

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**SECTION 08334 - OVERHEAD  
COILING GRILLES**

**PART 1 - GENERAL**

**1.1 SUMMARY**

**A. Section Includes:**

1. Open-curtain overhead coiling grilles.

**B. Related Sections:**

1. Division 5 Section "Metal Fabrications" for miscellaneous steel supports.
2. Division 16 Sections for electrical service and connections for powered operators and accessories.

**1.2 PERFORMANCE REQUIREMENTS**

**A. Seismic Performance:** Overhead coiling grilles shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
2. Seismic Component Importance Factor: 1.5.

**B. Operation Cycles:** Provide overhead coiling grille components and operators capable of operating for not less than number of cycles indicated for each grille. One operation cycle is complete when a grille is opened from the closed position to the fully open position and returned to the closed position.

**1.3 SUBMITTALS**

**A. Product Data:** For each type and size of overhead coiling grille and accessory. Include the following:

1. Construction details, material descriptions, dimensions of individual components, profiles for curtain components, and finishes.
2. Rated capacities, operating characteristics, electrical characteristics, and furnished accessories.

- B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data. Include plans, elevations, sections, details, and attachments to other work.
  - 1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - 2. Wiring Diagrams: For power, signal, and control wiring.
- C. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.
  - 1. Open-Curtain Grille: 18-inch- (457-mm-) square assembly with full-size components consisting of rods, spacers, and links as required to illustrate each assembly.
  - 2. Bottom Bar: 6 inches (150 mm) long with sensor edge.
  - 3. Guides: 6 inches (150 mm) long.
  - 4. Brackets: 6 inches (150 mm) square.
  - 5. Hood: 6 inches (150 mm) square.
- D. Delegated-Design Submittal: For overhead coiling grilles 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. Detail fabrication and assembly of seismic restraints.
  - 2. Summary of forces and loads on walls and jambs.
- E. Qualification Data: For qualified Installer.
- F. Seismic Qualification Certificates: For overhead coiling grilles, accessories, and components, from manufacturer.
- G. Maintenance Data: For overhead coiling grilles to include in maintenance manuals.

#### 1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for both installation and maintenance of units required for this Project.
- B. Source Limitations: Obtain overhead coiling grilles from single source from single manufacturer.



1. Obtain operators and controls from overhead coiling grille manufacturer.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- D. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

## PART 2 - PRODUCTS

### 2.1 GRILLE CURTAIN MATERIALS AND CONSTRUCTION

- A. Open-Curtain Grilles: Fabricate metal grille curtain as an open network of horizontal rods, spaced at regular intervals, that are interconnected with vertical links, which are formed and spaced as indicated and are free to rotate on the rods.
  1. Aluminum Grille Curtain: ASTM B 221 (ASTM B 221M), alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.
- B. Endlocks: Continuous end links, chains, or other devices at ends of rods; locking and retaining grille curtain in guides against excessive pressures, maintaining grille curtain alignment, and preventing lateral movement.
- C. Bottom Bar: Manufacturer's standard continuous channel or tubular shape, finished to match grille.
  1. Astragal: Equip each grille bottom bar with a replaceable, adjustable, continuous, compressible gasket of flexible vinyl, rubber, or neoprene as a cushion bumper.
  2. Provide motor-operated grilles with combination bottom astragal and sensor edge.
- D. Grille Curtain Jamb Guides: Manufacturer's standard shape having curtain groove with return lips or bars to retain curtain. Provide continuous integral wear strips to prevent metal-to-metal contact and to minimize operational noise; with removable stops on guides to prevent overtravel of curtain.

### 2.2 HOODS AND ACCESSORIES

- A. General: Form sheet metal hood to entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Form closed ends for surface-

mounted hoods and fascia for any portion of between-jamb mounting that projects beyond wall face. Equip hood with intermediate support brackets as required to prevent sagging.

1. Aluminum: 0.040-inch- (1.02-mm-) thick aluminum sheet complying with ASTM B 209 (ASTM B 209M), of alloy and temper recommended by manufacturer and finisher for type of use and finish indicated.
  2. Removable Metal Soffit: Of same material and finish as curtain if hood is mounted above ceiling, unless otherwise indicated.
- B. Mounting Frame: Manufacturer's standard mounting frame designed to support grille; factory fabricated from ASTM A 36/A 36M structural-steel tubes or shapes, hot-dip galvanized per ASTM A 123/A 123M; fastened to floor and structure above grille; to be built into wall construction; and complete with anchors, connections, and fasteners.

## 2.3 LOCKING DEVICES

- A. Locking Device Assembly: Fabricate with cylinder lock, spring-loaded dead bolt, operating handle, cam plate, and adjustable locking bars to engage through slots in tracks.
1. Lock Cylinders: Provide cylinders standard with manufacturer and keyed to building keying system.
  2. Keys: Three for each cylinder.
- B. Safety Interlock Switch: Equip power-operated grilles with safety interlock switch to disengage power supply when grille is locked.

## 2.4 COUNTERBALANCING MECHANISM

- A. General: Counterbalance grilles by means of manufacturer's standard mechanism with an adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to top of curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.
- B. Counterbalance Barrel: Fabricate spring barrel of manufacturer's standard hot-formed, structural-quality, welded or seamless carbon-steel pipe, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of parts and to limit barrel deflection to not more than 0.03 in./ft. (2.5 mm/m) of span under full load.
- C. Spring Balance: One or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Secure ends of springs to barrel and shaft with cast-steel barrel plugs.

- D. Torsion Rod for Counterbalance Shaft: Fabricate of manufacturer's standard cold-rolled steel, sized to hold fixed spring ends and carry torsional load.
- E. Brackets: Manufacturer's standard mounting brackets of either cast iron or cold-rolled steel plate.

## 2.5 ELECTRIC GRILLE OPERATORS

- A. General: Electric grille operator assembly of size and capacity recommended and provided by grille manufacturer for grille and operation-cycles requirement specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, remote-control stations, control devices, integral gearing for locking grille, and accessories required for proper operation.
  - 1. Comply with NFPA 70.
  - 2. Provide control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6, with NFPA 70 Class 2 control circuit, maximum 24 V, ac or dc.
- B. Usage Classification: Electric operator and components capable of operating for not less than number of cycles per hour indicated for each grille.
- C. Grille Operator Location(s): Operator location indicated for each grille.
- D. Electric Motors: Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements specified in Division 11 Section "Common Motor Requirements for Equipment" unless otherwise indicated.
  - 1. Electrical Characteristics:
    - a. Phase: Single phase.
    - b. Volts: As scheduled.
    - c. Hertz: 60.
  - 2. Motor Type and Controller: Reversible motor and controller (disconnect switch) for motor exposure indicated.
  - 3. Motor Size: Minimum size as indicated. If not indicated, large enough to start, accelerate, and operate grille in either direction from any position, at a speed not less than 8 in./sec. (203 mm/s) and not more than 12 in./sec. (305 mm/s), without exceeding nameplate ratings or service factor.
  - 4. Operating Controls, Controllers (Disconnect Switches), Wiring Devices, and Wiring: Manufacturer's standard unless otherwise indicated.

5. Coordinate wiring requirements and electrical characteristics of motors and other electrical devices with building electrical system and each location where installed.
- E. Limit Switches: Equip each motorized grille with adjustable switches interlocked with motor controls and set to automatically stop grille at fully opened and fully closed positions.
- F. Obstruction Detection Device: Equip motorized grille with indicated external automatic safety sensor capable of protecting full width of grille opening. Activation of sensor immediately stops and reverses downward grille travel.
  1. Photoelectric Sensor: Manufacturer's standard system designed to detect an obstruction in grille opening without contact between grille and obstruction.
    - a. Self-Monitoring Type: Designed to interface with grille operator control circuit to detect damage to or disconnection of sensing device. When self-monitoring feature is activated, grille closes only with sustained pressure on close button.
  2. Sensor Edge: Automatic safety sensor edge, located within astragal or weather stripping mounted to bottom bar. Contact with sensor activates device. Connect to control circuit using manufacturer's standard take-up reel or self-coiling cable.
    - a. Self-Monitoring Type: Four-wire configured device designed to interface with grille operator control circuit to detect damage to or disconnection of sensing device.
- G. Remote-Control Station: Momentary-contact, three-button control station with push-button controls labeled "Open," "Close," and "Stop."
  1. Interior units, full-guarded, surface-mounted, heavy-duty type, with general-purpose NEMA ICS 6, Type 1 enclosure.
  2. Exterior units, full-guarded, standard-duty, surface-mounted, weatherproof type; NEMA ICS 6, Type 4 enclosure, key operated.
- H. Emergency Manual Operation: Equip each electrically powered grille with capability for emergency manual operation. Design manual mechanism so required force for grille operation does not exceed 25 lbf (111 N).
- I. Emergency Operation Disconnect Device: Equip operator with hand-operated disconnect mechanism for automatically engaging manual operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Mount mechanism so it is accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.

- J. Motor Removal: Design operator so motor may be removed without disturbing limit-switch adjustment and without affecting emergency manual operation.
- K. Audible and Visual Signals: Audible alarm and visual indicator lights in compliance with regulatory requirements for accessibility.
- L. Emergency-Egress Release: Flush, wall-mounted handle mechanism, for ADA-ABA-compliant egress feature, not dependent on electric power. The release allows an unlocked grille to partially open without affecting limit switches to permit passage, and it automatically resets motor drive upon return of handle to original position.

## 2.6 OPEN-CURTAIN GRILLE ASSEMBLY

- A. Open-Curtain Grille: Overhead coiling grille with a curtain having a network of horizontal rods that interconnect with vertical links.
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. ACME Rolling Doors.
    - b. Alpine Overhead Doors, Inc.
    - c. AlumaTek, Inc.
    - d. City-Gates.
    - e. Cookson Company.
    - f. Cornell Iron Works, Inc.
    - g. Dynaflair Corporation.
    - h. Dynamic Closures Corp.
    - i. Lawrence Roll-Up Doors, Inc.
    - j. Mahon Door Corporation.
    - k. McKeon Rolling Steel Door Company, Inc.
    - l. Metro Door.
    - m. Overhead Door Corporation.
    - n. Raynor.

- o. Windsor Door.
- B. Operation Cycles: Not less than 50,000.
  - 1. Include tamperproof cycle counter.
- C. Grille Curtain Material: Aluminum.
  - 1. Space rods at approximately 1-1/2 inches (38 mm) o.c.
  - 2. Space links approximately 6 inches (152 mm) apart in a straight in-line pattern.
  - 3. Spacers: Metal tubes matching curtain material.
- D. Curtain Jamb Guides: Aluminum with exposed finish matching curtain slats. Provide continuous integral wear strips to prevent metal-to-metal contact and to minimize operational noise.
- E. Hood: Match curtain material and finish.
  - 1. Shape: Round or as shown on Drawings
  - 2. Mounting: Face of wall.
- F. Locking Devices: Equip grille with locking device assembly.
  - 1. Locking Device Assembly: Cremone type, both jamb sides locking bars, operable from inside and outside with cylinders.
- G. Electric Grille Operator:
  - 1. Usage Classification: Standard duty, up to 60 cycles per hour.
  - 2. Operator Location: As shown on Drawings.
  - 3. Motor Exposure: Interior and Exterior, wet, and humid.
  - 4. Emergency Manual Operation: Push-up type.
  - 5. Obstruction-Detection Device: Automatic, either photoelectric sensor or electric sensor edge on bottom bar; self-monitoring type.
    - a. Sensor Edge Bulb Color: As selected by Architect from manufacturer's full range.
  - 6. Remote-Control Station: Where directed or shown on Drawings.
  - 7. Other Equipment: Audible and visual signals.

H. Grille Finish:

1. Aluminum Finish: Anodized color or clear as selected by Architect from full range of industry colors and color densities.

2.7 GENERAL FINISH REQUIREMENTS

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

2.8 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.
- B. Color Anodic Finish: AAMA 611, AA-M12C22A32/A34, Class II, 0.010 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 INSTALLATION

- A. Install overhead coiling grilles and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.
- B. Install overhead coiling grilles, hoods, and operators at the mounting locations indicated for each grille.
- C. Accessibility: Install overhead coiling grilles, switches, and controls along accessible routes in compliance with regulatory requirements for accessibility.

### 3.3 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
  - 1. Perform installation and startup checks according to manufacturer's written instructions.
  - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
  - 3. Test grille opening when activated by detector, fire-alarm system, emergency-egress release, or self-opening mechanism as required. Reset grille-opening mechanism after successful test.

### 3.4 ADJUSTING

- A. Adjust hardware and moving parts to function smoothly so that grilles operate easily, free of warp, twist, or distortion.
- B. Lubricate bearings and sliding parts as recommended by manufacturer.

### 3.5 DEMONSTRATION

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

END OF SECTION 08334



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

**SECTION 08385 - HIGH-SPEED  
OVERHEAD DOORS**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

- A. General: Provide all labor, material, equipment, related services and supervision required, including manufacturing, erection and installation for high-speed overhead doors in accordance with the requirements of the Contract Documents.
- B. The extent of high-speed overhead doors is shown on the drawings.
- C. Extent of high-speed overhead doors is shown on drawings.
- D. Provide complete operating door assemblies including door curtain, guides, counterbalance mechanism, hardware, operating hardware, electric operation, programmable logic controller, safety devices, sensor detection and installation accessories.
- E. Related sections include the following:
  - 1. Division 9, Section "EXTERIOR PAINTING" for field-applied paint finish on steel channel frame.
  - 2. Electrical service and connections for powered operators and accessories are specified in Division 16.

**1.3 PERFORMANCE REQUIREMENTS**

- A. Structural Performance: Provide high-speed overhead doors capable of withstanding the effects of gravity loads and the following loads and stresses without evidencing permanent deformation of door components.
  - 1. Wind Load: Uniform pressure (velocity pressure) of 20 lbs./sq. ft., acting inward and outward.

#### 1.4 SUBMITTALS

- A. General: Submit the following according to the Conditions of Contract and the Division 1 Specification sections.
- B. Product Data: For each type and size of high-speed overhead doors and accessories. Include details of construction relative to materials, dimensions of individual components, profiles, and finishes. Provide roughing-in diagrams, operating instructions, and maintenance information. Include the following:
  - 1. Setting drawings, templates, and installation instructions for built-in or embedded anchor devices.
  - 2. Motors: Show nameplate data and ratings; characteristics; mounting arrangements; size and location of winding termination lugs, conduit entry, and grounding lug; and coatings.
- C. Shop Drawings: For special components and installations not dimensioned or detailed in manufacturer's data sheets.
  - 1. Wiring Diagrams: Detail wiring for power, signal, and control systems. Differentiate between manufacturer-installed and field-installed wiring and between components provided by door manufacturer and those provided by others.
- D. Samples for Verification: Of each type of exposed finish required, prepared on Samples of size indicated below and of same thickness and material indicated for Work. Where finishes involve normal color and texture variations, include Sample sets showing the full range of variations expected.
  - 1. Door Panel: 12 inch by 12 inch.

#### 1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced installer who is an authorized representative of the high-speed overhead door manufacturer for both installation and maintenance of units required for this Project.
- B. Source Limitations: Obtain high-speed overhead doors through one source from a single manufacturer. Furnish each door as a complete unit, including hardware, accessories, mounting and installation components.
  - 1. Obtain operators and controls from the high-speed overhead door manufacturer.
- C. Inserts and Anchorages: Furnish inserts and anchoring devices that must be set in concrete to install units. Provide setting drawings, templates, instructions and directions to install anchorage devices. Coordinate

delivery with other work to avoid delay. Installation of inserts and anchorage devices are covered in Divisions 3 sections.

#### 1.6 WARRANTY:

- A. Manufacturer shall warrant:
  - 1. Balance/Tension springs for a period of five (5) years.
  - 2. Rolltex™ fabric for a period of five (5) years.
- B. Manufacturer shall warrant mechanical and electrical components against defects in material and workmanship for one (1) year.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Manufacturer's Basis of Design: The named manufacturer and associated product is the basis of design for the project. Other manufacturer's whose products may be incorporated into the work, subject to compliance with requirements, are also listed. The Contractor is responsible for any modifications to the work resulting from the use of materials other than the basis of design, at no additional cost to the Owner.
  - 1. Albany International, "Rapid Roll Model 670 HD."
- B. Additional Acceptable Manufacturers (providing equal products):
  - 1. Rite-Hite.
  - 2. Overhead Door Corporation.
  - 3. Chase Doors.

#### 2.2 MATERIAL AND COMPONENTS

- A. Door Panel:
  - 1. Fabric: Fabricate panel of fabric comprised of a polyester monofilament woven, double layer seamless fabric, impregnated and coated with PVC.
    - a. Thickness: 0.08 inch.
    - b. Impact Strength: Capable of sustaining impacts up to 3,000 lbs. per square inch.
    - c. Tensile Strength: 1,500 lbs. per inch lengthwise and 2,200 lbs. per inch crosswise.

- d. Colors: Custom color selected by Architect.
- B. Door Roll: 5.5 inches diameter, steel tube from 11 gauge galvanized steel complying with ASTM A513. Drum tube deflection shall not exceed 0.01 inch per foot and shall not exceed 0.14 inch over the entire length.
- C. Counterbalance System:
  - 1. Internally mounted counterbalance/curtain tension system shall utilize an extension spring along with a cable and pulley mechanism.
  - 2. Construct pulleys of high-impact injected molded plastic. Pulleys shall contain two permanently sealed and lubricated ball bearings.
  - 3. Provide factory lubricated steel cables with fiber core with Alloy 319 die cast aluminum drums.
- D. Bottom Beam: Beam shall be anodized alloy 6063 extruded aluminum; profile shall be 4.5 inches high and capable of being removed if necessary.
- E. Primary Safety Edge: Through-beam photo cells shall be mounted on retractable steel guides at each end of the bottom beam. Photocell position shall be between door panel guide and 6 inches below bottom edge of door panel during door travel. At closing, photocell shall detect any object and reverse door immediately before bottom edge rubber profile strikes object.
- F. Secondary Safety Edge: EDPM rubber profile shall pneumatically operate a pressure switch. Safety edge cover shall be weatherproof yellow polyester woven PVC impregnated material. On contact with foreign object, door shall reverse to full open position.
- G. Safety Photocell: Provide a safety photocell in proximity to door line.
- H. Side Frames: 14 gauge galvanized steel section including hinged cover together with 12 gauge steel structural C-channel to guide door panel in its upward and downward movement. Provide brush seals to seal against door panel.
  - 1. Finish: Durable, chemical and corrosion resistant-painted coating applied to steel components. Custom color as selected by Architect.
- I. Rapid Reset System or Self Repair System:
  - 1. Provide either Rapid Reset or Self Repair System in accordance with manufacturer's recommendations for door size.
- J. Electrical Operation:

1. High-speed doors shall be electrically operated by a heavy duty drive unit featuring a self-inhibiting worm gear. The motor and gearbox shall be designed for high-cycle operation. Door position shall be controlled by a bi-directional pulse encoder. Basic operation features shall include soft starting and stopping, automatic closing timer, emergency stop, one actuating push button, a safety photocell and a manual disengagement lever to place the door in manual operation. A safety disengagement switch shall be included with the disengagement mechanism.
2. Electrical Motor:
  - a. Provide high-starting torque, reversible intermittent duty, enclosed non-ventilated electric motor, sized to move door in either direction, from any position, at no less than the specified operating speed.
  - b. Motor: Three (3) phase motor rated for 1.25 h.p.
  - c. Door Speed: Up to 100 inches per second.
  - d. Power Supply: Coordinate wiring requirements and current characteristics of door electrical system with building electrical system. Supply shall be rated at 480 volt, three-phase, 60 Hz, 15 amps.
3. Control Panel:
  - a. Panel enclosure shall be NEMA 4.
  - b. Wiring shall be completed by manufacturer and shall be ULC listed.
  - c. Drive shall be controlled by a programmable logic controller.
  - d. Control functions determined by manufacturer's preparation of programmable logic controller.
  - e. Top and bottom limits to be adjustable from the control panel.
  - f. Optional custom designed control system and/or components.
  - g. Control panel shall include an adjustable, automatic closing timer, emergency stop, one actuating push button and a cycle counter.
4. Push button stations and/or pull switches are standard actuation systems.

- a. On side of door's normal direction of traffic, each door shall each have push button station on a pedestal mounted for tug driver access from the driver seat.
  - b. Opposite side of door from normal direction of traffic shall have wall mounted push button stations and metallic activated floor loop receiver reset system for vehicle detection to close door..
  - c. Include photocell featuring an infrared beam that maintains "open" signal when interrupted.
- 5. Door shall be equipped with safety photocell.
- K. Electrical Protection Features:
  - 1. Provide fuses to protect from power line overcurrent and from secondary control voltage overcurrent.
  - 2. Provide complete motor monitoring protection from the programmable operation.
  - 3. Provide thermal protection to protect motor from temperature build-up.
  - 4. Provide switch to electrically disconnect control circuitry during manual operation.
  - 5. Provide running timer to protect drive unit from motor run-on.
  - 6. Provide safety edge system that is continuously monitored and prevents door from closing if a fault is detected.
  - 7. Provide emergency stop feature to instantly stop door in any position.
  - 8. Provide start-up protection to ensure there is no movement of door when system detects a failure.

## 2.3 ACCESSORIES

- A. Heavier drum tube, acrylic fabric, larger bottom beam, heavy duty motor mounting bracket, larger motor, extra wrap of fabric on top roll for stiffness.
- B. Warning horn and light shall indicate when door is about to close.
- C. Windbar shall provide added protection against pressure differentials.

- C. Impact Release System: Connection between aluminum bottom beam and end bracket shall be a steel clevis and brass tang in a 25 degree angle. Load transmission from balance/tension system through clevis and tang shall be the only mechanism that maintains joint during normal operation.

## 2.4 FINISHES

- A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

## 2.5 STEEL AND GALVANIZED STEEL FINISHES

- A. Powder-Coat Applied Finish: Apply manufacturer's standard powder-coat applied finish consisting of primer and topcoat(s) according to coating manufacturer's written instructions for cleaning, pretreatment, application, thermosetting and minimum dry film thickness.
  - 1. Color and Gloss: Custom color as selected by Architect.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas and conditions under which the work is to be installed and notify Architect and Owner of any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. General: Install door and operating equipment complete with necessary hardware, jamb and head mold strips, anchors, inserts, hangers, and equipment supports according to approved shop drawings, manufacturer's written instructions, and as specified.
  - 1. Secure guides to walls, plumb, level and true to line. Anchor guides at spacings indicated on approved shop drawings.
  - 2. Provide additional support as necessary for attachment of guides, brackets and door and operator mechanisms to interfacing surfaces.

3.3 ADJUSTING

- A. After completing installation, including work by other trades, lubricate bearings and sliding parts; adjust doors to operate easily, free from warp, twist, or distortion and fitting weathertight for entire perimeter.
  - 1. Connect and adjust electrical components and operating hardware.

3.4 DEMONSTRATION

- A. Startup Services: Engage a factory-authorized service representative to perform startup services and to train Owner's maintenance personnel as specified below:
  - 1. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment. Test door closing when activated by detector or alarm connected fire-release system. Reset door closing mechanism after successful test.
  - 2. Provide training for the Owner's maintenance personnel on procedures and schedules related to startup and shutdown, troubleshooting, servicing, preventive maintenance, and procedures for testing and resetting release devices.
  - 3. Review data in the maintenance manuals. Refer to Division 1 requirements.
  - 4. Schedule training with Owner with at least 7 days' advance notice.

END OF SECTION 08385



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

**SECTION 08460 -AUTOMATIC  
ENTRANCE DOORS**

**PART 1 - GENERAL**

**1.1 SUMMARY**

**A. Section Includes:**

1. Sliding, bi-parting, power-operated automatic entrances.

**B. Related Sections:**

1. Division 16 Sections for electrical connections including conduit and wiring for automatic entrance operators.

**1.2 DEFINITIONS**

- A. AAADM: American Association of Automatic Door Manufacturers.
- B. Activation Device: Device that, when actuated, sends an electrical signal to the door operator to open the door.
- C. IBC: International Building Code.
- D. Safety Device: Device that, to avoid injury, prevents a door from opening or closing.
- E. For automatic door terminology, refer to BHMA A156.10 for definitions of terms.

**1.3 PERFORMANCE REQUIREMENTS**

- A. Delegated Design: Design automatic entrances, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Structural Performance: Automatic entrances shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated according to SEI/ASCE 7.
  1. Seismic Loads: As indicated on Drawings.
  2. Wind Loads: As indicated on Drawings.
- C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes. 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 (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
- D. Operating Temperature Range: Provide automatic entrances that operate within minus 20 to plus 122 deg F (minus 29 to plus 50 deg C).
- E. Air Infiltration: Maximum air leakage through fixed glazing and framing areas of 1.25 cfm/sq. ft. (6.4 L/s x sq. m) of fixed entrance system area when tested according to ASTM E 283 at a minimum static-air-pressure difference of 6.24 lbf/sq. ft. (300 Pa).
- F. Opening-Force Requirements:
1. Power-Operated Doors: Not more than 50 lbf (222 N) required to manually set door in motion if power fails, and not more than 15 lbf (67 N) required to open door to minimum required width.
  2. Breakaway Device for Power-Operated Doors: Not more than 50 lbf (222 N) required for a breakaway door or panel to open.
  3. Accessible Interior Doors: Not more than 5 lbf (22 N) to fully open door.
- G. Entrapment Force Requirements:
1. Power-Operated Sliding Doors: Not more than 30 lbf (133 N) required to prevent stopped door from closing.

#### 1.4 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for automatic entrances. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Shop Drawings: For automatic entrances. Include plans, elevations, sections, details, hardware mounting heights, and attachments to other work.
1. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
  2. Wiring Diagrams: For power, signal, and control wiring.
  3. Activation and safety devices.
  4. Include hardware schedule and indicate hardware types, functions, quantities, and locations.
- C. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.
- D. Delegated-Design Submittal: For automatic entrances 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. Design Calculations: Calculate requirements for seismic restraints.
  - E. Qualification Data: For Installer and manufacturer.
  - F. Product Certificates: For each type of emergency-exit automatic entrance, from manufacturer.
  - G. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for automatic entrances.
  - H. Field quality-control reports.
  - I. Maintenance Data: For automatic entrances, safety devices, and control systems to include in maintenance manuals.
  - J. Warranties: Sample of special warranties.
- 1.5 QUALITY ASSURANCE
- A. Manufacturer Qualifications: A manufacturer with company certificate issued by AAADM.
  - B. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation and maintenance of units required for this Project.
  - C. Certified Inspector Qualifications: Certified by AAADM.
  - D. Source Limitations for Automatic Entrances: Obtain automatic entrances from single source from single manufacturer.
  - E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
  - F. Power-Operated Door Standard: BHMA A156.10.
  - G. Emergency-Exit Door Requirements: Comply with requirements of authorities having jurisdiction for automatic entrances serving as a required means of egress.
  - H. Preinstallation Conference: Conduct conference at Project site.
1. Review methods and procedures related to automatic entrances including, but not limited to, the following:
    - a. Structural load limitations.
    - b. Construction schedule. Verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
    - c. Coordination with electrical, glazing, and other trades.

- d. Required testing, inspecting, and certifying procedures.

## 1.6 PROJECT CONDITIONS

- A. Field Measurements: Verify actual dimensions of openings to receive automatic entrances by field measurements before fabrication.

## 1.7 COORDINATION

- A. Templates: Obtain templates for doors, frames, and other work specified to be factory prepared for installing automatic entrances, and distribute to parties involved. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing automatic entrances to comply with indicated requirements.
- B. Coordinate hardware with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish. Coordinate hardware for automatic entrances with hardware required for rest of Project.
- C. Electrical System Roughing-in: Coordinate layout and installation of automatic entrances with connections to power supplies.

## 1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of automatic entrances that fail in materials or workmanship within specified warranty period.

- 1. Failures include, but are not limited to, the following:

- a. Structural failures including, but not limited to, excessive deflection.
- b. Faulty operation of operators, controls, and hardware.
- c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.

- 2. Warranty Period: Two years from date of Substantial Completion.

- B. Special Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components that show evidence of deterioration of factory-applied finishes within specified warranty period.

- 1. 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. Warranty Period: 10 years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
  - 1. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221 (ASTM B 221M).
  - 2. Sheet and Plate: ASTM B 209 (ASTM B 209M).
- B. Steel Reinforcement: With manufacturer's standard corrosion-resistant primer complying with SSPC-PS Guide No. 12.00 applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM and prepare surfaces according to applicable SSPC standard.
  - 1. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
  - 2. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
  - 3. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.
- C. Stainless-Steel Bars: ASTM A 276 or ASTM A 666, Type 304.
- D. Stainless-Steel Tubing: ASTM A 554, Grade MT 304.
- E. Stainless-Steel Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304, stretcher-leveled standard of flatness, in entrance manufacturer's standard thickness.
- F. Glazing: As specified in Division 8 Section "Glazing."
- G. Sealants and Joint Fillers: As specified in Division 7 Section "Joint Sealants."
- H. Bituminous Paint: Cold-applied, asphalt-mastic paint complying with SSPC-Paint 12 requirements, except containing no asbestos; formulated for 30-mil (0.76-mm) thickness per coat.
- I. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

### 2.2 SLIDING AUTOMATIC ENTRANCES

- A. General: Provide manufacturer's standard automatic entrances including doors, sidelites, framing, headers, carrier assemblies, roller tracks, door

operators, activation and safety devices, and accessories required for a complete installation.

B. Sliding Automatic Entrance:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Biparting-Sliding Units:
    - 1) Besam Automated Entrance Systems, Inc.; an ASSA ABLOY Group company.
    - 2) DORMA Automatics; Div. of DORMA Group North America.
    - 3) Horton Automatics; Div. of Overhead Door Corporation.
    - 4) Stanley Access Technologies; Div. of The Stanley Works.
2. Configuration: Biparting-sliding doors, with two sliding leaves and sidelites on each side.
  - a. Traffic Pattern: Two way.
  - b. Emergency Breakaway Capability: Sliding leaves and sidelites and as indicated on Drawings.
  - c. Mounting: Between jambs.
3. Operator Features:
  - a. Power opening and closing.
  - b. Drive System: Chain or belt.
  - c. Adjustable opening and closing speeds.
  - d. Adjustable hold-open time between 0 and 30 seconds.
  - e. Obstruction recycle.
  - f. On-off/hold-open switch to control electric power to operator, key operated.
4. Sliding Door Carrier Assemblies and Overhead Roller Tracks: Manufacturer's standard carrier assembly that allows vertical adjustment; consisting of nylon- or delrin-covered, ball-bearing-center steel wheels operating on a continuous roller track, or ball-bearing-center steel wheels operating on a nylon- or delrin-covered, continuous roller track. Support doors from carrier assembly by cantilever and pivot assembly.
  - a. Rollers: Minimum of two ball-bearing roller wheels and two antirise rollers for each active leaf.
  - b. Configuration: No threshold across door opening and surface-mounted or recessed guide track system at sidelites.
5. Combination Activation and Safety Device: Combination motion/presence sensor mounted on each side of door header to detect pedestrians in activating zone and to open door.
6. Safety Devices: Two photoelectric beams mounted in sidelite jambs to detect pedestrians in presence zone and to prevent door from closing.

7. Finish: Finish framing, door(s), sidelite(s), and header with metal cladding.
  - a. Metal Cladding: No. 8 mirrorlike reflective, nondirectional-polish-finish stainless steel.

## 2.3 ENTRANCE COMPONENTS

- A. Framing Members: Manufacturer's standard extruded aluminum, minimum 0.125 inch (3.2 mm) thick and reinforced as required to support imposed loads.
  1. Nominal Size: As indicated on Drawings.
- B. Stile and Rail Doors: Manufacturer's standard 1-3/4-inch- (45-mm-) thick, glazed doors with minimum 0.125-inch- (3.2-mm-) thick, extruded-aluminum tubular stile and rail members and clad in stainless-steel sheet. Mechanically fasten corners with reinforcing brackets that are welded, or incorporate concealed tie-rods that span full length of top and bottom rails.
  1. Glazing Stops and Gaskets: Square, snap-on, extruded-aluminum stops and manufacturer's standard preformed gaskets.
  2. Stile Design: Thin stile, as indicated on Drawings.
  3. Rail Design: 6-1/2-inch (165-mm) nominal height or as indicated on Drawings.
- C. Sidelite(s): Manufacturer's standard 1-3/4-inch- (45-mm-) deep sidelite(s) with minimum 0.125-inch- (3.2-mm-) thick, extruded-aluminum tubular stile and rail members and clad in stainless-steel sheet, matching door design and finish.
  1. Glazing Stops and Gaskets: Same materials and design as for doors.
- D. Headers: Fabricated from minimum 0.125-inch- (3.2-mm-) thick, extruded aluminum and extending full width of automatic entrance units to conceal door operators and controls. Provide hinged or removable access panels for service and adjustment of door operators and controls. Secure panels to prevent unauthorized access.
  1. Mounting: Concealed, with one side of header flush with framing.
  2. Capacity: Capable of supporting doors up to 175 lb (79 kg) per leaf over spans up to 14 feet (4.3 m) without intermediate supports.
    - a. Provide sag rods for spans exceeding 14 feet (4.3 m).
- E. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.
- F. Signage: Affixed to both sides of each door as required by BHMA A156.10 for type of door and its operation.
  1. Application Process: Door manufacturer's standard process.

2. Provide sign materials with instructions for field application after glazing is installed.

## 2.4 DOOR OPERATORS AND ACTIVATION AND SAFETY DEVICES

- A. Door Operators: Provide door operators of size recommended by manufacturer for door size, weight, and movement; for condition of exposure; and for long-term, maintenance-free operation under normal traffic load for type of occupancy indicated.
  1. Door Operator Performance: Provide door operators that will open and close doors and maintain them in fully closed position when subjected to Project's design wind loads.
  2. Electromechanical Operators: Concealed, self-contained, overhead unit powered by fractional-horsepower, permanent-magnet dc motor; with closing speed controlled mechanically by gear train and dynamically by braking action of electric motor; with solid-state microprocessor controller; UL 325; and with manual operation with power off.
- B. Combination Motion/Presence Sensors: Self-contained units; consisting of both motion and presence sensors in a single metal or plastic housing; adjustable to provide detection field sizes and functions required by BHMA A156.10.
  1. Motion Sensor: K-band-frequency, microwave-scanner units; with relay hold time of not less than 2 to 10 seconds.
  2. Presence Sensor: Infrared-scanner units; with relay hold time of not less than 2 to 10 seconds. Sensors shall remain active at all times.
- C. Photoelectric Beams: Pulsed infrared, sender-receiver assembly for recessed mounting. Beams shall not be active when doors are fully closed.
- D. Electrical Interlocks: Unless units are equipped with self-protecting devices or circuits, provide electrical interlocks to prevent activation of operator when door is locked, latched, or bolted.
- E. Opening-Width Control: Two-position switch that in the normal position allows sliding doors to travel to full opening width and in the alternate position reduces opening to a selected partial opening width.

## 2.5 HARDWARE

- A. General: Provide units in sizes and types recommended by automatic entrance and hardware manufacturers for entrances and uses indicated. Finish exposed parts to match door finish.
- B. Breakaway Device for Power-Operated Doors: Provide breakaway device that allows door to swing out in direction of egress to full 90 degrees from any operating position. Maximum force to open door shall be 50 lbf (222 N)



according to BHMA A156.10. Interrupt powered operation of door operator while in breakaway mode.

C. Pivots:

1. Center-Pivot Sets: BHMA A156.4, Grade 1, with exposed parts of cast-aluminum alloy.

D. Deadlocks: Manufacturer's standard deadbolt operated by exterior cylinder and interior thumb turn, with minimum 1-inch- (25-mm-) long throw bolt; BHMA A156.5, Grade 1.

1. Cylinders: [BHMA A156.5, Grade 1, six-pin mortise type. as specified in Division 8 Section "Door Hardware."

- a. Keying: Integrate into building master key system.

2. Deadbolts: Laminated-steel hook, mortise type, BHMA A156.5, Grade 1.
3. Two-Point Locking for Sliding Doors: Mechanism in stile of active door leaf that automatically extends second lockbolt into overhead carrier assembly and threshold.
4. Include locking devices for sidelites, to prevent manual break out.

E. Weather Stripping: Manufacturer's standard replaceable components.

1. Sliding Type: AAMA 701, made of wool, polypropylene, or nylon woven pile with nylon-fabric or aluminum-strip backing.

## 2.6 FABRICATION

A. General: Factory fabricate automatic entrance components to designs, sizes, and thicknesses indicated and to comply with indicated standards.

1. Form aluminum shapes before finishing.
2. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
3. Use concealed fasteners to greatest extent possible. Where exposed fasteners are required, use countersunk Phillips flat-head machine screws fabricated from stainless steel.
  - a. Where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration, use self-locking devices.
  - b. Reinforce members as required to receive fastener threads.
4. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose.

- B. Framing: Provide automatic entrances as prefabricated assemblies. Complete fabrication, assembly, finishing, hardware application, and other work before shipment to Project site.
  - 1. Fabricate tubular and channel frame assemblies with manufacturer's standard welded or mechanical joints. Provide subframes and reinforcement as required for a complete system to support required loads.
  - 2. Perform fabrication operations in manner that prevents damage to exposed finish surfaces.
  - 3. Form profiles that are sharp, straight, and free of defects or deformations.
  - 4. Provide components with concealed fasteners and anchor and connection devices.
  - 5. Fabricate components with accurately fitted joints with ends coped or mitered to produce hairline joints free of burrs and distortion.
  - 6. Fabricate exterior components to drain water passing joints and condensation and moisture occurring or migrating within system to the exterior.
  - 7. Provide anchorage and alignment brackets for concealed support of assembly from building structure.
  - 8. Allow for thermal expansion of exterior units.
- C. Doors: Factory fabricated and assembled in profiles indicated. Reinforce as required to support imposed loads and for installing hardware.
- D. Metal Cladding: Provide metal cladding, completely cladding all visible surfaces as part of prefabricated entrance assemblies before shipment to Project site.
  - 1. Perform fabrication operations in manner that prevents damage to exposed finish surfaces.
  - 2. Form profiles that are sharp, straight, and free of defects or deformations.
  - 3. Provide components with concealed fasteners and anchor and connection devices.
  - 4. Fabricate components with accurately fitted joints with ends coped or mitered to produce hairline joints free of burrs and distortion.
  - 5. Fabricate exterior components to drain water passing joints and condensation and moisture occurring or migrating within system to the exterior.
  - 6. Allow for thermal expansion at exterior entrances.
- E. Door Operators: Factory fabricated and installed in headers, including adjusting and testing.
- F. Glazing: Fabricate framing with minimum glazing edge clearances for thickness and type of glazing indicated, according to GANA's "Glazing Manual."
- G. Hardware: Factory install hardware to greatest extent possible; remove only as required for final finishing operation and for delivery to and installation at Project site. Cut, drill, and tap for factory-installed hardware before applying finishes.
  - 1. Provide sliding-type weather stripping, mortised into door, at perimeter of doors and breakaway sidelites.

H. Activation and Safety Devices:

1. General: Factory install devices in doors and headers as required by BHMA A156.10 for type of door and direction of travel.
2. Install photoelectric beams in vertical jambs of sidelites, with dimension above finished floor as follows:
  - a. Top Beam: 48 inches (1219 mm).
  - b. Bottom Beam: 24 inches (610 mm).

## 2.7 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Apply organic and anodic finishes to formed metal after fabrication unless otherwise indicated.
- D. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

## 2.8 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.
- B. High-Performance Organic Finish: 2-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
  1. Color and Gloss: As selected by Architect from manufacturer's full range.

## 2.9 AUTOMATIC ALL-GLASS ENTRANCE DOORS

- A. Provide automatic operators and required components as specified in this section for the automatic all-glass entrance doors specified in Section 08450 – ALL GLASS ENTRANCES AND STOREFRONTS.”

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances, header support, and other conditions affecting performance of automatic entrances.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. General: Do not install damaged components. Fit frame joints to produce hairline joints free of burrs and distortion. Rigidly secure nonmovement joints. Seal joints watertight.
  - 1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose.
  - 2. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.
- B. Entrances: Install automatic entrances plumb and true in alignment with established lines and grades without warp or rack of framing members and doors. Anchor securely in place.
  - 1. Install surface-mounted hardware using concealed fasteners to greatest extent possible.
  - 2. Set headers, carrier assemblies, tracks, operating brackets, and guides level and true to location with anchorage for permanent support.
  - 3. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within system to exterior.
- C. Door Operators: Connect door operators to electrical power distribution system as specified in Division 16 Sections.
- D. Access-Control Devices: Connect access-control devices to access-control system as specified in Division 16 Sections.
- E. Activation and Safety Devices: Install and adjust devices to provide detection field and functions indicated.
- F. Glazing: Install glazing as specified in Division 8 Section "Glazing."
- G. Sealants: Comply with requirements specified in Division 7 Section "Joint Sealants" to provide weathertight installation.
  - 1. Set framing members and flashings in full sealant bed.

2. Seal perimeter of framing members with sealant.

- H. Signage: Apply signage on both sides of each door and breakaway sidelight as required by referenced door standards.
- I. Wiring within Automatic Entrance Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's written limitations on bending radii. Provide and use lacing bars and distribution spools.

### 3.3 FIELD QUALITY CONTROL

- A. Inspection: Engage Installer's certified inspector to test and inspect automatic entrances and prepare test and inspection reports.
  - 1. Certified inspector shall test and inspect each automatic entrance to determine compliance of installed systems with applicable BHMA standards.
  - 2. Inspection Report: Certified inspector shall submit report in writing to Architect and Contractor within 24 hours after inspection.
- B. Work will be considered defective if it does not pass tests and inspections.

### 3.4 ADJUSTING

- A. Adjust door operators, controls, and hardware for smooth and safe operation and for weathertight closure; comply with requirements in BHMA A156.10.
- B. Lubricate operating hardware and other moving parts as recommended by manufacturer.
- C. Readjust door operators and controls after repeated operation of completed installation equivalent to 3 days' use by normal traffic (100 to 300 cycles). Lubricate hardware, operating equipment, and other moving parts.
- D. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

### 3.5 CLEANING AND PROTECTION

- A. Clean glass and metal surfaces promptly after installation. Remove excess glazing and sealant compounds, dirt, and other substances. Repair damaged finish to match original finish.
  - 1. Comply with requirements in Division 8 Section "Glazing" for cleaning and maintaining glass.

3.6 DEMONSTRATION

- A. Engage a certified inspector to train Owner's maintenance personnel to adjust, operate, and maintain automatic entrances.

END OF SECTION 08460

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

**SECTION 08710 - FINISH  
HARDWARE**

**PART 1 - GENERAL**

**1.1 WORK INCLUDES:**

- A. Finish Hardware
  - Aluminum Door Hardware
  - Thresholds
  - Weather-stripping

**1.2 RELATED WORK**

- |    |                               |                       |
|----|-------------------------------|-----------------------|
| A. | Hollow Metal Doors and Frames | Section 08100         |
|    | Flush Wood Doors              | Section 08210         |
|    | Aluminum Storefront Doors     | Section 08400         |
|    | Security                      | Section 16000 / 17000 |

**1.3 QUALITY ASSURANCE**

- A. **STANDARDS:** Manufacturers and model numbers listed are to establish a standard of quality. Similar items by approved manufacturers, unless otherwise noted, that are equal in design, finish and quality will be accepted upon prior approval of the architect and provided required data and physical samples are submitted at least ten (10) days prior to date of bid. Products listed as "No Substitute" are specified as such to match existing or by the Owners request.
- B. **SUPPLIER QUALIFICATIONS:** Hardware supplier must be engaged regularly in contracting work and be staffed to expedite work, the firm shall have been furnishing hardware on similar projects for not less than five years. The supplier must have in his employ a certified Architectural Hardware Consultant (AHC) to periodically inspect and direct detailing, setting, applying of all hardware items.
- C. **INSTALLER QUALIFICATIONS:** Hardware for the project shall be installed by factory authorized personnel who have successfully completed factory training courses and shall be certified for the installation of locksets, door closers and exit devices. Prior to installation, the installer shall inspect all door frames for proper plum and square condition. General Contractor shall be notified of frames found out of square, plum or unsuitable for door installation at the installation meeting.
- D. **FIELD INSPECTION:** Inspection of existing doors, frames and hardware is required to evaluate compliance with the Americans with Disabilities Act, (ADA) the operation of the door hardware and the compatibility of new hardware with existing doors and frames. A written report detailing

any deficiencies or incompatibility shall be forwarded to the Architect ten (10) business days prior to bid of project.

- E. **ELECTRONIC/ELECTRIC HARDWARE:** It shall be the responsibility of supplier to coordinate with the approved manufacturer and the electrical contractor / security / fire systems contractor all electronic / electrical finish hardware items covered within this section via factory wiring diagram showing point to point connections, riser diagram and system schematic. **Factory wiring diagram shall be furnished with hardware submittals (See 1.5). Refer to Security wiring diagrams for coordination of electro-mechanical hardware with access control and life safety systems.**
  
- F. **PREINSTALLATION CONFERENCE FOR MECHANICAL HARDWARE:** Conduct conference at Project site to comply with requirements in Division 1 Section "Project Meeting." Review methods and procedures related to mechanical door hardware, including but not limited to the following:
  - 1. Review and finalize construction schedule and verify availability of materials, installer's personnel, equipment and facilities needed to make progress and avoid delays.
  - 2. Present General Contractor with a written report of the condition of door frames in terms of squareness and any other condition that may impede the installation and operation of the doors and hardware.
  - 3. Review installer's responsibilities for testing, inspecting and adjusting doors and hardware in accordance with 08710 Part 3 EXECUTION.
  
- G. **PREINSTALLTION CONFERENCE FOR ELECTRIFIED HARDWARE:** Conduct conference prior to electrical Rough-in for electro-mechanical hardware components. Review methods and procedures related to electrified door hardware including, but not limited to the following:
  - 1. Discuss electrical rough-in requirements, factory wiring diagrams and other preparatory work to be performed by other trades.
  - 2. Review sequence of operation for each type of electrical door hardware.
  - 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. Review installer's responsibilities for testing, inspecting and adjusting doors and hardware in accordance with 08710 Part 3 EXECUTION.
  
- H. **FLORIDA WIND AND IMPACT REQUIREMENTS:** All hardware shall meet or exceed requirements for Wind Pressure and Impact ratings. Furnish copies of Notice of Acceptance as required by the Architect.



## 1.4 REFERENCES

- A. ANSI/BHMA designations where used in schedules to describe hardware items or to define quality or function are derived from the following standards and requirements specified elsewhere in this section.

1.	Butts and Hinges:	ANSI A156.1 (BHMA 101)
2.	Locks and Lock Trim:	ANSI A156.2 (BHMA 601)
3.	Exit Devices:	ANSI A156.3 (BHMA 701)
4.	Door Controls: Closers:	ANSI A156.4 (BHMA 301)
5.	Auxiliary Locks:	ANSI A156.5 (BHMA 501)
6.	Architectural Door Trim:	ANSI A156.6 (BHMA 1001)
7.	Template Hinge Dimensions:	ANSI A156.7
8.	Door Controls: Overhead Holders:	ANSI 156.8 (BHMA 311)
9.	Interconnected Locks & Latches:	ANSI A156.12 (BHMA 311)
10.	Mortise Locks & Latches:	ANSI A156.14 (BHMA 401)
11.	Sliding & Folding Door Hardware:	ANSI A156.14 (BHMA 401)
12.	Closer Holder Release Devices:	ANSI A156.16 (BHMA 1201)
13.	Self Closing Hinges & Pivots:	ANSI A156.17 (BHMA 1101)
14.	Materials and Finishes:	ANSI A156.18 (BHMA 1301)

## 1.5 SUBMITTALS

- A. **GENERAL REQUIREMENTS:** Submit manufacturer's product data for each item of hardware. Include whatever information may be necessary to show compliance with requirements, and instructions for installation and maintenance of operating parts and exposed finishes.
- B. **SCHEDULES:** Submit six (6) copies of the finish hardware schedule for approval. Schedule format shall be similar to the one included at the end of Part 3 of this section. Submit a Factory Wiring Diagram for ALL electrical hardware components for the approval of the project Electrical Engineer.
- C. **SAMPLES:** At the request of the architect, submit samples of products for approval of design, finish, etc.
- D. **TEMPLATES:** Whenever required, furnish templates to the necessary fabricators of other related work, which is to receive finish hardware, such as door and steel door frames and or aluminum doors and frames.
- E. **CATALOG CUTS:** Submit six (6) copies of catalog cuts of all products listed in the finish hardware schedule.
- F. **KEYING SCHEDULE:** The specific keying requirements should be noted elsewhere in this schedule. If these requirements are not noted then, it is the supplier's responsibility to submit a keying schedule based on the format listed in the DHI annual Keying Procedures, Systems and Nomenclature.

## 1.6 DELIVERY STORAGE AND HANDLING

- A. MARKING & PACKAGING: Hardware should be required to be sent to the job site in the manufacturers original packages marked to correspond with the approved hardware schedule.
- B. Some items of hardware may have to be delivered to fabricators for factory installation. (i.e.: Aluminum Storefront).
- C. Storage and protection of the materials is the responsibility of the General Contractor. Proper storage methods are advised as protection of the material and finish as necessary.

## 1.7 WARRANTIES

- A. All door closers shall have a ten (10) year warranty against defects in material and workmanship from the date of occupancy of the project.
- B. Power supplies and power controllers shall be warranted for the life of the installation.
- C. Exit hardware shall be warranted for a period of three (3) years against defects material and workmanship.
- D. All other products shall have a one (1) year warranty against defects in the material and workmanship from the date of occupancy of the project

## PART 2 - PRODUCTS

### 2.1 ACCEPTABLE PRODUCTS

- A. The following is a list of acceptable products:

<u>Products:</u>	<u>Specified Manufacturers:</u>	<u>Acceptable Manufacturers:</u>
HINGES	MCKINNEY	HAGER, LAWERENCE
PIVOTS	RIXON	LCN
FLUSH BOLTS	ROCKWOOD	HAGER, TRIMCO
EXIT DEVICES	CORBIN-RUSSWIN	YALE, SARGENT
CYLINDERS	MATCH EXISTING	NO SUBSTITUTE
LOCKS	CORBIN-RUSSWIN	YALE, SARGENT
ELECTRIC STRIKES	FOLGER ADAM	NO SUBSTITUTE
POWER SUPPLIES	SECURITRON	FOLGER ADAM
MAGNETIC LOCKS	SECURITRON	FOLGER ADAM
PUSH-PULLS	ROCKWOOD	McKINNEY, TRIMCO
DOOR CLOSERS	CORBIN-RUSSWIN	YALE, SARGENT
KICK PLATES	ROCKWOOD	McKINNEY, TRIMCO
DOOR STOPS	ROCKWOOD	McKINNEY, TRIMCO
THRESHOLDS	PEMKO	NAT. GUARD, McKINNEY

FINISH HARDWARE  
08710-4

W / S SETS  
DOOR BOTTOMS

PEMKO  
PEMKO

NAT. GUARD, McKINNEY  
NAT. GUARD, McKINNEY

- B. To the greatest extent possible, obtain materials from one manufacturer. Manufacturers listed above are intended to insure quality and design of the project. Other manufacturers submitted will be acceptable, provided they are equal or exceed standard of quality proposed for this project.

## 2.2 MATERIALS

- A. **SCREWS & FASTENERS:** All screws and fasteners required for the hardware items are listed in the individual hardware sets. Any omission of these items should be reflected in the schedule submitted for approval.
- B. **HINGES:** Where hinges are specified unless otherwise noted they shall be of types and sizes as required by ANSI A156.1. **SIZE HINGES ACCORDING TO MANUFACTURERS RECOMMENDATIONS.** Provide stainless steel continuous hinges as listed in the hardware sets.
1. Provide electric hinges with ElectroLynx standardized plug in connectors to accommodate up to twelve wires.
  2. Plug connectors shall plug directly into ElectroLynx through door wiring harness for connection to electric locking devices and power supplies.
  3. Provide sufficient number of concealed wires to accommodate electric function of specified electro mechanical hardware.
- C. **PIVOTS:** All pivots and/or pivot sets shall be the product of one (1) manufacturer. Sets as noted in the hardware groups shall be matching in design for aluminum storefront doors. The doors as noted in the hardware sets are to have intermediate pivots as well as top pivots. All pivot sets are required to meet ANSI Grade One standards as standard listed in ANSI A156.4, 1980.
- D. **FLUSH BOLTS:** Provide annual and automatic flush bolts as noted in the hardware sets. All flush bolts are required to meet ANSI A156.3.
- E. **COORDINATOR & CARRY BARS:** Provide coordinator and carry bars as noted in the hardware sets. Coordinators and carry bars are required to meet ANSI A156.2 TYPE 21.
- F. **LOCKSETS & CYLINDERS:** Provide lock sets and cylinders as noted in hardware sets. Lock sets shall meet ANSI A156.13, Grade One operational, Grade Two security, UL listed. Lock cases shall be field reversible without disassembly of lock case. Cylinders shall be 7 pin.
1. Provide locksets with ElectroLynx standardized plug in connectors.
- G. **LOCK TRIM:** The design criteria selected for the lock set is as noted in

the hardware sets. This is the acceptable design selected by the owner and intended for this project.

- H. EXIT DEVICES: Provide the series and type of exit devices as noted in the hardware sets. These exit devices are required to meet ANSI A156.3 Grade One. All exit devices and electrically controlled exit devices shall be of one manufacturer.

- 1. Provide exit devices with ElectroLynx standardized plug in connectors.

- I. DOOR CLOSERS: Provide the series and type of door closers as noted in the hardware sets. These door closers are required to meet ANSI A156.4 Grade One. All closers and power actuated closers shall be of one manufacturer. Plated finish door closers shall have plated arms and brackets. Painted finish door closers shall be powder coated.

- J. PUSH, PULL & KICK PLATE: Provide the type and size of these plates as noted in the hardware sets. These items are intended for the use and accessibility as protection of the openings indicated in the hardware schedule.

- K. DOOR STOPS & HOLDERS: Provide the types as noted in the hardware sets. Any variation in the job site conditions could change the type as specified. This should be reflected in the schedule submitted for approval. Install all floor stops so as not to interfere with pedestrian or cart traffic. Floor stops shall be installed within 12 inches of the pivot point of the door and frame assembly.

- L. THRESHOLD & WEATHER-STRIPPING: Provide the types as noted in the hardware sets. All exterior openings and interior fire rated openings shall have the necessary items to meet the local building code standards. Provide stainless steel screws at all locations.

- M. SILENCERS: Provide the type required to accommodate the hollow metal frames and wood frames fabricated for the project.

- N. ELECTRICAL PRODUCTS: Too assure proper integration, ALL ELECTRICAL PRODUCTS TO BE PRODUCED BY THE SAME MANUFACTURER.

## 2.3 FINISHES

- A. Provide the finishes as specified in the hardware schedule. Otherwise, provide matching finishes for the hardware items at each door opening to the greatest extent possible. Refer to the ANSI A156.18 for the identification of these finishes.

## 2.4 KEYING

- A. Key all cylinders to existing key system at the direction of the owner.
- B. Review with the Architect and/or owner all keying requirements.
- C. Each key shall be marked and identified as directed by the Architect using the mechanical impact method of transferring the numerical impression to the key bow. Characters shall be consistent and uniform in their placement, alignment and depth of impression. Mark each key "DO NOT DUPLICATE".
- D. Provide 3 factory cut change keys per lock, 2 master keys per group, 5 pre-combinated cores and 50 key blanks. All factory cut and blank keys shall be restricted for use in the geographic area and be of nickel silver. Ship all permanent factory cut keys, key blanks and cylinders direct via registered US Mail to: the designated owners representative of: Springfield National Airport.

## 2.5 KEY CONTROL

- A. KEY CABINET: Provide a key control system including envelopes, labels tags, with self locking key clips, receipt forms, three-way visible card index, temporary markers and standard metal cabinet. Provide all of this material from one manufacturer and per that manufacturer's system standard. Provide a system with the capacity for 150% of the number of cylinders and lock sets required for the project.

## PART 3 – EXECUTION

### 3.1 INSPECTION

- A. After installation has been completed, the hardware supplier shall have a qualified Architectural Hardware Consultant (AHC); check the job to determine the proper application of hardware according to the approved hardware schedule and keying schedule. AHC shall also check the operation and adjustment of all hardware items. AHC shall submit a written report of specification compliance to the Architect with the close out documents required in 08710.3.4.A.

### 3.2 INSTALLATION

- A. Refer to the DHI manual publication for Recommended Locations for Builders Hardware, FLA ACCESSIBILITY CODE AND ADA REQUIREMENTS for instruction. Also, coordinate with the door suppliers for these locations. Install all hardware in compliance with manufacturer's instruction and recommendations. Drill and countersink all items which are not factory prepared for fasteners. Cut and fit all thresholds and weather-stripping to profile of door frames. Set threshold in accordance with the application condition.

### 3.3 OPERATIONS, MAINTENANCE AND TRAINING

- A. At completion of the project, provide the owner with a manual containing the following information:
  - 1. Final (as built) copy of hardware schedule.
  - 2. Final copy of keying schedule.
  - 3. Final copy of all system schematics and wiring diagrams.
  - 4. Copy of product data sheets as submitted including all Warranty data.
  - 5. Parts list for Locksets, Door Closers and Exit Devices.
  - 6. Copy of installation instructions for each type of hardware used.
  - 7. Name, address and phone number of each manufacturer and local representative.
  - 8. Complete set of any specialized tools.
  - 9. Complete set of manufacturer warranty information for each hardware type.
  - 10. Written AHC compliance report as described in 08710.3.1.A
- B. At the completion of the project the supplier shall engage a factory authorized service representative to train the Owner's maintenance personnel to adjust, operate and maintain door hardware and electronic cylinder, lock systems, and electro-mechanical hardware provided in this section.

### 3.2 PROTECTION

- A. The general contractor is responsible for the proper protection of all items of hardware until final acceptance of the project by the owner and the architect.

### 3.3 HARDWARE SCHEDULE

END OF SECTION 08710

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

**SECTION 08800 - GLAZING**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. This Section includes glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:
  - 1. Doors.
  - 2. Glazed curtain walls.
  - 3. Glazed entrances.
  - 4. Interior borrowed lites.
  - 5. Glazed interior partitions.
  - 6. Glazed elevator hoistway and cab.
  - 7. Glazed ornamental guardrails.
- B. Related Sections include the following:
  - 1. Division 5 Section "Ornamental Handrails and Railings."
  - 2. Division 8 Section "Aluminum-Framed Entrances and Storefronts."
  - 3. Division 8 Section "All-Glass Entrances and Storefronts."
  - 4. Division 8 Section "Glazed Aluminum Curtain Walls."
  - 5. Division 14 Section "Hydraulic Elevators."
- C. The curtain wall work specified in this section shall be performed under a single subcontract as specified in Section 08900 GLAZED ALUMINUM CURTAIN WALLS.
- D. The elevator car enclosure work specified in this section shall be performed under a single subcontract as specified in Section 14240 HYDRAULIC ELEVATORS.
- E. The glass and steel guardrail work specified in this section shall be performed under a single subcontract as specified in Section 05720 ORNAMENTAL HANDRAILS AND RAILINGS

**1.2 DEFINITIONS**

- A. Manufacturers of Glass Products: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.
- B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.



- C. Interspace: Space between lites of an insulating-glass unit that contains dehydrated air or a specified gas.
- D. Deterioration of Coated Glass: Defects developed from normal use that are attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in metallic coating.
- E. Deterioration of Insulating Glass: Failure of hermetic seal under normal use that is attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.
- F. Deterioration of Laminated Glass: Defects developed from normal use that are attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.

### 1.3 PERFORMANCE REQUIREMENTS

- A. General: Provide glazing systems capable of withstanding normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, and installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.
  - 1. Design, engineer, fabricate, assemble, furnish, and install the glass components of the glazed curtain wall system, including determination of glass thicknesses, in accordance with the design requirements, performance requirements, and installation tolerances specified herein and in Section 08900 GLAZED ALUMINUM CURTAIN WALLS
  - 2. Glass shall be of specified types, free from flaws and complying with grade requirements. All panels of each type of glass shall be produced by the same manufacturer. Each shipment of glass shall bear a manufacturer's statement indicating strength, grade, thickness, type, and quality of the contents.
  - 3. Glass shall be annealed, heat strengthened, fully tempered, or laminated, as recommended by the glass manufacturer, to ensure against heat breakage and to assure adequate glass performance at the specified design loads. The glass manufacturer's recommendations shall be accompanied by design load and thermal stress analysis calculations. Use of tempered glass shall be limited to areas where design pressures are beyond the capacity of heat strengthened glass or where required for safety glazing.

4. Unless otherwise indicated, exterior glass lights shall be of uniform appearance in order to maintain visual uniformity throughout the work. Glass required by code to meet safety glass requirements is excepted from this requirement.
5. Glass thickness of all vertical lights shall be the same and shall be based on design requirements for the most severe condition.
6. Sizes of glass shall be taken from the actual frames or from guaranteed dimensions provided by the frame supplier.
7. Tolerances between frame and edges of glass shall be those recommended by the glass manufacturer.
8. The work shall conform to requirements of CPSC 16 CFR 1201.
9. Glass 1/4" thick and thicker shall be factory graded and cut.
10. Sealants shall be supplied by a single manufacturer when available. After acceptance by the Commissioner, all sealant of each type shall be produced by the accepted manufacturer.

B. Glass Design: Glass thickness designations indicated are minimums and are for detailing only. Confirm glass thicknesses by analyzing Project loads and in-service conditions. Provide glass lites in the thickness designations indicated for various size openings, but not less than thicknesses and in strengths (annealed or heat treated) required to meet or exceed the following criteria:

1. Glass Thicknesses: Select minimum glass thicknesses to comply with ASTM E 1300, according to the following requirements:
  - a. Specified Design Wind Loads: As indicated, but not less than wind loads applicable to Project as required by ASCE 7 "Minimum Design Loads for Buildings and Other Structures": Section 6.0 "Wind Loads."
  - b. Design Wind Loads: Determine design wind loads applicable to Project from basic wind speed indicated in **miles per hour (meters per second)** at **33 feet (10 m)** above grade, according to ASCE 7, "Minimum Design Loads for Buildings and Other Structures": Section 6.5, "Method 2-Analytical Procedure," based on mean roof heights above grade indicated on Drawings.
  - c. Specified Design Snow Loads: As indicated, but not less than snow loads applicable to Project as required by ASCE 7, "Minimum Design Loads for Buildings and Other Structures": Section 7.0, "Snow Loads."
  - d. Probability of Breakage for Vertical Glazing: 8 lites per 1000 for lites set vertically or not more than 15 degrees off vertical and under wind action.
    - 1) Load Duration: 60 seconds or less.
  - e. Probability of Breakage for Sloped Glazing: 1 lite per 1000 for lites set more than 15 degrees off vertical and under wind and snow action.
    - 1) Load Duration: 30 days.

- f. Maximum Lateral Deflection: For the following types of glass supported on all 4 edges, provide thickness required that limits center deflection at design wind pressure to 1/50 times the short side length or 1 inch (25 mm), whichever is less.
    - 1) For monolithic-glass lites heat treated to resist wind loads.
    - 2) For insulating glass.
    - 3) For laminated-glass lites.
  - g. Minimum Glass Thickness for Exterior Lites: Not less than 6.0 mm.
- C. Thermal Movements: Provide glazing that allows for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures acting on glass framing members and glazing components. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
- 1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
- D. Thermal and Optical Performance Properties: Provide glass with performance properties specified based on manufacturer's published test data, as determined according to procedures indicated below:
- 1. For monolithic-glass lites, properties are based on units with lites 6.0 mm thick or of thickness indicated.
  - 2. For laminated-glass lites, properties are based on products of construction indicated.
  - 3. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
  - 4. Center-of-Glass Values: Based on using LBL-44789 WINDOW 5.0 computer program for the following methodologies:
    - a. U-Factors: NFRC 100 expressed as Btu/ sq. ft. x h x deg F (W/sq. m x K).
    - b. Solar Heat Gain Coefficient: NFRC 200.
    - c. Solar Optical Properties: NFRC 300.

#### 1.4 SUBMITTALS

- A. Product Data: For each glass product and glazing material indicated.
- B. Samples: For the following products, in the form of 12-inch- (300-mm-) square Samples for glass.
  - 1. Glass, 3 samples each designated type, displaying safety glass labeling when applicable, 12" x 12".
  - 2. Non-structural glazing gasket, 12" x 12" corner.
  - 3. Structural silicone glazing sealant, glass, and aluminum, 12" x 12".
  - 4. Extruded silicone glazing strips: 12" length.

- C. Shop Drawings: Shop drawings for glass components of a curtain wall system shall be submitted with shop drawings for the entire system.
  - 1. Design Data with recommended glass types, strengths, and thicknesses indicating design loads
  - 2. Recommended glazing materials and details, showing glass clearances, setting blocks, shims, preformed spacers, structural seals, tapes, gaskets and sealants.
- D. Glazing Schedule: Use same designations indicated on Drawings for glazed openings in preparing a schedule listing glass types and thicknesses for each size opening and location.
- E. Product Certificates: Signed by manufacturers of glass and glazing products certifying that products furnished comply with requirements.
  - 1. For solar-control low-e-coated glass, provide documentation demonstrating that manufacturer of coated glass is certified by coating manufacturer.
- F. Qualification Data: For installers.
- G. Preconstruction Adhesion and Compatibility Test Report: From glazing sealant manufacturer indicating glazing sealants were tested for adhesion to glass and glazing channel substrates and for compatibility with glass and other glazing materials.
- H. Product Test Reports: For each of the following types of glazing products:
  - 1. Clear float glass.
  - 2. Coated float glass.
  - 3. Insulating glass.
  - 4. Laminated glass.
  - 5. Glazing sealants.
  - 6. Glazing gaskets.
- I. Warranties: Special warranties specified in this Section.

## 1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has completed glazing similar in material, design, and extent to that indicated for this Project; whose work has resulted in glass installations with a record of successful in-service performance; and who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.
- B. Source Limitations for Glass: Obtain all glass through one source from a single manufacturer for each glass type:
- C. Source Limitations for Glass Sputter-Coated with Solar-Control Low-E Coatings: Where solar-control low-e coatings of a primary glass manufacturer that has

established a certified fabricator program is specified, obtain sputter-coated solar-control low-e-coated glass in fabricated units from a manufacturer that is certified by coated-glass manufacturer.

- D. Source Limitations for Glazing Accessories: Obtain glazing accessories through one source from a single manufacturer for each product and installation method indicated.
- E. Glass Product Testing: Obtain glass test results for product test reports in "Submittals" Article from a qualified testing agency based on testing glass products.
  - 1. Glass Testing Agency Qualifications: An independent testing agency with the experience and capability to conduct the testing indicated, as documented according to ASTM E 548.
- F. Glazing for Fire-Rated Door Assemblies: Glazing for assemblies that comply with NFPA 80 and that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 252.
- G. Safety Glazing Products: Comply with testing requirements in 16 CFR 1201 and, for wired glass, ANSI Z97.1.
  - 1. Subject to compliance with requirements, obtain safety glazing products permanently marked with certification label of the Safety Glazing Certification Council or another certification agency or manufacturer acceptable to authorities having jurisdiction.
  - 2. Where glazing units, including Kind FT glass and laminated glass, are specified in Part 2 articles for glazing lites more than 9 sq. ft. (0.84 sq. m) in exposed surface area of one side, provide glazing products that comply with Category II materials, for lites 9 sq. ft. (0.84 sq. m) or less in exposed surface area of one side, provide glazing products that comply with Category I or II materials, except for hazardous locations where Category II materials are required by 16 CFR 1201 and regulations of authorities having jurisdiction.
- H. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.
  - 1. GANA Publications: GANA Laminated Division's "Laminated Glass Design Guide" and GANA's "Glazing Manual."
  - 2. AAMA Publications: AAMA GDSG-1, "Glass Design for Sloped Glazing," and AAMA TIR-A7, "Sloped Glazing Guidelines."
  - 3. IGMA Publication for Sloped Glazing: IGMA TB-3001, "Sloped Glazing Guidelines."
  - 4. IGMA Publication for Insulating Glass: SIGMA TM-3000, "Glazing Guidelines for Sealed Insulating Glass Units."

- I. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of the following testing and inspecting agency:
  - 1. Insulating Glass Certification Council.
  - 2. Associated Laboratories, Inc.
- J. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Coordination."

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect glazing materials according to manufacturer's written instructions and as needed to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

## 1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.
  - 1. Do not install liquid glazing sealants when ambient and substrate temperature conditions are outside limits permitted by glazing sealant manufacturer.

## 1.8 WARRANTY

- A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer's standard form, made out to Owner and signed by coated-glass manufacturer agreeing to replace coated-glass units that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.
  - 1. Warranty Period: 10 years from date of Substantial Completion.
- B. Manufacturer's Special Warranty on Laminated Glass: Manufacturer's standard form, made out to Owner and signed by laminated-glass manufacturer agreeing to replace laminated-glass units that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.
  - 1. Warranty Period: Five years from date of Substantial Completion.
- C. Manufacturer's Special Warranty on Insulating Glass: Manufacturer's standard form, made out to Owner and signed by insulating-glass manufacturer agreeing to replace insulating-glass units that deteriorate as defined in "Definitions" Article,

f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.

1. Warranty Period: 10 years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

1. Subject to compliance with requirements provide products from the following manufacturers:
  - a. Interpane.
  - b. Viracon.
  - c. PPG.
  - d. Guardian.

### 2.2 GLASS PRODUCTS

- A. Annealed Float Glass: ASTM C 1036, Type I (transparent flat glass), Quality-Q3; of class indicated.
- B. Heat-Treated Float Glass: ASTM C 1048; Type I (transparent flat glass); Quality-Q3; of class, kind, and condition indicated.
  1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed, unless otherwise indicated.
  2. Provide Kind HS (heat-strengthened) float glass in place of annealed float glass where needed to resist thermal stresses induced by differential shading of individual glass lites and to comply with glass design requirements specified in Part 1 "Performance Requirements" Article.
  3. For uncoated glass, comply with requirements for Condition A.
  4. For coated vision glass, comply with requirements for Condition C (other uncoated glass).
  5. Provide Kind FT (fully tempered) float glass in place of annealed or Kind HS (heat-strengthened) float glass where safety glass is indicated.
- C. Sputter-Coated Float Glass: ASTM C 1376, float glass with metallic-oxide or -nitride coating deposited by vacuum deposition process after manufacture and heat treatment (if any), and complying with other requirements specified.
- D. Laminated Glass: ASTM C 1172, and complying with other requirements specified and with the following:
  1. Interlayer: Polyvinyl butyral of thickness indicated with a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after laminating glass lites and installation.

- a. For polyvinyl butyral interlayers, laminate lites in autoclave with heat plus pressure.
- 2. Laminating Process: Fabricate laminated glass to produce glass free of foreign substances and air or glass pockets.
- E. Insulating-Glass Units, General: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, and complying with ASTM E 774 for Class CBA units and with requirements specified in this Article and in Part 2 "Insulating-Glass Units" Article.
  - 1. Provide Kind HS (heat-strengthened) float glass in place of annealed glass where needed to resist thermal stresses induced by differential shading of individual glass lites and to comply with glass design requirements specified in Part 1 "Performance Requirements" Article.
  - 2. Provide Kind FT (fully tempered) glass lites where safety glass is indicated.
  - 3. Overall Unit Thickness and Thickness of Each Lite: Dimensions indicated for insulating-glass units are nominal and the overall thicknesses of units are measured perpendicularly from outer surfaces of glass lites at unit's edge.
  - 4. Sealing System: Dual seal, with primary and secondary sealants as follows:
    - a. Manufacturer's standard sealants.
  - 5. Spacer Specifications: Manufacturer's standard spacer material and construction.

## 2.3 GLAZING GASKETS

- A. Dense Compression Gaskets: Molded or extruded gaskets of material indicated below, complying with standards referenced with name of elastomer indicated below, and of profile and hardness required to maintain watertight seal:
  - 1. Neoprene, ASTM C 864.
  - 2. EPDM, ASTM C 864.
  - 3. Silicone, ASTM C 1115.
  - 4. Thermoplastic polyolefin rubber, ASTM C 1115.
  - 5. Any material indicated above.

## 2.4 GLAZING SEALANTS

- A. General: Provide products of type indicated, complying with the following requirements:
  - 1. Compatibility: Select glazing sealants that are compatible with one another and with other materials they will contact, including glass products, seals of insulating-glass units, and glazing channel substrates,



under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.

2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
3. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.

B. Elastomeric Glazing 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.

1. Single-Component Neutral- and Basic-Curing Silicone Glazing Sealants:

a. Products:

- 1) Dow Corning Corporation; 790.
- 2) GE Silicones; SilPruf LM SCS2700.
- 3) Tremco; Spectrem 1 (Basic).
- 4) GE Silicones; SilPruf SCS2000.
- 5) Pecora Corporation; 864.
- 6) Pecora Corporation; 890.
- 7) Polymeric Systems Inc.; PSI-641.
- 8) Sonneborn, Div. of ChemRex, Inc.; Omniseal.
- 9) Tremco; Spectrem 3.

b. Type and Grade: S (single component) and NS (nonsag).

c. Class: 100/50.

d. Use Related to Exposure: NT (nontraffic).

e. Uses Related to Glazing Substrates: M, G, A, and, as applicable to glazing substrates indicated, O.

2. Neutral-Curing Silicone Glazing Sealants:

a. Products:

- 1) Dow Corning Corporation; 791.
- 2) Dow Corning Corporation; 795.
- 3) GE Silicones; SilPruf NB SCS9000.
- 4) GE Silicones; UltraPruf II SCS2900.
- 5) Pecora Corporation; 865.
- 6) Pecora Corporation; 895.
- 7) Pecora Corporation; 898.

b. Type and Grade: S (single component) and NS (nonsag).

c. Class: 50.

d. Use Related to Exposure: NT (nontraffic).

e. Uses Related to Glazing Substrates: M, G, A, and, as applicable to glazing substrates indicated, O.

### 3. Class 25 Neutral-Curing Silicone Glazing Sealant:

#### a. Products:

- 1) Dow Corning Corporation; 799.
- 2) GE Silicones; UltraGlaze SSG4000.
- 3) GE Silicones; UltraGlaze SSG4000AC.
- 4) Polymeric Systems Inc.; PSI-631.
- 5) Schnee-Morehead, Inc.; SM5731 Poly-Glaze Plus.
- 6) Tremco; Proglaze SG.
- 7) Tremco; Spectrem 2.
- 8) Tremco; Tremsil 600.

#### b. Type and Grade: S (single component) and NS (nonsag).

#### c. Class: 25.

#### d. Use Related to Exposure: NT (nontraffic).

#### e. Uses Related to Glazing Substrates: M, G, A, and, as applicable to glazing substrates indicated, O.

## 2.5 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based elastomeric tape with a solids content of 100 percent; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; packaged on rolls with a release paper backing; and complying with ASTM C 1281 and AAMA 800 for products indicated below:

1. AAMA 804.3 tape, where indicated.
2. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
3. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; packaged on rolls with release liner protecting adhesive; and complying with AAMA 800 for the following types:

1. Type 1, for glazing applications in which tape acts as the primary sealant.

## 2.6 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

- C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.
- D. Spacers: Elastomeric blocks or continuous extrusions with a Shore, Type A durometer hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
- E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).
- F. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.
- G. Perimeter Insulation for Fire-Resistive Glazing: Identical to product used in test assembly to obtain fire-resistance rating.

## 2.7 FABRICATION OF GLAZING UNITS

- A. Fabricate glazing units in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.
- B. Grind smooth and polish exposed glass edges and corners.

## 2.8 MONOLITHIC FLOAT-GLASS UNITS

- A. Uncoated Clear Float-Glass Units: Class 1 (clear) annealed Kind HS (heat-strengthened) float glass where heat strengthening is required to resist thermal stresses induced by differential shading of individual glass lites and to comply with system performance requirements and float glass where required for safety glazing.
  - 1. Min. thickness: 6.0 mm.

## 2.9 INSULATING-GLASS UNITS

- A. Passive Solar Low-E Insulating-Glass Units:
  - 1. Basis-of-Design Product: Visteon; or a comparable product by one of the following:
    - a. AFG Industries, Inc.
    - b. Guardian Industries.
    - c. Pilkington Building Products, North America
    - d. PPG Industries, Inc.
    - d. Viracon, Inc.

2. Composition:
  - a. Outer lite: 3/8" (8mm) Clear HS with Low-E coating on #2 surface.
  - b. Interspace Content: Argon gas
  - c. Inner lite: 1/4" (6mm) Clear HS/.060 (1.52 mm) clear PVB/1/4" (6mm) Clear HS
3. Visible Light Transmittance: 44 percent minimum.
4. Winter Nighttime U-Factor: .30 maximum.
5. Summer Daytime U-Factor: .28 maximum.
6. Solar Heat Gain Coefficient: .37 minimum.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine framing glazing, with Installer present, for compliance with the following:
  1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
  2. Presence and functioning of weep system.
  3. Minimum required face or edge clearances.
  4. Effective sealing between joints of glass-framing members.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

### 3.3 GLAZING, GENERAL

- A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.
- B. Glazing channel dimensions, as indicated on Drawings, provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by Project conditions during installation.
- C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.

- D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.
- E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- G. Provide spacers for glass lites where length plus width is larger than **50 inches (1270 mm)** as follows:
  - 1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
  - 2. Provide **1/8-inch (3-mm)** minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.
- H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.
- I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.
- J. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.
- K. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

### 3.4 GASKET GLAZING (DRY)

- A. Fabricate compression gaskets in lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.
- B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.
- C. Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets

to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

- D. Install gaskets so they protrude past face of glazing stops.

### 3.5 CLEANING AND PROTECTION

- A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels, and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations, including weld splatter. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended by glass manufacturer.
- C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains; remove as recommended in writing by glass manufacturer.
- D. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.
- E. Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

END OF SECTION 08800

**PART 1 - GENERAL**

**1.1 WORK INCLUDED**

- A. Decorative glazing.

**1.2 REFERENCES**

- A. FGMA -Glazing Manual.
- B. ASTM C 1036: Standard Specification for Flat Glass.
- C. ASTM C 1048: Standard Specifications for Heat-Treated Flat Glass - Kind HS, Kind HT Coated and Uncoated Glass

**1.3 QUALITY ASSURANCE**

- A. Conform to Flat Glass Marketing Association (FGMA) Glazing Manual for glazing installation methods.

**1.4 SUBMITTALS**

- A. Submit product data under provisions of Section 01330.
- B. Provide structural, physical and environmental characteristics, size limitations, special handling or installation requirements.
- C. Provide data on glazing sealant. Identify colors available.
- D. Submit sealed glass unit manufacturer's certificate under provisions of Section 01400 indicating units meet or exceed specified requirements.

**1.5 SUSTAINABLE DESIGN SUBMITTALS**

- A. Section 01811 - Sustainable Design Requirements: Requirements for sustainable design submittals.
- B. Manufacturer's Certificate: Certify products meet or exceed specified sustainable design requirements.
  - 1. Materials Resources Certificates:
    - a. Certify recycled material content for recycled content products.
    - b. Certify source for local and regional materials and distance from Project site.
  - 2. Indoor Air Quality Certificates:
    - a. Certify volatile organic compound content for each interior adhesive and sealant and related primer.

- C. Product Cost Data: Submit cost of products to verify compliance with Project sustainable design requirements. Exclude cost of labor and equipment to install products.
  - 1. Provide cost data for the following products:
    - a. Products with recycled material content.
    - b. Local and regional products.

#### **1.6 DELIVERY, STORAGE, AND PROTECTION**

- A. Deliver products to site under provisions of Section 01600.
- B. Store and protect products under provisions of Section 01600.

#### **1.7 WARRANTY**

- A. Provide ten year manufacturer's warranty under provisions of Section 01700.

### **PART 2 - PRODUCTS**

#### **2.1 ACCEPTABLE GLASS MANUFACTURERS**

- A. Vivid Glass:
  - 1. Style: Vivigraphix View
  - 2. Description: Safety laminated glass w/ double inner layers per architect's custom graphic. To match architect's control sample
- B. Pulp Studio
  - 1. Style: .
  - 2. Description: .
- C. Bendheim
  - 1. Style: .
  - 2. Description: .
- D. Substitutions: Under provisions of Section 01600.

#### **2.2 MATERIALS**

- A. Plate Glass:
  - 1. 1/4 inch clear glass meeting ASTM C 1036 Glazing Select Quality.
- B. Tempered Glass:
  - 1. 1/4 inch clear tempered glass meeting ASTM C 1048 Kind FT Type I Class 1.
- C. Laminated Glass:



1. Laminated architectural safety glass consisting of 2 lites of clear 1/8 inch thick tempered glass meeting ASTM C 1172 Kind LHS with double inner layers with custom graphic.

## **2.3 ACCEPTABLE GLAZING ACCESSORIES MANUFACTURERS**

- A. Tremco.
- B. Substitutions: Under provisions of Section 01600.

## **2.4 GLAZING ACCESSORIES**

- A. Setting Blocks: Neoprene; 70-90 Shore A durometer hardness; 4 inch long x 3/8 inch wide x 1/4 inch high.
- B. Spacer Shims: Neoprene; 50 Shore A durometer hardness; 3 inch long x 1/4 inch wide x 1/4 inch thick; self adhesive one face.
- C. Glazing Tape: Pre-shimmed Tremco 440 tape.
- D. Sealant: Tremco Dymeric.
- E. Glazing Clips: Manufacturer's standard type.

# **PART 3 - EXECUTION**

## **3.1 INSPECTION**

- A. Verify surfaces of glazing channels or recesses are clean, free of obstructions, and ready for work of this Section.
- B. Beginning of installation means acceptance of substrate.

## **3.2 PREPARATION**

- A. Clean contact surfaces with solvent and wipe dry.
- B. Seal porous glazing channels or recesses.
- C. Prime surfaces scheduled to receive sealant.

## **3.3 INTERIOR DRY METHOD (TAPE AND TAPE)**

- A. Cut glazing tape to length and set against permanent stops, projecting 1/16 inch above sightline.
- B. Place setting blocks at 1/4 points.
- C. Rest glass on setting blocks and push against tape for full contact at perimeter of pane.

- D. Place glazing tape on free perimeter of pane in same manner described above.
- E. Install removable stop without displacement of tape. Exert pressure on tape for full continuous contact.
- F. Knife trim protruding tape.

**3.4 CLEANING**

- A. After installation, mark pane with an "X" by using plastic tape or removable paste.
- B. Remove glazing materials from finish surfaces.
- C. Remove labels after work is completed.

**END OF SECTION**

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

**SECTION 08911  
GLAZED ALUMINUM  
CURTAIN WALLS**

**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 conventionally glazed and structurally glazed aluminum curtain walls installed as unitized assemblies.
  - 1. The glazed curtain wall system described in the Contract Documents represents the design of a system for enclosing the building.
  - 2. The Contract Documents describe the general scope and essence of the glazed curtain wall work in terms of the design concept, principal dimensions, and major elements. They do not describe all of the requirements for the work. Design conditions which are not detailed in the Contract Documents shall be fully developed in shop drawings for the Architect's review
- B. Related Sections:
  - 1. Division 7 Section "Joint Sealants" for installation of joint sealants installed with glazed aluminum curtain walls and for sealants to the extent not specified in this Section.

**1.3 PERFORMANCE REQUIREMENTS**

- A. General Performance: Comply with performance requirements specified, as determined by testing of manufacturer's standard glazed aluminum curtain walls representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.
  - 1. Glazed aluminum curtain walls shall withstand movements of supporting structure indicated on Drawings including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
  - 2. Failure also includes the following:

- a. Thermal stresses transferring to building structure.
  - b. Glass breakage.
  - c. Noise or vibration created by wind and thermal and structural movements.
  - d. Loosening or weakening of fasteners, attachments, and other components.
  - e. Failure of operating units.
- B. Delegated Design: Design glazed aluminum curtain walls, including comprehensive engineering analysis, using performance requirements and design criteria indicated. Design the system and analyze support elements in their entirety to resist the required loadings and transfer the reactions to adequate support elements included for the main building structure:
- 1. Provide labor, design, engineering calculations, drafting, material, and equipment necessary for proper design, execution, completion, and satisfactory performance of the work.
  - 2. Employ a qualified structural engineer, licensed in the State of Minnesota, to be responsible for the design of the curtain wall system, including coordination with adjacent work.
  - 3. Design, engineer, fabricate, assemble, and install the glazed curtain wall system to withstand design wind pressure loads based on code requirements, inward and outward acting at any point on the system, and design and construction floor loads.
  - 4. System shall be shop glazed where possible.
  - 5. Exterior profiles and centerline dimensions shall be as shown on the Drawings, except as accepted by the Architect.
  - 6. Interior profiles shall be as shown on the Drawings, except as accepted by the Architect.
  - 7. Locations of structural support shall be as indicated. Supporting connections shall be designed for three-dimensional adjustment and accurate location of components.
  - 8. Glass areas shall be designed for ease of reglazing. Provide removable stops for installation and replacement of glass. Stops shall be removable without deformation of the stops.
  - 9. Exterior building maintenance and window washing will be performed from the ground.
  - 10. Primary and secondary controlled drainage systems shall be provided to the exterior face of the wall for water entering at joints and condensation taking place within the construction.
  - 11. Weather barrier system shall be continuous.
  - 12. In general, sealants and tapes shall be concealed unless otherwise indicated.
  - 13. In general, fasteners shall be concealed unless otherwise indicated.
  - 14. In general, joints, welding, and other fabrication requirements shall be as specified herein.
  - 15. Finishes shall be as specified herein.
  - 16. Fabrication and installation tolerances shall be as specified herein.
  - 17. Performance requirements shall be as specified herein.

18. The insulated glass units shall resist the local and global out of plane deflections due to wind and live loading.
- C. Structural Loads:
1. Wind Loads: As indicated.
- D. Structural-Test Performance: Test according to ASTM E 330 as follows:
1. When tested at positive and negative wind-load design pressures, assemblies do not evidence deflection exceeding specified limits.
  2. When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, and permanent deformation of main framing members exceeding 0.2 percent of span.
  3. Test Durations: As required by design wind velocity, but not less than 10 seconds.
- E. Deflection of Framing Members: At design wind pressure, as follows:
1. Deflection Normal to Wall Plane: Limited to edge of glass in a direction perpendicular to glass plane not exceeding  $L/175$  of the glass edge length for each individual glazing lite or an amount that restricts edge deflection of individual glazing lites to **3/4 inch (19 mm)**, whichever is less.
  2. Deflection Parallel to Glazing Plane: Limited to amount not exceeding that which reduces glazing bite to less than 75 percent of design dimension and that which reduces edge clearance between framing members and glazing or other fixed components to less than **1/8 inch (3.2 mm)**.
    - a. Operable Units: Provide a minimum **1/16-inch (1.6-mm)** clearance between framing members and operable units.
  3. Cantilever Deflection: Where framing members overhang an anchor point, limit deflection to two times the length of cantilevered member, divided by 175.
- F. Seismic Performance: Glazed aluminum curtain walls shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.
1. Component Importance Factor is 1.5.
- G. Water Penetration under Static Pressure: No evidence of water penetration through fixed glazing and framing areas when tested according to ASTM E 331 at a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than **6.24 lbf/sq. ft. (300 Pa)**.

- H. Water Penetration under Dynamic Pressure: No evidence of water penetration through fixed glazing and framing areas when tested according to AAMA 501.1 at dynamic pressure equal to 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft. (300 Pa).
  - 1. Maximum Water Leakage: No uncontrolled water penetrating assemblies or water appearing on assemblies' normally exposed interior surfaces from sources other than condensation. Water leakage does not include water controlled by flashing and gutters that is drained to exterior.
- I. Thermal Movements: Allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures:
  - 1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
  - 2. Test Interior Ambient-Air Temperature: 75 deg F (24 deg C).
- J. Energy Performance: Glazed aluminum curtain walls shall have certified and labeled energy performance ratings in accordance with NFRC.
  - 1. Thermal Transmittance (U-factor): Fixed glazing and framing areas shall have U-factor of not more than 0.34 Btu/sq. ft. x h x deg F (2.55 W/sq. m x K) as determined according to NFRC 100.
  - 2. Solar Heat Gain Coefficient: Fixed glazing and framing areas shall have a solar heat gain coefficient of no greater than 0.37 as determined according to NFRC 200.
  - 3. Air Infiltration: Maximum air leakage through fixed glazing and framing areas of 0.30 cfm/sq. ft. (1.50 L/s per sq. m) of fixed wall area as determined according to ASTM E 283 at a minimum static-air-pressure differential of 6.24 lbf/sq. ft. (300 Pa).
  - 4. Condensation Resistance: Fixed glazing and framing areas shall have an NFRC- certified condensation resistance rating of no less than 15 as determined according to NFRC 500.
- K. Sound Transmission: Provide glazed aluminum curtain walls with fixed glazing and framing areas having the following sound-transmission characteristics:
  - 1. Outdoor-Indoor Transmission Class: Minimum 35 when tested for laboratory sound transmission loss according to ASTM E 90 and determined by ASTM E 1332.

#### 1.4 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 glazed aluminum curtain walls. Include plans, elevations, sections, full-size details, and attachments to other work.
  - 1. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
  - 2. Include full-size isometric details of each vertical-to-horizontal intersection of glazed aluminum curtain walls, showing the following:
    - a. Joinery, including concealed welds.
    - b. Anchorage.
    - c. Expansion provisions.
    - d. Glazing.
    - e. Flashing and drainage.
- C. Samples for Initial Selection: For units with factory-applied color finishes.
- D. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.
- E. Fabrication Sample: Of each vertical-to-horizontal intersection of assemblies, made from 12-inch (300-mm) lengths of full-size components and showing details of the following:
  - 1. Joinery, including concealed welds.
  - 2. Anchorage.
  - 3. Expansion provisions.
  - 4. Glazing.
  - 5. Flashing and drainage.
- F. Delegated-Design Submittal: For glazed aluminum curtain walls indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified structural engineer responsible for their preparation.
- G. Qualification Data: For qualified Installer and testing agency.
- H. Seismic Qualification Certificates: For glazed aluminum curtain walls, accessories, and components, from manufacturer.
  - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
- I. Welding certificates.
- J. Energy Performance Certificates: For glazed aluminum curtain walls, accessories, and components, from manufacturer.
  - 1. Basis for Certification: NFRC-certified energy performance values for each glazed aluminum curtain wall.

- K. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified preconstruction testing agency, for glazed aluminum curtain walls, indicating compliance with performance requirements.
- L. Field quality-control reports.
- M. Maintenance Data: For glazed aluminum curtain walls to include in maintenance manuals.
- N. Warranties: Sample of special warranties.

## 1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A manufacturer capable of fabricating glazed aluminum curtain walls that meet or exceed energy performance requirements indicated and of documenting this performance by certification, labeling, and inclusion in lists.
- B. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
- C. Testing Agency Qualifications: Qualified according to ASTM E 699 for testing indicated.
- D. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.
  - 1. Do not revise intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If revisions are proposed, submit comprehensive explanatory data to Architect for review.
- E. Welding Qualifications: Qualify procedures and personnel according to the following:
  - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
  - 2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
- F. Energy Performance Standards: Comply with NFRC for minimum standards of energy performance, materials, components, accessories, and fabrication. Comply with more stringent requirements if indicated.
  - 1. Provide NFRC-certified glazed aluminum curtain walls with an attached label.



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

## 1.6 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of structural supports for glazed aluminum curtain walls by field measurements before fabrication and indicate measurements on Shop Drawings.

## 1.7 WARRANTY

- A. Special Assembly Warranty: Standard form in which manufacturer agrees to repair or replace components of glazed aluminum curtain walls that do not comply with requirements or that fail in materials or workmanship within specified warranty period.

- 1. Failures include, but are not limited to, the following:
  - a. Structural failures including, but not limited to, excessive deflection.
  - b. Noise or vibration created by wind and thermal and structural movements.
  - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
  - d. Water penetration through fixed glazing and framing areas.
  - e. Failure of operating components.

- 2. Warranty Period: Five years from date of Substantial Completion.

- B. Special Finish Warranty: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.

- 1. 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. Warranty Period: 20 years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
1. Arch Aluminum & Glass Co., Inc.
  2. EFCO Corporation.
  3. Enclos Corp.
  4. Harmon, Inc.
  5. Kawneer North America; an Alcoa company.
  6. Permasteelisa North America.
  7. Pittco Architectural Metals, Inc.
  8. Tubelite.
  9. United States Aluminum.
  10. Vistawall Architectural Products; The Vistawall Group; a Bluescope Steel company.
  11. Wausau Window and Wall Systems.

### 2.2 MATERIALS

- A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
1. Sheet and Plate: **ASTM B 209 (ASTM B 209M)**.
  2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221 (ASTM B 221M).
  3. Extruded Structural Pipe and Tubes: ASTM B 429.
  4. Structural Profiles: ASTM B 308/B 308M.
  5. Welding Rods and Bare Electrodes: AWS A5.10/A5.10M.
- B. Steel Reinforcement: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM and prepare surfaces according to applicable SSPC standard.
1. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
  2. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
  3. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

### 2.3 FRAMING

- A. Framing Members: Manufacturer's standard extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.

1. Construction: Nonthermal.
  2. Glazing System: Retained mechanically with gaskets on four sides.
  3. Glazing Plane: Front.
- B. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.
- C. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
  2. Reinforce members as required to receive fastener threads.
- D. Anchors: Three-way adjustable anchors with minimum adjustment of **1 inch (25.4 mm)** that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.
1. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123/A 123M or ASTM A 153/A 153M requirements.
- E. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.
- F. Framing Sealants: Manufacturer's standard sealants.

## 2.4 GLAZING

- A. Glazing: Comply with Division 8 Section "Glazing."
- B. Glazing Gaskets: Manufacturer's standard sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers.
- C. Glazing Sealants: As recommended by manufacturer.

## 2.5 INSULATED SPANDREL PANELS

- A. Insulated Spandrel Panels: Laminated, metal-faced flat panels with no deviations in plane exceeding 0.8 percent of panel dimension in width or length.
1. Overall Panel Thickness: **1 inch (25.4 mm)**.

2. Exterior Skin: Aluminum.
  - a. Thickness: Manufacturer's standard for finish and texture indicated.
  - b. Finish: Matching framing system.
  - c. Texture: Smooth.
  - d. Backing Sheet: 0.125-inch- (3.2-mm-) thick, corrugated, high-density polyethylene.
3. Interior Skin: Aluminum.
  - a. Thickness: Manufacturer's standard for finish and texture indicated.
  - b. Finish: Matching curtain-wall framing.
  - c. Texture: Smooth.
  - d. Backing Sheet: 0.125-inch- (3.2-mm-) thick, corrugated, high-density polyethylene.
4. Thermal Insulation Core: Manufacturer's standard rigid, closed-cell, polyisocyanurate board.
5. Surface-Burning Characteristics: For exposed interior surfaces of panels, when tested according to ASTM E 84 as follows:
  - a. Flame-Spread Index: 25 or less.
  - b. Smoke-Developed Index: 450 or less.

## 2.6 ACCESSORY MATERIALS

- A. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil (0.762-mm) thickness per coat.

## 2.7 FABRICATION

- A. Form or extrude aluminum shapes before finishing.
- B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
- C. Fabricate components that, when assembled, have the following characteristics:
  1. Profiles that are sharp, straight, and free of defects or deformations.
  2. Accurately fitted joints with ends coped or mitered.
  3. Physical and thermal isolation of glazing from framing members.

4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
  5. Provisions for field replacement of glazing from exterior.
  6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
- D. Fabricate components that, when assembled, have the following characteristics:
1. Internal guttering system or other means to drain water passing joints, condensation occurring within framing members, and moisture migrating within glazed aluminum curtain wall to exterior.
  2. Pressure-equalized system or double barrier design with primary air and vapor barrier at interior side of glazed aluminum curtain wall and secondary seal weeped and vented to exterior.
- E. Curtain-Wall Framing: Fabricate components for assembly using shear-block system.
- F. Factory-Assembled Frame Units:
1. Rigidly secure nonmovement joints.
  2. Seal joints watertight unless otherwise indicated.
  3. Install glazing to comply with requirements in Division 8 Section "Glazing."
- G. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

## 2.8 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

#### A. General:

1. Comply with manufacturer's written instructions.
2. Do not install damaged components.
3. Fit joints to produce hairline joints free of burrs and distortion.
4. Rigidly secure nonmovement joints.
5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
6. Seal joints watertight unless otherwise indicated.

#### B. Metal Protection:

1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape or installing nonconductive spacers as recommended by manufacturer for this purpose.
2. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

#### C. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within glazed aluminum curtain wall to exterior.

#### D. Install components plumb and true in alignment with established lines and grades.

#### E. Install operable units level and plumb, securely anchored, and without distortion. Adjust weather-stripping contact and hardware movement to produce proper operation.

### 3.3 ERECTION TOLERANCES

#### A. Erection Tolerances: Install glazed aluminum curtain walls to comply with the following maximum tolerances:

1. Plumb: **1/8 inch in 10 feet (3.2 mm in 3 m); 1/4 inch in 40 feet (6 mm in 12 m).**
2. Level: **1/8 inch in 20 feet (3.2 mm in 6 m); 1/4 inch in 40 feet (6 mm in 12 m).**
3. Alignment:
  - a. Where surfaces abut in line or are separated by reveal or protruding element up to **1/2 inch (12.7 mm)** wide, limit offset from true alignment to **1/16 inch (1.6 mm).**
  - b. Where surfaces are separated by reveal or protruding element from **1/2 to 1 inch (12.7 to 25.4 mm)** wide, limit offset from true alignment to **1/8 inch (3.2 mm).**

- c. Where surfaces are separated by reveal or protruding element of 1 inch (25.4 mm) wide or more, limit offset from true alignment to 1/4 inch (6 mm).
- 4. Location: Limit variation from plane to 1/8 inch in 12 feet (3.2 mm in 3.7 m); 1/2 inch (12.7 mm) over total length.

### 3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Testing Services: Testing and inspecting of representative areas of glazed aluminum curtain walls shall take place as installation proceeds to determine compliance of installed assemblies with specified requirements.
  - 1. Air Infiltration: Areas shall be tested for air leakage of 1.5 times the rate specified for laboratory testing in "Performance Requirements" Article, but not more than 0.50 cfm/sq. ft. (2.25 L/s per sq. m), of fixed wall area when tested according to ASTM E 783 at a minimum static-air-pressure differential of 6.24 lbf/sq. ft. (300 Pa).
    - a. Test Area: One bay wide, but not less than 30 feet (9.1 m), by one story of glazed aluminum curtain wall.
    - b. Perform a minimum of three tests in areas as directed by Architect.
  - 2. Water Penetration: Areas shall be tested according to ASTM E 1105 at a minimum uniform and cyclic static-air-pressure differential of 0.67 times the static-air-pressure differential specified for laboratory testing in "Performance Requirements" Article, but not less than 6.24 lbf/sq. ft. (300 Pa), and shall not evidence water penetration.
    - a. Test Area: One bay wide, but not less than 30 feet (9.1 m), by one story of glazed aluminum curtain wall.
    - b. Perform a minimum of three tests in areas as directed by Architect.
  - 3. Water Spray Test: Before installation of interior finishes has begun, areas designated by Architect shall be tested according to AAMA 501.2 and shall not evidence water penetration.
    - a. Test Area: A minimum area of 75 feet (23 m) by one story of glazed aluminum curtain wall.
- C. Glazed aluminum curtain walls will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

END OF SECTION 08911



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

**SECTION 09111 – NON-STRUCTURAL  
STEEL FRAMING**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

- A. This Section includes non-load-bearing steel framing members for the following applications:
  - 1. Interior framing systems (e.g., supports for partition walls, framed soffits, furring and support for other interior finishes requiring framing.
  - 2. Interior suspension systems including supports for ceilings and suspended soffits.
- B. Related Sections include the following:
  - 1. Division 5 Section "Cold-Formed Metal Framing" for exterior and interior load-bearing and exterior non-load-bearing framing.
  - 2. Division 7 Section "Building Insulation" for insulation installed with Z-shaped furring members.
  - 3. Division 7 Section "Fire-Resistive Joint Systems" for head-of-wall joint systems installed with non-load-bearing steel framing.
  - 4. Division 9 Section "Gypsum Board Shaft-Wall Assemblies" for non-load-bearing metal shaft-wall framing, gypsum panels, and other components of shaft-wall assemblies.

**1.3 SUBMITTALS**

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

**1.4 QUALITY ASSURANCE**

- A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

## PART 2 - PRODUCTS

### 2.1 NON-LOAD-BEARING STEEL FRAMING, GENERAL

- A. Framing Members, General: Comply with ASTM C 754 for conditions indicated.
  - 1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal, unless otherwise indicated.
  - 2. Protective Coating: ASTM A 653/A 653M, **G40** (**Z120**) hot-dip galvanized, unless otherwise indicated.

### 2.2 SUSPENSION SYSTEM COMPONENTS

- A. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, **0.0625-inch** (**1.59-mm**-) diameter wire, or double strand of **0.0475-inch** (**1.21-mm**-) diameter wire.
- B. Hanger Attachments to Concrete:
  - 1. Anchors: Fabricated from corrosion-resistant materials with holes or loops for attaching wire hangers and capable of sustaining, without failure, a load equal to 5 times that imposed by construction as determined by testing according to ASTM E 488 by an independent testing agency.
    - a. Type: Postinstalled, chemical anchor or postinstalled, expansion anchor.
  - 2. Powder-Actuated Fasteners: Suitable for application indicated, fabricated from corrosion-resistant materials with clips or other devices for attaching hangers of type indicated, and capable of sustaining, without failure, a load equal to 10 times that imposed by construction as determined by testing according to ASTM E 1190 by an independent testing agency.
- C. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, **0.162-inch** (**4.12-mm**) diameter.
- D. Carrying Channels: Cold-rolled, commercial-steel sheet with a base-metal thickness of **0.0538 inch** (**1.37 mm**) and minimum **1/2-inch** (**12.7-mm**-) wide flanges.

1. Depth: As indicated on Drawings.
- E. Furring Channels (Furring Members):
1. Steel Studs: ASTM C 645.
    - a. Minimum Base-Metal Thickness: 0.0179 inch (0.45 mm).
    - b. Depth: As indicated on Drawings.
  2. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8 inch (22.2 mm) deep.
    - a. Minimum Base Metal Thickness: 0.0179 inch (0.45 mm).
- F. Grid Suspension System for Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Armstrong World Industries, Inc.; Drywall Grid Systems.
    - b. Chicago Metallic Corporation; Drywall Furring System.
    - c. USG Corporation; Drywall Suspension System.
    - d. Approved equivalent.

## 2.3 STEEL FRAMING FOR FRAMED ASSEMBLIES

- A. Steel Studs and Runners: ASTM C 645.
1. Minimum Base-Metal Thickness: 0.0312 inch (0.79 mm).
  2. Depth: As indicated on Drawings.
- B. Slip-Type Head Joints: Where indicated, provide one of the following:
1. Single Long-Leg Runner System: ASTM C 645 top runner with 2-inch- (50.8-mm-) deep flanges in thickness not less than indicated for studs, installed with studs friction fit into top runner and with continuous bridging located within 12 inches (305 mm) of the top of studs to provide lateral bracing.
  2. Double-Runner System: ASTM C 645 top runners, inside runner with 2-inch- (50.8-mm-) deep flanges in thickness not less than indicated for studs and fastened to studs, and outer runner sized to friction fit inside runner.
  3. Deflection Track: Steel sheet top runner manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.

- a. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
    - 1) Steel Network Inc. (The); VertiTrack VTD Series.
    - 2) Superior Metal Trim; Superior Flex Track System (SFT).
    - 3) Approved equivalent.
- C. Firestop Tracks: Top runner manufactured to allow partition heads to expand and contract with movement of the structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.
  - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Fire Trak Corp.; Fire Trak attached to studs with Fire Trak Slip Clip.
    - b. Metal-Lite, Inc.; The System.
    - c. Approved equivalent.
- D. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
  - 1. Minimum Base-Metal Thickness: 0.0179 inch (0.45 mm).
- E. Cold-Rolled Channel Bridging: 0.0538-inch (1.37-mm) bare-steel thickness, with minimum 1/2-inch- (12.7-mm-) wide flanges.
  - 1. Depth: 1-1/2 inches (38.1 mm) minimum.
  - 2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches (38.1 by 38.1 mm), 0.068-inch- (1.73-mm-) thick, galvanized steel.
- F. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
  - 1. Minimum Base Metal Thickness: 0.0179 inch (0.45 mm).
  - 2. Depth: 7/8 inch (22.2 mm).
- G. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches (31.8 mm), wall attachment flange of 7/8 inch (22.2 mm), minimum bare-metal thickness of 0.0179 inch (0.45 mm), and depth required to fit insulation thickness indicated.

## 2.4 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards.

1. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.
- B. Isolation Strip at Exterior Walls: Provide one of the following:
1. Asphalt-Saturated Organic Felt: ASTM D 226, Type I (No. 15 asphalt felt), nonperforated.
  2. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, **1/8 inch (3.2 mm)** thick, in width to suit steel stud size.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance.
1. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION, GENERAL

- A. Installation Standard: ASTM C 754, except comply with framing sizes and spacing indicated.
1. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.
- B. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
- C. Install bracing at terminations in assemblies.
- D. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

### 3.3 INSTALLING SUSPENSION SYSTEMS

- A. Install suspension system components in sizes and spacings indicated on Drawings, but not less than those required by referenced installation standards for assembly types and other assembly components indicated.

- B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.
- C. Suspend hangers from building structure as follows:
  - 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.
    - a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
  - 2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
    - a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.
  - 3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
  - 4. Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
  - 5. Do not attach hangers to steel roof deck.
  - 6. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
  - 7. Do not connect or suspend steel framing from ducts, pipes, or conduit.
- D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.
- E. Seismic Bracing: Sway-brace suspension systems with hangers used for support.
- F. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.
- G. Installation Tolerances: Install suspension systems that are level to within **1/8 inch in 12 feet (3 mm in 3.6 m)** measured lengthwise on each member

that will receive finishes and transversely between parallel members that will receive finishes.

### 3.4 INSTALLING FRAMED ASSEMBLIES

- A. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
- B. Install studs so flanges within framing system point in same direction.
  - 1. Space studs as follows:
    - a. Single-Layer Application: 16 inches (406 mm) o.c., unless otherwise indicated.
    - b. Multilayer Application: 16 inches (406 mm) o.c., unless otherwise indicated.
    - c. Tile backing panels: 16 inches (406 mm) o.c., unless otherwise indicated.
- C. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.
  - 1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
  - 2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
    - a. Install two studs at each jamb, unless otherwise indicated.
    - b. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
  - 3. Other Framed Openings: Frame openings other than door openings the same as required for door openings, unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
  - 4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
    - a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.
  - 5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.

## 6. Curved Partitions:

- a. Bend track to uniform curve and locate straight lengths so they are tangent to arcs.
- b. Begin and end each arc with a stud, and space intermediate studs equally along arcs. On straight lengths of not less than 2 studs at ends of arcs, place studs **6 inches (150 mm)** o.c.

## D. Direct Furring:

1. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced **24 inches (610 mm)** o.c.

## E. Z-Furring Members:

1. Erect insulation (specified in Division 7 Section "Building Insulation") vertically and hold in place with Z-furring members spaced **24 inches (610 mm)** o.c.
2. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced **24 inches (600 mm)** o.c.
3. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel. At interior corners, space second member no more than **12 inches (300 mm)** from corner and cut insulation to fit.

- F. Installation Tolerance: Install each framing member so fastening surfaces vary not more than **1/8 inch (3 mm)** from the plane formed by faces of adjacent framing.

END OF SECTION 09111



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**SECTION 09250  
GYPSUM BOARD**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

- A. This Section includes the following:
  - 1. Interior gypsum board.
  - 2. Exterior gypsum board for ceilings and soffits.
  - 3. Tile backing panels.
- B. Related Sections include the following:
  - 1. Division 5 Section "Cold-Formed Metal Framing" for load-bearing steel framing that supports gypsum board.
  - 2. Division 6 Section "Rough Carpentry" for wood framing and furring that supports gypsum board.
  - 3. Division 6 Section "Sheathing" for gypsum sheathing.
  - 4. Division 7 Section "Building Insulation" for insulation and vapor retarders installed in assemblies that incorporate gypsum board.
  - 5. Division 7 Section "Fire-Resistive Joint Systems" for head-of-wall assemblies that incorporate gypsum board.
  - 6. Division 9 Section "Non-Load-Bearing Steel Framing" for non-structural framing and suspension systems that support gypsum board.
  - 7. Division 9 Section "Gypsum Shaft-Wall Assemblies" for metal shaft-wall framing, gypsum shaft liners, and other components of shaft-wall assemblies.
  - 8. Division 9 painting Sections for primers applied to gypsum board surfaces.

**1.3 SUBMITTALS**

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

#### 1.4 QUALITY ASSURANCE

- A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.
- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

#### 1.5 STORAGE AND HANDLING

- A. Store materials inside under cover and keep them dry and protected against damage from weather, condensation, direct sunlight, construction traffic, and other causes. Stack panels flat to prevent sagging.

#### 1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.
- B. Do not install interior products until installation areas are enclosed and conditioned.
- C. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.
  - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
  - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

### PART 2 - PRODUCTS

#### 2.1 PANELS, GENERAL

- A. Size: Provide in maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

#### 2.2 INTERIOR GYPSUM BOARD

- A. General: Complying with ASTM C 36/C 36M or ASTM C 1396/C 1396M, as applicable to type of gypsum board indicated and whichever is more stringent.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. American Gypsum Co.
  - b. BPB America Inc.
  - c. G-P Gypsum.
  - d. Lafarge North America Inc.
  - e. National Gypsum Company.
  - f. PABCO Gypsum.
  - g. Temple.
  - h. USG Corporation.
  
- B. Type X:
  1. Thickness: 5/8 inch (15.9 mm).
  2. Long Edges: Tapered.
  
- C. Type C:
  1. Thickness: As required by fire-resistance-rated assembly indicated on Drawings.
  2. Long Edges: Tapered.
  
- D. Flexible Type: Manufactured to bend to fit radii and to be more flexible than standard regular-type gypsum board of same thickness.
  1. Thickness: 1/4 inch (6.4 mm).
  2. Long Edges: Tapered.
  
- E. Ceiling Type: Manufactured to have more sag resistance than regular-type gypsum board.
  1. Thickness: 1/2 inch (12.7 mm).
  2. Long Edges: Tapered.
  
- F. Abuse-Resistant Type: Manufactured to produce greater resistance to surface indentation, through-penetration (impact resistance), and abrasion than standard, regular-type and Type X gypsum board.
  1. Core: As indicated on Drawings.
  2. Long Edges: Tapered.
  
- G. Moisture- and Mold-Resistant Type: With moisture- and mold-resistant core and surfaces.
  1. Core: 5/8 inch (15.9 mm), Type X.
  2. Long Edges: Tapered.

## 2.3 EXTERIOR GYPSUM BOARD FOR CEILINGS AND SOFFITS

- A. Exterior Gypsum Soffit Board: ASTM C 931/C 931M or ASTM C 1396/C 1396M, with manufacturer's standard edges.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. American Gypsum Co.
    - b. BPB America Inc.
    - c. G-P Gypsum.
    - d. Lafarge North America Inc.
    - e. National Gypsum Company.
    - f. PABCO Gypsum.
    - g. Temple.
    - h. USG Corporation.
  - 2. Core: As indicated.
- B. Glass-Mat Gypsum Sheathing Board: ASTM C 1177/C 1177M.
  - 1. Product: Subject to compliance with requirements, provide "Dens-Glass Gold" by G-P Gypsum.
  - 2. Core: 5/8 inch (15.9 mm), Type X.

## 2.4 TILE BACKING PANELS

- A. Water-Resistant Gypsum Backing Board: ASTM C 630/C 630M or ASTM C 1396/C 1396M.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. American Gypsum Co.
    - b. BPB America Inc.
    - c. G-P Gypsum.
    - d. Lafarge North America Inc.
    - e. National Gypsum Company.
    - f. PABCO Gypsum.
    - g. Temple.
    - h. USG Corporation.
  - 2. Core: As indicated on Drawings.
- B. Glass-Mat, Water-Resistant Backing Board:
  - 1. Complying with ASTM C 1178/C 1178M.
    - a. Product: Subject to compliance with requirements, provide "DensShield Tile Guard" by G-P Gypsum.

2. Complying with ASTM C1177/C 1177M.
  - a. Product: Subject to compliance with requirements, provide "DensArmor Plus Interior Guard" by G-P Gypsum.
3. Core: As indicated on Drawings.

C. Cementitious Backer Units: ANSI A118.9.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:
  - a. Custom Building Products; Wonderboard.
  - b. FinPan, Inc.; Util-A-Crete Concrete Backer Board.
  - c. USG Corporation; DUROCK Cement Board.
3. Thickness: As indicated on Drawings.

## 2.5 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.

1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc.
2. Shapes:
  - a. Cornerbead.
  - b. LC-Bead: J-shaped; exposed long flange receives joint compound.
  - c. L-Bead: L-shaped; exposed long flange receives joint compound.
  - d. Expansion (control) joint.
  - e. Curved-Edge Cornerbead: With notched or flexible flanges.

B. Exterior Trim: ASTM C 1047.

1. Material: Hot-dip galvanized steel sheet or rolled zinc.
2. Shapes:
  - a. Cornerbead.
  - b. LC-Bead: J-shaped; exposed long flange receives joint compound.
  - c. Expansion (Control) Joint: One-piece, rolled zinc with V-shaped slot and removable strip covering slot opening.

- C. Aluminum Trim: Extruded accessories of profiles and dimensions indicated.
  - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Fry Reglet Corp.
    - b. Gordon, Inc.
    - c. Pittcon Industries.
  - 3. Aluminum: Alloy and temper with not less than the strength and durability properties of **ASTM B 221** (**ASTM B 221M**), Alloy 6063-T5.
  - 4. Finish: Corrosion-resistant primer compatible with joint compound and finish materials specified.

## 2.6 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C 475/C 475M.
- B. Joint Tape:
  - 1. Interior Gypsum Wallboard: Paper.
  - 2. Exterior Gypsum Soffit Board: Paper.
  - 3. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.
  - 4. Tile Backing Panels: As recommended by panel manufacturer.
- C. Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
  - 1. Prefilling: At open joints and damaged surface areas, use setting-type taping compound.
  - 2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.
    - a. Use setting-type compound for installing paper-faced metal trim accessories.
  - 3. Fill Coat: For second coat, use setting-type, sandable topping compound.
  - 4. Finish Coat: For third coat, use setting-type, sandable topping compound.
  - 5. Skim Coat: For final coat of Level 5 finish, use setting-type, sandable topping compound.

- D. Joint Compound for Exterior Applications:
  - 1. Exterior Gypsum Soffit Board: Use setting-type taping compound and setting-type, sandable topping compound.
  - 2. Glass-Mat Gypsum Sheathing Board: As recommended by sheathing board manufacturer.
- E. Joint Compound for Tile Backing Panels:
  - 1. Water-Resistant Gypsum Backing Board: Use setting-type taping compound and setting-type, sandable topping compound.
  - 2. Glass-Mat, Water-Resistant Backing Panel: As recommended by backing panel manufacturer.
  - 3. Cementitious Backer Units: As recommended by backer unit manufacturer.

## 2.7 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.
- B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.
- C. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
  - 1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick.
  - 2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.
- D. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
  - 1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
- E. Acoustical Sealant: As specified in Division 7 Section "Joint Sealants."
- F. Thermal Insulation: As specified in Division 7 Section "Building Insulation."

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames and framing, for compliance with requirements and other conditions affecting performance.
- B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 APPLYING AND FINISHING PANELS, GENERAL

- A. Comply with ASTM C 840.
- B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
- C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than **1/16 inch (1.5 mm)** of open space between panels. Do not force into place.
- D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.
- E. Form control and expansion joints with space between edges of adjoining gypsum panels.
- F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
  - 1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than **8 sq. ft. (0.7 sq. m)** in area.
  - 2. Fit gypsum panels around ducts, pipes, and conduits.
  - 3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow **1/4- to 3/8-inch- (6.4- to 9.5-mm-)** wide joints to install sealant.



- G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- (6.4- to 12.7-mm-) wide spaces at these locations, and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
- H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
- I. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.

### 3.3 APPLYING INTERIOR GYPSUM BOARD

- A. Install interior gypsum board in the following locations:
  - 1. Type X: As indicated on Drawings.
  - 2. Type C: As indicated on Drawings.
  - 3. Flexible Type: Apply in double layer at curved assemblies.
  - 4. Ceiling Type: As indicated on Drawings.
  - 5. Abuse-Resistant Type: As indicated on Drawings.
  - 6. Moisture- and Mold-Resistant Type: As indicated on Drawings.
- B. Single-Layer Application:
  - 1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing, unless otherwise indicated.
  - 2. On partitions/walls, apply gypsum panels vertically (parallel to framing), unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
    - a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
    - b. At stairwells and other high walls, install panels horizontally, unless otherwise indicated or required by fire-resistance-rated assembly.
  - 3. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
  - 4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.
- C. Multilayer Application:

1. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
2. Fastening Methods: Fasten base layers and face layers separately to supports with screws.

D. Curved Surfaces:

1. Install panels horizontally (perpendicular to supports) and unbroken, to extent possible, across curved surface plus **12-inch-(300-mm-)** long straight sections at ends of curves and tangent to them.
2. For double-layer construction, fasten base layer to studs with screws **16 inches (400 mm)** o.c. Center gypsum board face layer over joints in base layer, and fasten to studs with screws spaced **12 inches (300 mm)** o.c.

### 3.4 APPLYING EXTERIOR GYPSUM PANELS FOR CEILINGS AND SOFFITS

- A. Apply panels perpendicular to supports, with end joints staggered and located over supports.
  1. Install with **1/4-inch (6.4-mm)** open space where panels abut other construction or structural penetrations.
  2. Fasten with corrosion-resistant screws.

### 3.5 APPLYING TILE BACKING PANELS

- A. Water-Resistant Gypsum Backing Board: Install at showers, tubs, and where indicated. Install with **1/4-inch (6.4-mm)** gap where panels abut other construction or penetrations.
- B. Glass-Mat, Water-Resistant Backing Panel: Comply with manufacturer's written installation instructions and install where indicated. Install with **1/4-inch (6.4-mm)** gap where panels abut other construction or penetrations.
- C. Cementitious Backer Units: ANSI A108.11, at locations indicated to receive tile.
- D. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

### 3.6 INSTALLING TRIM ACCESSORIES

- A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
- B. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect for visual effect.
- C. Interior Trim: Install in the following locations:
  - 1. Cornerbead: Use at outside corners, unless otherwise indicated.
  - 2. LC-Bead: Use at exposed panel edges.
  - 3. L-Bead: Use where indicated.
  - 4. Curved-Edge Cornerbead: Use at curved openings.
- D. Exterior Trim: Install in the following locations:
  - 1. Cornerbead: Use at outside corners.
  - 2. LC-Bead: Use at exposed panel edges.
- E. Aluminum Trim: Install in locations indicated on Drawings.

### 3.7 FINISHING GYPSUM BOARD

- A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
- B. Prefill open joints and damaged surface areas.
- C. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.
- D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:
  - 1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
  - 2. Level 2: Panels that are substrate for tile.
  - 3. Level 4: At panel surfaces that will be exposed to view, unless otherwise indicated.
    - a. Primer and its application to surfaces are specified in other Division 9 Sections.
  - 4. Level 5: Where indicated on Drawings.

- a. Primer and its application to surfaces are specified in other Division 9 Sections.
- E. Glass-Mat Gypsum Sheathing Board: Finish according to manufacturer's written instructions for use as exposed soffit board.
- F. Glass-Mat, Water-Resistant Backing Panels: Finish according to manufacturer's written instructions.
- G. Cementitious Backer Units: Finish according to manufacturer's written instructions.

### 3.8 PROTECTION

- A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- B. Remove and replace panels that are wet, moisture damaged, and mold damaged.
  - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
  - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 09250

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section includes:
  - 1. Porcelain Floor Tile.
  - 2. Porcelain Wall Tile.
  - 3. Glass Tile.

**1.2 REFERENCES**

- A. ANSI A108 Series/A118 Series/A136.1 - American National Standard Specifications for Installation of Ceramic Tile
- B. TCA (Tile Council of America) - Handbook for Ceramic Tile Installation.

**1.3 SUBMITTALS**

- A. Section 01330 - Submittal Procedures: Submittal procedures.
- B. Product Data: Submit instructions for using grouts and adhesives.
- C. Samples: Submit tile illustrating pattern and color.
- D. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

**1.4 SUSTAINABLE DESIGN SUBMITTALS**

- A. Section 01811 - Sustainable Design Requirements: Requirements for sustainable design submittals.
- B. Manufacturer's Certificate: Certify products meet or exceed specified sustainable design requirements.
  - 1. Materials Resources Certificates:
    - a. Certify recycled material content for recycled content products.
    - b. Certify source for local and regional materials and distance from Project site.
  - 2. Indoor Air Quality Certificates:
    - a. Certify volatile organic compound content for each interior adhesive and sealant and related primer.
- C. Product Cost Data: Submit cost of products to verify compliance with Project sustainable design requirements. Exclude cost of labor and equipment to install products.
  - 1. Provide cost data for the following products:
    - a. Products with recycled material content.

- b. Local and regional products.

**1.5 CLOSEOUT SUBMITTALS**

- A. Section 01700 - Execution Requirements: Closeout procedures.
- B. Operation and Maintenance Data: Submit recommended cleaning methods, cleaning materials, stain removal methods, and polishes and waxes.

**1.6 QUALITY ASSURANCE**

- A. Perform Work in accordance with TCA Handbook and ANSI A108 Series/A118 Series.
- B. Maintain one copy copies of each document on site.

**1.7 QUALIFICATIONS**

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
- B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

**1.8 MOCKUP**

- A. Section 01400 - Quality Requirements: Requirements for mockup.
- B. Construct mock-up with finish grout, and specified accessories.
- C. Locate where directed by Architect.
- D. Incorporate accepted mockup as part of Work.

**1.9 PRE-INSTALLATION MEETING**

- A. Section 01300 - Administrative Requirements: Preinstallation meeting.
- B. Convene minimum one week before starting Work of this section.

**1.10 DELIVERY, STORAGE, AND HANDLING**

- A. Section 01600 - Product Requirements: Product storage and handling requirements.
- B. Protect adhesives and grouts from freezing or overheating.

**1.11 ENVIRONMENTAL REQUIREMENTS**

- A. Section 01600 - Product Requirements.

- B. Do not install adhesives and grouts in unventilated environment.
- C. Maintain ambient and substrate temperature of 50 degrees F during installation of mortar materials.

**1.12 EXTRA MATERIALS**

- A. Section 01700 - Execution and Closeout Requirements: Spare parts and maintenance products.
- B. Supply ten percent (10%) of each size, color, and surface finish specified.

**PART 2 - PRODUCTS**

**2.1 PORCELAIN FLOOR TILE**

- A. Dale Tile
  - 1. Style:
  - 2. Description:
- B. Crossville
  - 1. Style:
  - 2. Description:
- C. American Olean
  - 1. Style:
  - 2. Description:

**2.2 PORCELAIN WALL TILE**

- A. Dale Tile
  - 1. Style:
  - 2. Description:
- B. Crossville
  - 1. Style:
  - 2. Description:
- C. American Olean
  - 1. Style:
  - 2. Description:

**2.3 MOSAIC GLASS TILE**

- A. Dale Tile
  - 1. Style:
  - 2. Description:

- B. Crossville
  - 1. Style:
  - 2. Description:
- C. American Olean
  - 1. Style:
  - 2. Description:

**2.4 BASE/PATTERN**

- A. Base shall be as shown on the Drawings.
- B. Pattern shall be as shown on the Drawings.

**2.5 ADHESIVE MATERIALS**

- A. Manufacturers
  - 1. Adhesive: LATICRETE International, Inc.
  - 2. Substitutions: Under provisions of Section 01600.
- B. Adhesive: "LATICRETE 125 Sound & Crack Adhesive" as manufactured by LATICRETE International, Inc.

**2.6 GROUT MATERIALS**

- A. Manufacturers
  - 1. Grout: LATICRETE International, Inc.
  - 2. Substitutions: Under provisions of Section 01600.
- B. Grout: Grouting materials shall be "SpectraLOCK™ PRO Grout as manufactured by LATICRETE International, Inc.

**2.7 MORTAR MIX AND GROUT MIX**

- A. Mix and proportion pre-mix setting bed and grout materials in accordance with manufacturer's instructions.

**2.8 ACCESSORIES**

- A. Tile Substrate: Wonder-Board® as supplied by American Olean Tile Company.
- B. Waterproofing Membrane:
  - 1. REDGARD Waterproofing and Anti-Fracture Membrane as manufactured by Custom Building Products.
  - 2. Pro-Red® Waterproofing Membrane 963 as manufactured by C-Cure.



**PART 3 - EXECUTION**

**3.1 EXAMINATION**

- A. Section 01300 - Administrative Requirements: Coordination and project conditions.
- B. Verify surfaces are ready to receive work.

**3.2 PREPARATION**

- A. Protect surrounding work from damage.
- B. Vacuum clean surfaces and damp clean.
- C. Seal substrate surface cracks with filler. Level existing substrate surfaces to acceptable flatness tolerances.
- D. Install cementitious backer board. Tape joints and corners, cover with skim coat of dry-set mortar to feather edge.
- E. Prepare substrate surfaces for adhesive installation.

**3.3 EXISTING WORK**

- A. Section 01700 - Execution Requirements: Requirements for maintenance service.
- B. Prepare and remodel existing tile installations using materials and methods as specified.
- C. Clean and repair existing tile that remains.

**3.4 INSTALLATION**

- A. Install tile, thresholds, and grout in accordance with applicable requirements of ANSI A108.1 through A108.10, and TCA Handbook recommendations.
- B. Lay tile to pattern indicated. Do not interrupt tile pattern through openings.
- C. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly. Align floor, base and wall joints.
- D. Place tile with joints uniform in width, subject to variance in tolerance allowed in tile size. Make joints watertight, without voids, cracks, excess mortar, or excess grout.
  - 1. Ceramic Tile: 1/16 inch inch.

- E. Form internal angles coved and external angles bullnosed.
- F. Install ceramic accessories rigidly in prepared openings.
- G. Sound tile after setting. Replace hollow sounding units.
- H. Keep control joints free of adhesive or grout. Apply sealant to joints.
- I. Allow tile to set for a minimum of 48 hours prior to grouting.
- J. Grout tile joints.
- K. Apply sealant to junction of tile and dissimilar materials and junction of dissimilar planes.
- L. Installation - Floors - Thin-Set Methods:
  - 1. Over interior concrete substrates, install in accordance with TCA Handbook Method F113, dry-set or latex-portland cement bond coat, with standard grout, unless otherwise indicated.
    - a. Where waterproofing membrane is indicated, install in accordance with TCA Handbook Method F122, with latex-portland cement grout.
  - 2. Over wood substrates, install in accordance with TCA Handbook Method F142, with standard grout, unless otherwise indicated.
- M. Installation - Wall Tile:
  - 1. Over cementitious backer units install in accordance with TCA Handbook Method W244, using membrane at toilet rooms, kitchens, and locker rooms.
  - 2. Over gypsum wallboard on wood or metal studs install in accordance with TCA Handbook Method W243, thin-set with dry-set or latex-portland cement bond coat, unless otherwise indicated.
    - a. Where waterproofing membrane is indicated other than at showers and bathtub walls, install in accordance with TCA Handbook Method W222, one coat method.
  - 3. Over interior concrete and masonry install in accordance with TCA Handbook Method W202, thin-set with dry-set or latex-portland cement bond coat.

### **3.5 CLEANING**

- A. Section 01700 - Execution Requirements: Final cleaning.
- B. Clean tile and grout surfaces.

### **3.6 PROTECTION OF INSTALLED CONSTRUCTION**

- A. Section 01700 - Execution Requirements: Protecting installed construction.

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**SECTION 09310 - TILE**

- B. Do not permit traffic over finished floor surface for 4 days after installation.

**END OF SECTION**

**NEW PASSENGER TERMINAL  
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**SECTION 09402 – RESINOUS  
MATRIX TERRAZZO  
FLOORING**

**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. Thin-set, epoxy-resin terrazzo flooring and base.
  - 2. Precast epoxy-resin terrazzo units.
- B. Related Requirements:
  - 1. Division 7 Section "Joint Sealants" for sealants installed with terrazzo.

**1.3 DEFINITIONS**

- A. Aggregate: Marble chips or other types of aggregate.

**1.4 PREINSTALLATION MEETINGS**

- A. Preinstallation Conference: Conduct conference at Project site.
  - 1. Review methods and procedures related to terrazzo including, but not limited to, the following:
    - a. Inspect and discuss condition of substrate and other preparatory work performed by other trades.
    - b. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
    - c. Review special terrazzo designs and patterns.

**1.5 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
- B. LEED Submittals:
  - 1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.
  - 2. Product Data for Credit IEQ 4.1: For adhesives, documentation including printed statement of VOC content.
  - 3. Product Data for Credit IEQ 4.3: For sealers, documentation including printed statement of VOC content.
  - 4. Product Data for Credit IEQ 4.3: For terrazzo flooring, documentation from an independent testing agency indicating compliance with the FloorScore Standard.

- C. Shop Drawings: Include terrazzo installation requirements. Include plans, elevations, sections, component details, and attachments to other work. Show layout of the following:
  - 1. Divider strips.
  - 2. Control-joint strips.
  - 3. Accessory strips.
  - 4. Abrasive strips.
  - 5. Stair treads, risers, and landings.
  - 6. Precast terrazzo jointing and edge configurations.
  - 7. Terrazzo patterns.
- D. Samples for Verification: For each type, material, color, and pattern of terrazzo and accessory required showing the full range of color, texture, and pattern variations expected. Label each terrazzo sample to identify manufacturer's matrix color and aggregate types, sizes, and proportions. Prepare Samples of same thickness and from same material to be used for the Work, in size indicated below:
  - 1. Terrazzo: 12" square Samples.
  - 2. Accessories: 12" long Samples of each exposed strip item required.

#### 1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Material Certificates: For each type of terrazzo material or product, from manufacturer.
- C. Installer Certificates: Signed by manufacturers certifying that installers comply with requirements.

#### 1.7 CLOSEOUT SUBMITTALS

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

#### 1.8 QUALITY ASSURANCE

- A. Installer Qualifications:
  - 1. Engage an installer who is a contractor member of NTMA.
  - 2. Engage an installer who is certified in writing by terrazzo manufacturer as qualified to install manufacturer's products.
- B. Source Limitations: Obtain primary terrazzo materials from single source from single manufacturer. Provide secondary materials including patching and fill material, joint sealant, and repair materials of type and from source recommended by manufacturer of primary materials.
- C. Source Limitations for Aggregates: Obtain each color, grade, type, and variety of granular materials from single source with resources to provide materials of consistent quality in appearance and physical properties.

#### 1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to Project site in supplier's original wrappings and containers, labeled with sources or manufacturer's name, material or product brand name, and lot number if any.
- B. Store materials in their original, undamaged packages and containers, inside a well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.

#### 1.10 FIELD CONDITIONS

- A. Environmental Limitations: Comply with manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting terrazzo installation.
- B. Field Measurements: Verify actual dimensions of construction contiguous with precast terrazzo by field measurements before fabrication.
- C. Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during terrazzo installation.
- D. Close spaces to traffic during terrazzo application and for not less than 24 hours after application unless manufacturer recommends a longer period.
- E. Control and collect water and dust produced by grinding operations. Protect adjacent construction from detrimental effects of grinding operations.

### PART 2 - PRODUCTS

#### 2.1 PERFORMANCE REQUIREMENTS

- A. NTMA Standards: Comply with NTMA's "Terrazzo Specifications and Design Guide" and with written recommendations for terrazzo type indicated unless more stringent requirements are specified.
- B. FloorScore Compliance: Terrazzo floors shall comply with requirements of FloorScore Standard.

#### 2.2 EPOXY-RESIN TERRAZZO

- A. Epoxy-Resin Terrazzo: Comply with NTMA's "Terrazzo Specifications and Design Guide" and manufacturer's written instructions for matrix and aggregate proportions and mixing.
  - 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. Crossfield Products Corp., Dex-O-Tex Division; Cheminert Terrazzo.
    - b. General Polymers Corporation; Terrazzo 1100.
    - c. Key Resin Company; Key Epoxy Terrazzo.
    - d. Master Terrazzo Technologies LLC; Morricite.
    - e. Quadrant Chemical Corporation; Quadset Epoxy Terrazzo.
    - f. TEC Specialty Construction Brands, Inc.; Tuff-Lite Epoxy Terrazzo.

- g. Terrazzo & Marble Supply Companies; Terroxy Resin Systems.
- 2. Thickness: **3/8 inch (9.5 mm)** nominal.
- 3. Custom Mix Color and Pattern: Match Architect's sample.

B. Materials:

- 1. Flexible Reinforcing Membrane: Manufacturer's resinous membrane for substrate-crack preparation and reflective-crack reduction.
  - a. Reinforcement: Fiberglass scrim.
- 2. Primer: Manufacturer's product recommended for substrate and use indicated.
- 3. Epoxy-Resin Matrix: Manufacturer's standard recommended for use indicated and in color required for mix indicated.
  - a. Physical Properties without Aggregates:
    - 1) Hardness: 60 to 85 per ASTM D 2240, Shore D.
    - 2) Minimum Tensile Strength: **3000 psi (20.7 MPa)** per ASTM D 638 for a **2-inch (51-mm)** specimen made using a "C" die per ASTM D 412.
    - 3) Minimum Compressive Strength: **10,000 psi (6.9 MPa)** per ASTM D 695, Specimen B cylinder.
    - 4) Chemical Resistance: No deleterious effects by contaminants listed below after seven-day immersion at room temperature per ASTM D 1308.
      - a) Distilled water.
      - b) Mineral water.
      - c) Isopropanol.
      - d) Ethanol.
      - e) 0.025 percent detergent solution.
      - f) 1.0 percent soap solution.
      - g) 10 percent sodium hydroxide.
      - h) 10 percent hydrochloric acid.
      - i) 30 percent sulfuric acid.
      - j) 5 percent acetic acid.
  - b. Physical Properties with Aggregates: For resin blended with Georgia white marble, ground, grouted, and cured per requirements in NTMA's "Terrazzo Specifications and Design Guide"; comply with the following:
    - 1) Flammability: Self-extinguishing, maximum extent of burning **1/4 inch (6.35 mm)** per ASTM D 635.
    - 2) Thermal Coefficient of Linear Expansion: **0.0025 inch/inch per deg F (0.0025 mm/mm per 0.5556 deg C)** for temperature range of **minus 12 to plus 140 deg F (minus 24 to plus 60 deg C)** per ASTM D 696.
- 4. Aggregates: Comply with NTMA gradation standards for mix indicated and contain no deleterious or foreign matter.
  - a. Abrasion and Impact Resistance: Less than 40 percent loss per ASTM C 131.
  - b. 24-Hour Absorption Rate: Less than 0.75 percent.
  - c. Dust Content: Less than 1.0 percent by weight.
  - d. Recycled Content of Epoxy-Resin Terrazzo: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **<Insert number>** percent.
- 5. Finishing Grout: Resin based.

## 2.3 PRECAST EPOXY-RESIN TERRAZZO

- 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:
- B. Precast Terrazzo Units: Comply with NTMA's written recommendations for fabricating precast terrazzo units in sizes and profiles indicated. Reinforce units as required by unit sizes, profiles, and thicknesses and as recommended by manufacturer. Finish exposed-to-view edges and reveals to match face finish. Ease exposed edges to **1/8-inch (3.2-mm)** radius.
  - 1. Stair treads and landings.
  - 2. Color, Pattern, and Finish: Match Architect's sample for adjacent poured-in-place terrazzo flooring.

## 2.4 STRIP MATERIALS

- A. Thin-Set Divider Strips: L-type angle, **1/4 inch (6.4 mm)** deep.
  - 1. Material: White-zinc alloy, Aluminum and/or Plastic, in color(s) selected, as indicated.
  - 2. Top Width: As indicated.
- B. Control-Joint Strips: Separate, double L-type angles, positioned back to back, that match material and color of divider strips and in depth required for topping thickness indicated.
- C. Accessory Strips: Match divider-strip width, material, and color unless otherwise indicated. Use the following types of accessory strips as required to provide a complete installation:
  - 1. Base-bead strips for exposed top edge of terrazzo base.
  - 2. Edge-bead strips for exposed edges of terrazzo.
  - 3. Nosings for terrazzo stair treads and landings.
- D. Abrasive Strips: Three-line abrasive inserts at nosings. Silicon carbide or aluminum oxide, or combination of both, in epoxy-resin binder and set in channel.
  - 1. Width: **1/2 inch (12.7 mm)**.
  - 2. Depth: As required by terrazzo thickness.
  - 3. Length: **4 inches (100 mm)** less than stair width.
  - 4. Color: As selected by Architect from full range of industry colors.

## 2.5 MISCELLANEOUS ACCESSORIES

- A. Strip Adhesive: Epoxy-resin adhesive recommended by adhesive manufacturer for this use.
  - 1. Adhesives shall have a VOC content of 70 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Anchoring Devices:
  - 1. Strips: Provide mechanical anchoring devices or adhesives for strip materials as recommended by manufacturer and required for secure attachment to substrate.
  - 2. Precast Terrazzo: Provide mechanical anchoring devices as recommended by fabricator for proper anchorage and support of units for conditions of installation and support.



- C. Patching and Fill Material: Terrazzo manufacturer's resinous product approved and recommended by manufacturer for application indicated.
- D. Joint Compound: Terrazzo manufacturer's resinous product approved and recommended by manufacturer for application indicated.
- E. Resinous Matrix Terrazzo Cleaner: Chemically neutral cleaner with pH factor between 7 and 10 that is biodegradable, phosphate free, and recommended by sealer manufacturer for use on terrazzo type indicated.
- F. Sealer: Slip- and stain-resistant, penetrating-type sealer that is chemically neutral; does not affect terrazzo color or physical properties; is recommended by sealer manufacturer; and complies with NTMA's "Terrazzo Specifications and Design Guide" for terrazzo type indicated.
  - 1. Surface Friction: Not less than 0.6 according to ASTM D 2047.
  - 2. Acid-Base Properties: With pH factor between 7 and 10.
  - 3. Sealers shall have a VOC content of 200 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions, including levelness tolerances, have been corrected.

### 3.2 PREPARATION

- A. Clean substrates of substances, including oil, grease, and curing compounds, that might impair terrazzo bond. Provide clean, dry, and neutral substrate for terrazzo application.
- B. Concrete Slabs:
  - 1. Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants incompatible with terrazzo.
    - a. Shot-blast surfaces with an apparatus that abrades the concrete surface, contains the dispensed shot within the apparatus, and recirculates the shot by vacuum pickup.
    - b. Repair damaged and deteriorated concrete according to terrazzo manufacturer's written recommendations.
    - c. Use patching and fill material to fill holes and depressions in substrates according to terrazzo manufacturer's written instructions.
- C. Verify that concrete substrates are dry and moisture-vapor emissions are within acceptable levels according to manufacturer's written instructions.
  - 1. Moisture Testing: Perform tests indicated below.

- a. Calcium Chloride Test: Perform anhydrous calcium chloride test per ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of **3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m)** in 24 hours.
- D. Protect other work from water and dust generated by grinding operations. Control water and dust to comply with environmental protection regulations.
  - 1. Erect and maintain temporary enclosures and other suitable methods to limit water damage and dust migration and to ensure adequate ambient temperatures and ventilation conditions during installation.

### 3.3 EPOXY-RESIN TERRAZZO INSTALLATION

- A. Comply with NTMA's written recommendations for terrazzo and accessory installation.
- B. Place, rough grind, grout, cure grout, fine grind, and finish terrazzo according to manufacturer's written instructions and NTMA's "Terrazzo Specifications and Design Guide."
- C. Installation Tolerance: Limit variation in terrazzo surface from level to **[1/4 inch in 10 feet (6.4 mm in 3 m)]**; noncumulative.
- D. Ensure that matrix components and fluids from grinding operations do not stain terrazzo by reacting with divider and control-joint strips.
- E. Delay fine grinding until heavy trade work is complete and construction traffic through area is restricted.
- F. Flexible Reinforcing Membrane:
  - 1. Prepare and prefill substrate cracks with membrane material.
  - 2. Install membrane to produce full substrate coverage in areas to receive terrazzo.
  - 3. Reinforce membrane with fiberglass scrim.
  - 4. Prepare membrane according to manufacturer's written instructions before applying substrate primer.
- G. Primer: Apply to terrazzo substrates according to manufacturer's written instructions.
- H. Strip Materials:
  - 1. Divider and Control-Joint Strips:
    - a. Locate divider strips in locations indicated.
    - b. Install control-joint strips back to back directly above concrete-slab control joints and/or in locations indicated.
    - c. Install strips in adhesive setting bed without voids below strips, or mechanically anchor strips as required to attach strips to substrate, as recommended by strip manufacturer.
  - 2. Accessory Strips: Install as required to provide a complete installation.
  - 3. Abrasive Strips: Install with surface of abrasive strip positioned **1/16 inch (1.6 mm)** higher than terrazzo surface.

### 3.4 PRECAST TERRAZZO INSTALLATION

- A. Install precast terrazzo units using method recommended by NTMA and manufacturer unless otherwise indicated.
- B. Do not install units that are chipped, cracked, discolored, or not properly finished.
- C. Seal joints between units with joint compound matching precast terrazzo matrix.

### 3.5 REPAIR

- A. Cut out and replace terrazzo areas that evidence lack of bond with substrate. Cut out terrazzo areas in panels defined by strips and replace to match adjacent terrazzo, or repair panels according to NTMA's written recommendations, as approved by Architect.

### 3.6 CLEANING AND PROTECTION

- A. Cleaning:
  - 1. Remove grinding dust from installation and adjacent areas.
  - 2. Wash surfaces with cleaner according to NTMA's written recommendations and manufacturer's written instructions; rinse surfaces with water and allow them to dry thoroughly.
- B. Sealing:
  - 1. Seal surfaces according to NTMA's written recommendations.
  - 2. Apply sealer according to sealer manufacturer's written instructions.
- C. Protection: Provide final protection and maintain conditions, in a manner acceptable to Installer, that ensure that terrazzo is without damage or deterioration at time of Substantial Completion.

END OF SECTION 09402

**NEW PASSENGER TERMINAL  
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DULUTH, MINNESOTA**

**SECTION 09511 - ACOUSTICAL  
PANEL CEILINGS**

SECTION 09511 - ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes acoustical panels and exposed suspension systems for ceilings.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
  - 1. Ceiling suspension system members.
  - 2. Method of attaching hangers to building structure.
  - 3. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels and special moldings.
  - 4. Minimum Drawing Scale: ¼ inch = 1 foot.
- C. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below.
  - 1. Acoustical Panel: Set of full-size Samples of each type, color, pattern and texture.
  - 2. Exposed Suspension System Members, Moldings and Trim: Set of 12-inch-long Samples of each type, finish and color.
- D. Maintenance Data: For finished to include in maintenance manuals.

1.3 QUALITY ASSURANCE

- A. Acoustical Testing Agency Qualifications: An independent testing laboratory, or an NVLAP-accredited laboratory, with the experience and capability to conduct the testing indicated. NVLAP-accredited laboratories must document

accreditation, based on a "Certificate of Accreditation" and a "Scope of Accreditation" listing the test methods specified.

- B. Source Limitation:" Obtain each type of acoustical ceiling panel and supporting suspension system through one source from a single manufacturer.
- C. Fire-Test-Response Characteristics: Provide acoustical panel ceilings that comply with the following requirements:
  - 1. Fire-Resistance Characteristics: Where indicated, provide acoustical panel ceilings identical to those of assemblies tested for fire resistance per ASTM E 119 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
  - 2. Surface-Burning Characteristics: Provide acoustical panels with the following surface-burning characteristics complying with ASTM E 1264 for Class A materials as determined by testing identical products per ASTM E 84:

#### 1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver acoustical panels, suspension system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.
- B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.
- C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

#### 1.5 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

#### 1.6 COORDINATION

- A. Coordinate layout and installation of acoustical panels and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

## PART 2 - PRODUCTS

### 2.1 ACOUSTICAL PANELS, GENERAL

- A. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances, unless otherwise indicated.
  - 1. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches (400 mm) away from test surface per ASTM E 795.
- B. Acoustical Panel Colors and Patterns: Match appearance characteristics indicated for each product type.
  - 1. Where appearance characteristics of acoustical panels are indicated by referencing pattern designations in ASTM E 1264 and not manufacturers' proprietary product designations, provide products selected by Architect from each manufacturer's full range that comply with requirements indicated for type, pattern, color, light reflectance, acoustical performance, edge detail, and size.
- C. Broad Spectrum Antimicrobial fungicide and Bactericide Treatment: Provide acoustical panels treated with manufacturer's standard antimicrobial formulation that inhibits fungus, mold, mildew and gram-positive and gram-negative bacteria and showing no mold, mildew or bacterial growth when tested according to ASTM D 3273 and evaluated according to ASTM D 3274 or ASTM G 21.

### 2.2 ACOUSTICAL PANELS FOR ACOUSTICAL PANEL CEILING

- A. Available Products: Subject to compliance with requirements, provide products as scheduled on Drawings or an approved equivalent by one of the following:
  - 1. Armstrong World Industries, Inc.
  - 2. BPB USA.
  - 3. Ecophon CertainTeed, Inc.
  - 4. USG Interiors, Inc.
- B. Color: White or as indicated in a schedule
- C. LR: Not less than 0.85.
- D. NRC: Not less than 0.55.
- E. CAC: Not less than 33.

- F. Edge/Joint Detail: Square.
- G. Thickness: 5/8 inch.
- H. Modular Size: 24 by 24 inches.
- I. Antimicrobial Treatment: Broad spectrum fungicide and bactericide based.

## 2.3 METAL SUSPENSION SYSTEMS, GENERAL

- A. Metal Suspension System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635.
- B. Finishes and Colors, General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Provide manufacturer's standard factory-applied finish for type of system indicated.
- C. Attachment Devices: Size for five times the design load indicated in ASTM C 635, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.
- D. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
  - 1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
  - 2. Size: Select wire diameter so its stress at 3 times hanger design load (ASTM C 635, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than ~~0.106-inch~~ (2.69-mm) diameter wire.
- E. Hold-Down Clips: Where indicated, provide manufacturer's standard hold-down clips spaced 24 inches o.c. on all cross tees.

## 2.4 METAL SUSPENSION SYSTEM FOR ACOUSTICAL PANEL CEILING

- A. Products: Subject to compliance with requirements, provide one of the following:
  - 1. Armstrong World Industries, Inc.
  - 2. BPB USA.
  - 3. Chicago Metallic Corporation.
  - 4. Ecophon CertainTeed, Inc.
  - 5. USG Interiors, Inc.

- B. Wide-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet, prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653/A 653M, not less than **G30 (Z90)** coating designation, with prefinished **15/16-inch**-wide metal caps on flanges.
1. Structural Classification: Intermediate-duty system.
  2. End Condition of Cross Runners: Override (stepped) or butt-edge type.
  3. Face Design: Flat, flush.
  4. Cap Material: Steel or aluminum cold-rolled sheet.
  5. Cap Finish: Painted white.

## 2.5 METAL EDGE MOLDINGS AND TRIM

- A. Products: Subject to compliance with requirements, provide one of the following:
1. Armstrong World Industries, Inc.
  2. BPB USA.
  3. Chicago Metallic Corporation.
  4. USG Interiors, Inc.
- B. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension system runners.
1. Provide manufacturer's standard edge moldings that fit acoustical panel edge details and suspension systems indicated and that match width and configuration of exposed runners, unless otherwise indicated.
  2. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.

## 2.6 ACOUSTICAL SEALANT

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
1. Acoustical Sealant for Exposed and Concealed Joints:
    - a. Pecora Corporation; AC-20 FTR Acoustical and Insulation Sealant
    - b. USG Corporation; SHEETROCK Acoustical Sealant.
  2. Acoustical Sealant for Concealed Joints:



- a. OSI Sealants, Inc.; Pro-Series SC-175 Rubber Base Sound Sealant.
  - b. Pecora Corporation; BA-98.
  - c. Tremco, Inc.; Tremco Acoustical Sealant.
- B. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834 and effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.
  - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

### 3.3 INSTALLATION

- A. General: Install acoustical panel ceilings to comply with ASTM C 636 and seismic design requirements indicated, per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."
- B. Suspend ceiling hangers from building's structural members and as follows:
  - 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
  - 2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.

3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
  4. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
  5. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
  6. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
  7. Do not attach hangers to steel deck tabs.
  8. Do not attach hangers to steel roof deck. Attach hangers to structural members.
  9. Space hangers not more than 48 inches (1200 mm) o.c. along each member supported directly from hangers, unless otherwise indicated; provide hangers not more than 8 inches (200 mm) from ends of each member.
  10. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
- C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.
- D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
  2. Screw attach moldings to substrate at intervals not more than 16 inches (400 mm) o.c. and not more than 3 inches (75 mm) from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet (3.2 mm in 3.6 m). Miter corners accurately and connect securely.
  3. Do not use exposed fasteners, including pop rivets, on moldings and trim.
- E. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

- F. Install acoustical panels with undamaged edges and fit accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.
  - 1. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension system runners and moldings.
  - 2. Install hold-down clips in areas indicated, in areas required by authorities having jurisdiction, and for fire-resistance ratings; space as recommended by panel manufacturer's written instructions, unless otherwise indicated.

### 3.4 CLEANING

- A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 09511

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

**SECTION 09514 - ACOUSTICAL  
METAL PAN CEILINGS**

**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 torsion-spring acoustical metal pans and the following suspension system for ceilings:
  - 1. Direct hung, exposed tee grid.
- B. Related Sections:
  - 1. Division 9 Section "Acoustical Panel Ceilings" for ceilings consisting of mineral-base and glass-fiber-base acoustical panels and exposed suspension systems.
  - 2. Divisions 13, 15, and 16 Sections for light fixtures, sprinklers, and air-distribution components.

**1.3 DEFINITIONS**

- A. CAC: Ceiling Attenuation Class.
- B. LR: Light Reflectance coefficient.
- C. NRC: Noise Reduction Coefficient.

**1.4 PERFORMANCE REQUIREMENTS**

- A. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
  - 1. Temperature Change (Range): 95 °F to 40°F.

**1.5 SUBMITTALS**

- A. Product Data: For each type of product indicated.
- B. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below:
  - 1. Metal Pans: Set of 12 inch square samples of each type, finish, color, pattern, and texture. Samples to be pan corners showing pan edge profiles in two directions.
  - 2. Exposed Suspension System Members, Moldings and Trim: Set of 12-inch- (300-mm-) long Samples of each type, finish, and color.
  - 3. Sound Absorber: Match size of Sample metal pan.

- C. Performance Data: For installed products indicated to comply with design loads and other criteria, include structural analysis and other analytical data signed and sealed by the qualified professional engineer responsible for their preparation.
- D. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved:
  - 1. Ceiling suspension members.
  - 2. Method of attaching hangers to building structure.
  - 3. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
  - 4. Ceiling perimeter and penetrations through the ceiling; and trim and moldings.
  - 5. Minimum Drawing Scale:  $1/16 = 1$  foot.
- E. Qualification Data: For testing agency.
- F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each acoustical metal pan ceiling.
- G. Evaluation Reports: For each acoustical metal pan ceiling and components and anchor and fastener type.
- H. Field quality-control reports.
- I. Maintenance Data: For finishes to include in maintenance manuals.

## 1.6 QUALITY ASSURANCE

- A. Acoustical Testing Agency Qualifications: An independent testing laboratory or an NVLAP-accredited laboratory, with the experience and capability to conduct the testing indicated. NVLAP-accredited laboratories must document accreditation, based on a "Certificate of Accreditation" and a "Scope of Accreditation" listing the test methods specified.
- B. Source Limitations for Acoustical Metal Pan Ceilings: Obtain each combination of acoustical metal pans and exposed suspension systems from one source with resources to provide products of consistent quality in appearance, physical properties, and performance.
- C. Surface-Burning Characteristics: Complying with ASTM E 1264 for flame spread 25 + smoke developed 50 materials as determined by testing identical products according to ASTM E 84 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction for sound absorption.
- D. Seismic Standard: Provide acoustical metal pan ceilings designed and installed to withstand the effects of earthquake motions according to the following:
  - 1. Standard for Ceiling Suspension Systems Requiring Seismic Restraint: Comply with ASTM E 580.
- E. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
- F. Preinstallation Conference: Conduct conference at Project site.

## 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver acoustical metal pans, suspension system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.
- B. Handle acoustical metal pans, suspension system components, and accessories carefully to avoid damaging units and finishes in any way.

## 1.8 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install acoustical metal pan ceilings until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use and as per manufacturers' recommendations.

## 1.9 COORDINATION

- A. Coordinate layout and installation of acoustical metal pans and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

## 1.10 EXTRA MATERIALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Acoustical Metal Pans: Full-size units equal to 2 percent of quantity installed.
  - 2. Suspension System Components: Quantity of each grid and exposed molding and trim equal to 2 percent of quantity installed.
  - 3. Hold-Down Clips: Equal to 2 percent of quantity installed.

# PART 2 - PRODUCTS

## 2.1 ACOUSTICAL METAL CEILING PANS

- A. Acoustical Metal Pan Standard: Provide manufacturer's standard acoustical metal pans of configuration indicated that comply with ASTM E 1264 classifications as designated by types, acoustical ratings, and light reflectances unless otherwise indicated.
- B. Sheet Metal Characteristics: For metal components exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, roughness, stains, or discolorations.
  - 1. Aluminum Sheet: Roll-formed aluminum sheet, complying with ASTM B 209 (ASTM B 209M); alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.

- C. Sound-Absorbent Fabric Layer: Provide fabric layer, sized to fit concealed surface of pan, and consisting of black, nonwoven, nonflammable, sound-absorbent material with surface-burning characteristics for flame-spread index of 25 or less and smoke-developed index of 50 or less, as determined by testing per ASTM E 84.
  - 1. Bond fabric layer to panels in the factory with manufacturer's standard nonflammable adhesive.
- D. Sound-Absorbent Pads: Provide width and length to completely fill concealed surface of pan, with surface-burning characteristics for flame-spread index of 25 or less and smoke-developed index of 50 or less, as determined by testing per ASTM E 84, and to comply with the following requirements:
  - 1. Spacer Grids: Provide manufacturer's standard aluminum grid units that provide an air cushion between metal pans and insulation pads and that act to improve sound absorption.

## 2.2 ALUMINUM PANS FOR ACOUSTICAL METAL PAN CEILING

- A. Aluminum Metal Pans:
  - 1. Products: Subject to compliance with requirements, provide one of the following :
    - a. Simplex Ceilings, a division of Intalite Inc.
    - b. Chicago Metallic
    - c. Spitz Industries:
- B. Classification: Units complying with ASTM E 1264 for Type XX, other types described as perforated aluminum facing (pan) units with sound-absorbent fabric backing.
  - 1. Pattern: 1 to 7 (70%).
- C. Pan Fabrication: Manufacturer's standard units of size, profile, and edge treatment indicated, formed from metal indicated and finished to comply with requirements indicated.
  - 1. Torsion-Spring-Hinged Pans: Designed to be securely retained in preslotted exposed suspension grid by torsion springs.
- D. Pan Thickness: Not less than 0.040 inch (1.0 mm).
- E. Pan Edge Detail: Manufacturer's standard edge detail.
- F. Pan Size: As indicated
- G. Pan Face Finish: Pre-painted silver lum.
- H. LR: Not less than 0.70.
- I. NRC: Not less than 0.70.
- J. CAC: Not less than 40.

## 2.3 METAL SUSPENSION SYSTEMS

- A. Suspension Systems: Provide systems complete with carriers, runners, splice sections, connector clips, alignment clips, leveling clips, hangers, molding, trim,

retention clips, load-resisting struts, and other suspension components required to support ceiling units and other ceiling-supported construction.

- B. Attachment Devices: Size for five times the design load indicated in ASTM C 635, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.
- C. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
  - 1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
  - 2. Size: Select wire diameter so its stress at 3 times the hanger design load indicated in ASTM C 635, Table 1, Direct Hung will be less than yield stress of wire, but provide not less than 0.135-inch- (3.5-mm-) diameter wire.
- D. Hanger Rods: Mild steel, zinc coated or protected with rust-inhibitive paint.
- E. Angle Hangers: Angles with legs not less than 7/8 inch (22 mm) wide; formed with 0.04-inch- (1.0-mm-) thick, galvanized-steel sheet complying with ASTM A 653/A 653M, G90 (Z275) coating designation; with bolted connections and 5/16-inch- (8-mm-) diameter bolts.
- F. Hold-Down Clips: Manufacturer's standard hold-down clips spaced to secure acoustical metal pans in place at each pan.
- G. Exposed Metal Edge Moldings and Trim: Provide exposed members as indicated or as required to comply with seismic requirements of authorities having jurisdiction, to conceal edges of and penetrations through ceiling, to conceal edges of pans and runners, for fixture trim and adapters, for fasciae at changes in ceiling height, and for other conditions; of metal and finish matching acoustical metal pan ceiling units, unless otherwise indicated.
  - 1. For Circular Penetrations of Ceiling: Fabricate edge moldings to diameter required to fit penetration exactly.

## 2.4 ACOUSTICAL SEALANT

- A. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834 and effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
  - 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. Pecora Corporation; AC-20 FTR Acoustical and Insulation Sealant.
    - b. USG Corporation; SHEETROCK Acoustical Sealant.
    - c. <Insert manufacturer's name; product name or designation>.
- 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: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
  - a. OSI Sealants, Inc.; Pro-Series SC-175 Rubber Base Sound Sealant.
  - b. Pecora Corporation; BA-98.
  - c. Tremco, Inc.; Tremco Acoustical Sealant.

## 2.5 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 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.

## 2.6 ALUMINUM FINISHES

- A. Color-Coated Finish: Manufacturer's standard enamel baked paint complying with coating manufacturer's written instructions for surface preparation, pretreatment, application, baking, and minimum dry film thickness.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, including structural framing to which acoustical metal pan ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical metal pan ceilings.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 PREPARATION

- A. Measure each ceiling area and establish layout of acoustical metal pans to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width pans at borders, and comply with layout shown on reflected ceiling plans and Coordination Drawings.

## 3.3 INSTALLATION

- A. Install acoustical metal pan ceilings to comply with ASTM C 636 and seismic requirements indicated, per manufacturer's written instructions and Cisca's "Ceiling Systems Handbook."

- B. Suspend ceiling hangers from building's structural members and as follows:
1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
  2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
  3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
  4. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
  5. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both structure to which hangers are attached and type of hanger involved.
  6. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
  7. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
  8. Do not attach hangers to steel deck tabs.
  9. Do not attach hangers to steel roof deck. Attach hangers to structural members.
  10. Space hangers not more than 48 inches (1200 mm) o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches (200 mm) from ends of each member.
  11. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
- C. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical metal pans.
1. Do not use exposed fasteners, including pop rivets, on moldings and trim.
- D. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
- E. Cut acoustical metal pan units for accurate fit at borders and at interruptions and penetrations by other work through ceilings. Stiffen edges of cut units as required to eliminate evidence of buckling or variations in flatness exceeding referenced standards for stretcher-leveled metal sheet.
- F. Install acoustical metal pans in coordination with suspension system and exposed moldings and trim.

1. For torsion-spring-hinged pans, position pans according to manufacturer's written instructions.
  2. For snap-in pans, fit adjoining units to form flush, tight joints.
  3. Align joints in adjacent courses to form uniform, straight joints parallel to room axis in both directions unless otherwise indicated.
  4. Fit adjoining units to form flush, tight joints.
  5. Install directionally patterned or textured metal pans in directions indicated.
  6. Install sound-absorbent fabric layers in perforated metal pans.
  7. Install sound-absorbent pads in perforated metal pans over metal spacer grids.
- G. Install sound attenuation panels in areas indicated by reflected ceiling plans or room finish schedules. Lay panels directly on ceiling system and close major openings to form complete coverage in required areas.
- H. Install hold-down clips where indicated.

### 3.4 FIELD QUALITY CONTROL

### 3.5 CLEANING

- A. Clean exposed surfaces of acoustical metal pan ceilings, including trim and edge moldings after removing strippable, temporary protective covering, if any. Comply with manufacturer's written instructions for stripping of temporary protective covering, cleaning, and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage, including dented and bent units.

END OF SECTION 09514

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. Resilient vinyl tile flooring.
- B. Resilient base.

**1.2 SUBMITTALS**

- A. Submit manufacturer's product literature and samples under provisions of Section 01330 - Submittals.
- B. Include duplicate samples of flooring material, color and patterns.
- C. Submit manufacturer's printed installation instructions under provisions of Section 01330 - Submittals.
- D. Submit manufacturer's notarized certificate under provisions of Section 01330 - Submittals that products meet or exceed specified requirements.

**1.3 OPERATION AND MAINTENANCE DATA**

- A. Submit manufacturer's maintenance instructions under provisions of Section 01700 - Contract Close-Out.

**1.4 QUALITY ASSURANCE**

- A. Manufacturer: Company specializing in vinyl resilient flooring with five years experience.
- B. Applicator: Company specializing in installation of vinyl resilient flooring with three years documented experience.

**1.5 DELIVERY, STORAGE AND HANDLING**

- A. Deliver resilient vinyl tile and accessories to the project site in original factory containers, each carton clearly marked as to manufacturer, pattern, size, gauge, and lot number.
- B. Deliver adhesive to be used for resilient vinyl tile and accessories to the project site in original factory containers, each container clearly marked as to manufacturer.
- C. Store materials to prevent damage.

**1.6 PROJECT CONDITIONS**

- A. Maintain minimum 70 degrees F air temperature at flooring installation area for three days prior to, during and for 48 hours after installation.
- B. Store flooring materials in area of application. Allow three days for materials to reach equal temperature as area.
- C. Prevent exposure to installation to excessive heat or direct sunlight until adhesive has attained final set.

**1.7 SUSTAINABLE DESIGN SUBMITTALS**

- A. Section 01811 - Sustainable Design Requirements: Requirements for sustainable design submittals.
- B. Manufacturer's Certificate: Certify products meet or exceed specified sustainable design requirements.
  - 1. Materials Resources Certificates:
    - a. Certify recycled material content for recycled content products.
    - b. Certify source for local and regional materials and distance from Project site.
  - 2. Indoor Air Quality Certificates:
    - a. Certify volatile organic compound content for each interior adhesive and sealant and related primer.
- C. Product Cost Data: Submit cost of products to verify compliance with Project sustainable design requirements. Exclude cost of labor and equipment to install products.
  - 1. Provide cost data for the following products:
    - a. Products with recycled material content.
    - b. Local and regional products.
- D.

**1.8 WARRANTY**

- A. Provide manufacturer's warranty under provisions of Section 01 70 00 – Execution Requirements.
- B. Warranty: Include one year warranty that products are free from defects in materials and workmanship.

**1.9 EXTRA MATERIALS**

- A. Section 01700 - Execution and Closeout Requirements: Spare parts and maintenance products.
- B. Supply ten percent (10%) of each size, color, and surface finish specified.

**PART 2 - PRODUCTS**

**2.1 MANUFACTURERS**

- A. Mannington
  - 1. Style: .
  - 2. Description:
- B. Armstrong Flooring
  - 1. Style:
  - 2. Description:
- C. Johnsonite
  - 1. Style:
  - 2. Description:
- D. Substitutions: Under the provisions of Section 01 60 00.

**2.2 MATERIALS - BASE**

- A. As specified in Section 09678 - Resilient Base and Accessories.

**2.3 ACCESSORIES**

- A. Subfloor Filler: White premix latex; type recommended by adhesive material manufacturer.
- B. Primers and Adhesives: Waterproof; types recommended by flooring manufacturer.

**PART 3 - EXECUTION**

**3.1 EXAMINATION**

- A. Verify that concrete subfloors on or below grade are installed over a suitable moisture retardant membrane.
- B. Ensure concrete floors are dry and exhibit neutral alkalinity, carbonization, or dusting. Maximum Moisture Emission: Three lb./1,000 sq ft/24 hours.
- C. Ensure floor surfaces are smooth and flat with maximum variation of 1/8 inch in 10 feet.
- D. Ensure floor surfaces are clean and free from dust, paint, oil, grease, curing agents, parting compounds, surface hardeners, sealers, solvents, old adhesives, and other extraneous substances.

E. Ensure contact wall surfaces to 1/2 inch below top of base are clean and free from dirt, paint, oil, grease, wall covering, old adhesives, and other extraneous substances.

F. Beginning of installation means acceptance of surfaces and conditions.

### **3.2 PREPARATION**

A. Remove subfloor ridges and humps. Fill low spots, cracks, joints, holes, and other defects with subfloor filler.

B. Clean floor; apply, trowel, and float filler to leave smooth, flat, hard surface. Prohibit traffic until filler is cured.

### **3.3 INSTALLATION - FLOORING**

A. Install flooring in accordance with manufacturer's printed instructions.

B. Use adhesive recommended by floor tile manufacturer.

C. Clean substrate. Spread adhesive evenly in quantity recommended by flooring material manufacturer to ensure adhesion over entire area of installation. Use recommended notched trowel.

D. Set flooring in place, roll and cross roll with 150 lb. sectional roller while adhesive is still wet to ensure full adhesion.

E. Lay flooring with joints and seams parallel to building lines to produce symmetrical tile pattern.

F. Terminate resilient flooring at center line of door openings where adjacent floor finish is dissimilar.

G. Install reducer strips at unprotected or exposed edges where flooring terminates.

H. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.

I. Continue flooring through areas to receiver moveable type partitions without interrupting floor pattern.

### **3.4 INSTALLATION - BASE**

A. As specified in Section 09678 - Resilient Base and Accessories.

### **3.5 PROTECTION**

A. Prohibit traffic on finished floor for 48 hours after installation.

**3.6 CLEANING**

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

**3.7 SCHEDULE**

- A. Refer to Room Finish Schedule for a listing of rooms requiring work of this section.

**END OF SECTION**



**PART 1 GENERAL**

**1.1 SUMMARY**

- A. This Section includes a complete decorative methyl-methacrylate (MMA) resin interior floor coating system. The work includes the following:
  - 1. Surface preparation and joint and crack treatment.
  - 2. Application of a decorative acrylic flake floor coating system with integral cove bases.

**1.2 SYSTEM DESCRIPTION**

- A. General: The coating system shall be a solvent-free, 100 percent reactive MMA resin coating system with decorative flakes installed to a thickness of approximately 3/16 inch (4770 µm). The MMA system manufacturer shall supply colored flakes.
  - 1. Appearance: The finish floor coating system shall be uniform in color, texture, and appearance.
  - 2. Edge Termination: Edges that terminate at walls, floor discontinuities, and other embedded items shall be sharp and uniform with no thick or ragged edges. Edges that terminate at adjacent floor surfaces shall be feathered to the minimum thickness allowable.
- B. Slip Resistance: Provide finished surfaces with a verifiable slip resistance as recommended in the Americans with Disabilities Act (ADA), "Accessibility Guidelines for Buildings and Facilities (ADAAG), and as determined by the Owner and the Owner's insurance and legal counsels for slip and fall insurability and legal liability.

**1.3 SUBMITTALS**

- A. Product Data: Manufacturer's printed instructions for evaluating, preparing, and treating the substrate, technical data, and tested physical and performance properties of floor coating system.
- B. Samples: For each coating system, color, and texture required, one 12 inches (300 mm) square sample on a rigid backing.
  - 1. Provide stepped samples on backing large enough to illustrate build-up of floor coatings.
  - 2. Include integral aggregate wearing course in samples.
- C. LEED Submittal:
  - 1. Product Data for Credit EQ 4.1: For sealants, including printed statement of VOC content.

- D. Installer Certificates: Signed by manufacturer certifying that installers comply with specified requirements.
- E. Test Results: Indicate and interpret results of required tests including, but not limited to, bond testing, moisture testing, alkalinity, and other manufacturer recommended tests on concrete substrates. Verify compliance with requirements.
- F. Maintenance data for floor coatings to include in the "Operating and Maintenance Manual" specified in Division 01. Identify substrate and type of floor coatings applied. Include recommendations for periodic inspections, cleaning, care, maintenance, and repair of floor coatings.

#### **1.4 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Only manufacturers of 100 percent reactive, MMA based acrylic liquid as defined by their technical literature are acceptable. Technical literature shall provide the name of the material, generic type, descriptive information, Material Safety Data Sheets (MSDS) and certified test reports showing test results that demonstrate equivalent performance based on the specified products.
- B. Applicator Qualifications: Engage an experienced applicator for this project that shall be prequalified and approved by the material manufacturer at the time of project initiation. Acceptability will include judgment on equipment, history, and financial strength. The manufacturer shall not permit the application of any of its materials by untrained, non-approved personnel.
  - 1. Each approved applicator shall have been trained by the Manufacturer in all phases of surface preparation and application of the specified flooring system.
  - 2. Each approved applicator shall have five years experience of installing the specified flooring system and shall submit a list of five projects/references as a prequalification requirement. Each of the five projects/references shall be of the same type, equal size, quantity, and magnitude to this project as a prequalification requirement. Architect reserves the option to personally inspect the projects/references to accept or reject any of the Contractors prior to bid time as a prequalification requirement.
  - 3. Subcontractor: The only subcontractor to the applicator shall be for concrete surface preparation.
- C. Source Limitations: Obtain primary acrylic floor coating materials, including primers, resins, hardening agents, and topcoats, through one source from a single manufacturer. Provide secondary materials, including patching and fill material, joint sealant, and repair materials from manufacturer or from source recommended by manufacturer.

- D. Product Options: Products and manufacturers named in Part 2 establish requirements for product quality in terms of appearance, construction, and performance. Other manufacturers' products comparable in quality to named products and complying with requirements may be considered. Refer to Division 01 Section "Product Requirements."
1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval and only to the extent needed to comply with performance requirements. Where modifications are proposed, submit comprehensive explanatory data to Architect for review.
- E. Field Sample: Apply 200 square foot (18.5 square meters) of acrylic floor coating to an area selected by the Architect to demonstrate surface preparation, joint and crack treatment, thickness, texture, color, and standard of workmanship.
1. If Architect determines that field sample does not meet requirements, reapply coating until the field sample is accepted.
  2. Simulate finished lighting conditions for Architect's review of mockups.
  3. Keep the accepted field sample undisturbed during construction as a standard for judging completed work. The undamaged field sample may be incorporated into the Work.
  4. The Owner shall determine from field samples the size and amount of non-slip aggregate required to provide the slip resistance prescribed by the Owner's insurance and legal counsels.
- F. Bond Testing: Surface preparation shall be evaluated by conducting bond tests at the site prior to application of the coating system. Bond testing shall be performed in the presence of the manufacturer. At least two bond tests shall be performed in each bay. Locations of bond tests shall be documented on the record drawings and cross-referenced to the actual bond test specimen. Maintain test specimens at project office until completion of work. Proceed only after acceptance of test results by manufacturer.
- G. Preconstruction Conference: Prior to commencement of work representatives of the Owner, Contractor, Construction Manager, Applicator, Manufacturer, and Architect shall meet at the project site to review the testing, surface preparation, and application requirements of the Work of this Section.
1. Review requirements for floor coatings. Notify participants at least 3 working days before conference.
  2. Provide results of moisture test of the concrete prior to Preinstallation conference.

**1.5 DELIVERY, STORAGE AND HANDLING**

- A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storage and mixing with other components.
- B. Store materials as recommended by manufacturer to prevent deterioration from moisture, heat, cold, direct sunlight, or other detrimental effects.

**1.6 PROJECT CONDITIONS**

- A. Environmental Limitations:
  - 1. Material, air and surface temperatures shall be in the range of 25° to 85° F (-4° to 30° C) during application and cure, unless a special formulation is being used and Manufacturer has been consulted. For temperatures below 25° F (-4° C) consult manufacturer for cold weather temperature additives.
  - 2. Relative humidity in the specific location of the application shall be less than 85 percent and the surface temperature shall be at least 5°F (3° C) above the dew point
- B. Lighting: Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during acrylic coating application.
- C. Close spaces to traffic during acrylic coating application and for not less than 24 hours after application, unless manufacturer recommends a longer period.
- D. Conditions required for new concrete:
  - 1. The concrete shall be fully cured for a minimum of 28 days prior to application of the coating system pending moisture testing. Concrete curing compounds shall be evaluated by the manufacturer.
  - 2. Surface contaminants such as membranes, or other bond breakers should not be used. Curing compounds shall be approved by the manufacturer.

**1.7 SUSTAINABLE DESIGN SUBMITTALS**

- A. Section 01811 - Sustainable Design Requirements: Requirements for sustainable design submittals.
- B. Manufacturer's Certificate: Certify products meet or exceed specified sustainable design requirements.
  - 1. Materials Resources Certificates:
    - a. Certify recycled material content for recycled content products.

- b. Certify source for local and regional materials and distance from Project site.
  - 2. Indoor Air Quality Certificates:
    - a. Certify volatile organic compound content for each interior adhesive and sealant and related primer.
- C. Product Cost Data: Submit cost of products to verify compliance with Project sustainable design requirements. Exclude cost of labor and equipment to install products.
  - 1. Provide cost data for the following products:
    - a. Products with recycled material content.
    - b. Local and regional products.

#### **1.8 WARRANTY**

- A. General: Warranties specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and are in addition to and run concurrent with other warranties made by the Contractor under requirements of the Contract Documents.
- B. Warranty: Submit written warranty signed by floor coating manufacturer and applicator agreeing to repair or replace acrylic floor coatings that do not meet requirements or that deteriorate within the warranty period indicated below. Warranty does not include deterioration or failure of floor coating due to unusual weather phenomena, failure of prepared and treated substrate, formation of new joints and cracks in excess of 1/16 inch (1.5 mm) wide, fire, vandalism, or damage caused by truck traffic or maintenance equipment.
  - 1. Warranty Period: 5 years after date of Substantial Completion.

#### **1.9 EXTRA STOCK**

- A. General: Include enough material for Owner's personnel to perform repairs on an area equal to 200 square feet (18.5 square meters).

### **PART 2 PRODUCTS**

#### **2.1 MANUFACTURERS**

- A. Basis-of-Design System: The design is based on "Degacalad CF Self Leveling Full Flake Coating System" by BASF Building Systems. Subject to compliance with requirements, provide either the named system or a comparable system by one of the other specified manufacturers. Comparable systems are subject to review and approval through the submittal process specified.

- B. Manufacturers: Subject to compliance with requirements, provide systems by one of the manufacturers specified.
  - 1. BASF Building Systems
  - 2. Sika Flooring
  - 3. Dura- Flex Inc.
- C. The system includes, but is not limited to, the following: Degaclad CF Self Leveling Full Flake Coating System
  - 1. Saturating Primer/Sealer Coat: Degadur R41i Low Viscosity Primer.
  - 2. Base Coat: Degadur R61SL. Pigmented as indicated in Finish Legend.
  - 3. Vinyl Flakes: Distribution shall be as defined in the Finish Legend.
  - 4. First Topcoat: Degadur R71 Colorless Topcoat Resin.
    - a. Pigment: To complement flake colors and to be approved by Owner
  - 5. Antimicrobial Additive: Manufacturer's standard.
  - 6. Non-slip Aggregate:
    - a. #30 - #50 fine sand as required to meet field sample testing.
    - b. Glass beads (25-45 sieve) as required to meet field sample testing for showers, locker rooms and hydrotherapy areas only.
  - 7. Second Topcoat: Degadur R71 Colorless Topcoat Resin.
  - 8. Cove Bases: Thixotropic Degadur R61 with filler.
    - a. Height: 8 inches (203 mm).

## **2.2 MATERIALS**

- A. System Description: Provide primer, bond coat and topcoat as follows:
  - 1. Primer/Sealer: Solvent-free, 100 percent reactive, MMA-based liquid to which a curing agent is added at the job site.
  - 2. Topping: Two component pigmented, solvent-free, 100 percent reactive, MMA-based liquid.
  - 3. Topcoats: Two component transparent, solvent-free, 100 percent reactive, MMA-based liquid.
- B. Mixing: Follow manufacturer's prescribed procedures and recommendations.

## **PART 3 EXECUTION**

### **3.1 INSPECTION**

- A. Examine all surfaces to receive coatings and report to the Architect any conditions that will adversely affect the appearance or performance of the coating systems and that cannot be put into acceptable condition by the specified surface preparation.

- B. Do not proceed with installation until unsatisfactory conditions have been corrected.
- C. Protect adjacent surfaces not to be coated. Owner's equipment shall be protected from dust, cleaning solutions, and flooring materials.

### **3.2 PREPARATION**

- A. General: Prepare and clean substrates according to acrylic coating manufacturer's written instructions for substrate indicated. Provide clean, dry, and neutral Ph substrate for acrylic coating application.
- B. Concrete Substrates: Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants incompatible with acrylic coating.
  - 1. Roughen concrete substrates as follows:
    - a. Comply with ASTM C 811 requirements, unless manufacturer's written instructions are more stringent.
  - 2. Repair damaged and deteriorated concrete according to acrylic coating manufacturer's written recommendations.
  - 3. Verify that concrete substrates are dry.
    - a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with application only after substrates have maximum moisture vapor- emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) of slab in 24 hours.
    - b. Perform plastic sheet test, ASTM D 4263. Proceed with application only after testing indicates absence of moisture in substrates.
    - c. Perform additional moisture tests recommended by manufacturer. Proceed with application only after substrates pass testing.
  - 4. Verify that concrete substrates have neutral Ph and that acrylic coating will adhere to them. Perform tests recommended by manufacturer. Proceed with application only after substrates pass testing.
- C. Mask off adjoining surfaces not receiving floor coatings and close off deck drains and other deck penetrations to prevent spillage and migration of liquid coatings.
- D. Bond Testing:
  - 1. Evaluate completed surface preparation by conducting material bond tests in accordance with the manufacturer's written instruction.
- E. Use patching and fill material to fill holes and depressions in substrates according to manufacturer's written instructions.

- F. Treat control joints and other nonmoving substrate cracks to prevent cracks from reflecting through acrylic coating according to manufacturer's written recommendations.

### **3.3 APPLICATION**

- A. General: Apply components of acrylic coating system according to manufacturer's written instructions to produce a uniform, monolithic wearing surface of thickness indicated.
  - 1. Coordinate application of components to provide optimum adhesion of acrylic coating system to substrate, and optimum intercoat adhesion.
  - 2. Cure acrylic coating components according to manufacturer's written instructions. Prevent contamination during application and curing processes.
  - 3. At substrate expansion and isolation joints, provide joint in acrylic coating to comply with acrylic coating manufacturer's written recommendations.
- B. Apply primer over prepared substrate at manufacturer's recommended spreading rate.
- C. Apply self-leveling topping coat(s) in thickness indicated for flooring system.
  - 1. Broadcast colored flakes while the body coat resin is still wet to provide surfaces matching approved sample.

### **3.4 COVE BASES**

- A. Surface Preparation
  - 1. If walls are to be painted prior to installation of cove base, the bottom portion of the walls shall remain un-coated to the height of the cove base to insure a proper bond to the walls and partitions.
  - 2. If walls are constructed of a non-compatible material, a backer board of 5/8 inch cementitious backer board cut to the desired height of the cove base shall be installed. The top of the backer board shall be cut at a 45° angle to create a "beveled" edge.
  - 3. Backer boards shall be fastened using a high grade construction adhesive and counter sunk screws or concrete masonry anchors.
  - 4. Coordinate cove base height with block coursing at glazed block.
- B. System Description
  - 1. Cove base shall be installed according to manufacturers recommendations and shall be as follows:
    - a. Trowel-On Cove Base consisting of a trowel applied radius/base mix with a termination strip installed at the top of the base.



- C. Cove base will receive a broadcast and top coat consistent with flooring system.
  - 1. Slip resistant aggregate is not required on cove bases.

**3.5 FIELD QUALITY CONTROL/INSPECTION**

- A. Manufacturer's Installation Specialist shall be present during substrate preparation and evaluation and installation of the acrylic flake floor coating.
- B. Request acceptance of surface preparation from the Architect before application of the prime/seal coat.
- C. Work not acceptable to the Architect shall be corrected before consideration of final acceptance.

**3.6 CLEANING**

- A. Remove any material spatters and other material that is not where it should be. Remove masking and covers taking care not to contaminate surrounding area.
- B. Repair damage to adjacent surfaces and materials that is caused by coating application activities.

**END OF SECTION**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. Resilient base.

**1.2 SUBMITTALS**

- A. Submit under provisions of Section 01330.
- B. Product Data: Provide data on specified products, describing physical characteristics; sizes, patterns and colors available.
- C. Submit samples of base material.

**1.3 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver, store, protect and handle products to site under provisions of Section 01600.
- B. Protect materials from damage.

**1.4 ENVIRONMENTAL REQUIREMENTS**

- A. Store materials for three days prior to installation in area of installation to achieve temperature stability.
- B. Maintain ambient temperature required by adhesive manufacturer three days prior to, during, and 24 hours after installation of materials.

**1.5 SUSTAINABLE DESIGN SUBMITTALS**

- A. Section 01811 - Sustainable Design Requirements: Requirements for sustainable design submittals.
- B. Manufacturer's Certificate: Certify products meet or exceed specified sustainable design requirements.
  - 1. Materials Resources Certificates:
    - a. Certify recycled material content for recycled content products.
    - b. Certify source for local and regional materials and distance from Project site.
  - 2. Indoor Air Quality Certificates:
    - a. Certify volatile organic compound content for each interior adhesive and sealant and related primer.

- C. Product Cost Data: Submit cost of products to verify compliance with Project sustainable design requirements. Exclude cost of labor and equipment to install products.
  - 1. Provide cost data for the following products:
    - a. Products with recycled material content.
    - b. Local and regional products.

#### 1.6 EXTRA MATERIALS

- A. Section 01700 - Execution and Closeout Requirements: Spare parts and maintenance products.
- B. Supply ten percent (10%) of each size, color, and surface finish specified.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Mannington
  - 1. Style:
  - 2. Description:
- B. Armstrong Flooring
  - 1. Style:
  - 2. Description:
- C. Johnsonite
  - 1. Style:
  - 2. Description:
- D. Substitutions: Under the provisions of Section 01 60 00.

#### 2.2 MATERIALS

- A. Resilient base at **carpet areas** to be **flat base**.
- B. Resilient base at **hard surface floors** to be **coved base**
- C. Adhesive: As recommended by the base manufacturer.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION - BASE

- A. Fit joints tight and vertical. Maintain minimum measurement of 18 inches between joints.

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

**SECTION 09678 - RESILIENT  
BASE & ACCESSORIES**

- B. Miter internal corners. At external corners, 'V' cut back of base strip to 2/3 of its thickness and fold. At exposed ends, use premolded units.
- C. Install base on solid backing. Bond tight to wall and floor surfaces.
- D. Scribe and fit to door frames and other interruptions.

**3.2 CLEANING**

- A. Clean work under provisions of 01700.
- B. Remove access adhesive from base, and wall surfaces without damage.

**END OF SECTION**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. Surface preparation.
- B. Commercial carpet system on floor surfaces.
- C. Accessories.

**1.2 REFERENCES**

- A. ASTM E-84 - Standard Test Method for Surface Burning Characteristics of Building Materials (tunnel test).
- B. HUD/FHA UM-44d - Standards for Carpet and Carpet Certification Program.

**1.3 SUBMITTALS**

- A. Submit manufacturer's certification that the commercial carpet meets or exceeds all codes and traffic ratings for the intended application.
- B. Submit manufacturer's installation instructions under provisions of Section 01330.
- C. Submit shop drawings that indicate seaming plan, method of joining seams, and direction of carpet under provisions of Section 01 33 00.

**1.4 OPERATION AND MAINTENANCE**

- A. Submit operation and maintenance data under provisions of Section 01700. Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.

**1.5 QUALITY ASSURANCE**

- A. Manufacturer's quality assurance test results shall be available for inspection and evaluation.

**1.6 ENVIRONMENTAL REQUIREMENTS**

- A. Store materials a minimum of one day prior to installation in area of installation to achieve temperature stability.
- B. Keep materials dry during delivery and storage.

**1.7 SUSTAINABLE DESIGN SUBMITTALS**

- A. Section 01811 - Sustainable Design Requirements: Requirements for sustainable design submittals.
- B. Manufacturer's Certificate: Certify products meet or exceed specified sustainable design requirements.
  - 1. Materials Resources Certificates:
    - a. Certify recycled material content for recycled content products.
    - b. Certify source for local and regional materials and distance from Project site.
  - 2. Indoor Air Quality Certificates:
    - a. Certify volatile organic compound content for each interior adhesive and sealant and related primer.
- C. Product Cost Data: Submit cost of products to verify compliance with Project sustainable design requirements. Exclude cost of labor and equipment to install products.
  - 1. Provide cost data for the following products:
    - a. Products with recycled material content.
    - b. Local and regional products.

**1.8 WARRANTY**

- A. Submit manufacturer's warranties under provisions of Section 01700. List exclusions and details of the extent of coverage.

**1.9 EXTRA MATERIAL**

- A. Provide an additional 5 percent of carpet under provisions of Section 01700.

**1.10 EXTRA MATERIALS**

- A. Section 01700 - Execution and Closeout Requirements: Spare parts and maintenance products.
- B. Supply ten percent (10%) of each size, color, and surface finish specified.

**PART 2 - PRODUCTS**

**2.1 MANUFACTURER**

- A. Shaw
  - 1. Style:
  - 2. Description:

- B. Atlas
  - 1. Style:
  - 2. Description:
- C. Tandus
  - 1. Style:
  - 2. Description:
- D. Substitutions: Under the provisions of Section 01600.

## **2.2 ADHESIVE MANUFACTURERS**

- A. Acceptable adhesive manufacturer's:
  - 1. Advanced Adhesive Tech. (AAT)
  - 2. Adhesive Industry MFG. Co. (AIM)
  - 3. The W.W. Henry Co.
  - 4. Para-Chem Southern
  - 5. XL, Corp.

## **2.3 ACCESSORIES**

- A. Flooring accessories shown in the finish schedule or listed herein as cove base or wall base shall be 1/8" thick extruded rubber cove base as manufactured by Roppe Corporation. It shall be constructed of first-quality materials properly vulcanized, and shall be smooth and free from imperfections which detract from its appearance. The base shall conform fully to the requirements of US Federal Specification SS-W-40a, Type I Rubber.
- B. Base: As specified in Section 09678 – Resilient Base & Accessories.

# **PART 3 - EXECUTION**

## **3.1 CARPET - CUTTING AND SEAMING**

- A. When more than one width of carpet is required, precut the carpet to the proper length allowing flash up at walls and through doorway.
- B. Position first two pieces of carpet, and cut seam by row cutting and trace cutting to it for the second piece in a manner that will produce a tight, uniform seam requiring only minimal amount of adjusting with a knee kicker.
- C. If row cutting the carpet for seaming is impractical, use a chalkline the entire length to mark your cut on the secondary backing side of both pieces of carpet to be seamed. Then proceed with the aid of a straight edge in cutting the carpet to produce a tight, uniform seam.

- D. The preferred method of seaming the carpet is with a non-releasable backed low profile hot melt seaming tape, before application of adhesive to cushion.
- E. If the carpet seams are of the length which makes it impractical to apply hot melt seaming tape before the application of adhesive to the cushion, it can be inserted after the first width of carpet is folded back into the adhesive.
- F. It is recognized that some boarder and inset work can not be easily seamed with hot melt tape. In which case all seams must be carefully sealed with a carpet seam sealer adhesive/cement.
- G. Apply an approved manufacturers premium soft-set permanent adhesive to the surface of the cushion according to their current guidelines, paying close attention to coverage rates and open times.
- H. Finish wall trim, door jambs, etc. and repeat the proceeding steps for additional widths of carpet.
- I. Roll the completed carpet installation with a light roller, or use a carpet tube to help bed the carpet and push out any vapor bubbles.
- J. Install cove base in accordance with the manufacturers recommendations.

### **3.2 FIELD QUALITY CONTROL**

- A. Field inspection will be performed under provisions of Section 01400.

### **3.3 CLEANING**

- A. Clean and vacuum carpet surfaces.

**END OF SECTION**



**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section includes carpet tile, fully adhered carpet for direct-glued installation and accessories.

**1.2 REFERENCES**

- A. ASTM International:
  - 1. ASTM D2859 - Standard Test Method for Flammability of Finished Textile Floor Covering Materials.
  - 2. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
  - 3. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source.
- B. Carpet and Rug Institute:
  - 1. CRI 104 - Standard for Installation of Commercial Carpet.
- C. National Fire Protection Association:
  - 1. NFPA 253 - Standard Method of Test for Critical Radiant Flux for Floor Covering Systems Using a Radiant Heat Energy Source.

**1.3 SUBMITTALS**

- A. Section 01330 - Submittal Procedures: Submittal procedures.
- B. Shop Drawings: Indicate layout of joints, direction of carpet pile, and location of edge moldings.
- C. Product Data: Submit data on specified products, describing physical and performance characteristics; sizes, patterns, colors available, and method of installation.
- D. Samples:
  - 1. Submit two carpet tiles illustrating color and pattern design for each carpet color selected. Matching roll carpet samples.
- E. Manufacturer's Installation Instructions: Submit special procedures, and perimeter conditions requiring special attention.

**1.4 CLOSEOUT SUBMITTALS**

- A. Section 01700 - Execution Requirements: Closeout procedures.

- B. Operation and Maintenance Data: Submit maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.

**1.5 QUALIFICATIONS**

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years [documented] experience.
- B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

**1.6 SUSTAINABLE DESIGN SUBMITTALS**

- A. Section 01811 - Sustainable Design Requirements: Requirements for sustainable design submittals.
- B. Manufacturer's Certificate: Certify products meet or exceed specified sustainable design requirements.
  - 1. Materials Resources Certificates:
    - a. Certify recycled material content for recycled content products.
    - b. Certify source for local and regional materials and distance from Project site.
  - 2. Indoor Air Quality Certificates:
    - a. Certify volatile organic compound content for each interior adhesive and sealant and related primer.
- C. Product Cost Data: Submit cost of products to verify compliance with Project sustainable design requirements. Exclude cost of labor and equipment to install products.
  - 1. Provide cost data for the following products:
    - a. Products with recycled material content.
    - b. Local and regional products.

**1.7 PRE-INSTALLATION MEETINGS**

- A. Section 01300 - Administrative Requirements: Pre-installation meeting.
- B. Convene minimum one week prior to commencing work of this section.

**1.8 ENVIRONMENTAL REQUIREMENTS**

- A. Section 01600 - Product Requirements.
- B. Store materials in area of installation for 48 hours prior to installation.

**1.9 EXTRA MATERIALS**

- A. Section 01700 - Execution Requirements: Spare parts and maintenance products.
- B. Supply 20 of carpet tiles of each color and pattern selected.

**PART 2 - PRODUCTS**

**2.1 MANUFACTURER**

- A. Shaw
  - 1. Style:
  - 2. Description:
- B. Atlas
  - 1. Style:
  - 2. Description:
- C. Tandus
  - 1. Style:
  - 2. Description:
- D. Substitutions: Under the provisions of Section 01600.

**2.2 ACCESSORIES**

- A. Sub-Floor Filler: Type recommended by flooring material manufacturer.
- B. Contact Adhesive: Recommended by carpet manufacturer.

**PART 3 - EXECUTION**

**3.1 EXAMINATION**

- A. Section 01300 - Administrative Requirements: Coordination and project conditions.
- B. Verify floor surfaces are smooth and flat within tolerances and are ready to receive work.

**3.2 PREPARATION**

- A. Remove sub-floor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with sub-floor filler.
- B. Apply, trowel, and float filler to achieve smooth, flat, hard surface. Prohibit traffic until filler is cured.

- C. Clean substrate.

### **3.3 INSTALLATION**

- A. Install carpet tile in accordance with CRI 104.
- B. Do not mix carpet from different cartons unless from same dye lot.
- C. Cut carpet tile clean. Fit carpet tight to intersection with vertical surfaces without gaps.
- D. Install carpet tile in square pattern, with pile direction parallel or alternating to next unit as directed by the Architect, set parallel to building lines.
- E. Locate change of color or pattern between rooms under door centerline.
- F. Fully adhere carpet tile to substrate.
- G. Adhere carpet tile with self-stick adhesive backing by removing protective membrane and pressing tile back onto clean and dry substrate.
- H. Trim carpet tile neatly at walls and around interruptions.
- I. Complete installation of edge strips, concealing exposed edges.

### **3.4 CLEANING**

- A. Section 01700 - Execution Requirements: Final cleaning.
- B. Remove excess adhesive from floor, base, and wall surfaces without damage.
- C. Clean and vacuum carpet surfaces.

**END OF SECTION**

**PART 1 - GENERAL**

**1.1 SCOPE**

- A. Provide vinyl wallcovering as shown and specified and in accordance with the Contract Documents.

**1.2 SUBMITTALS**

- A. Samples: Submit sample of each type and color to be installed for the Architect's approval.
- B. Certification of Compliance: Submit certificate from manufacturer that wallcovering used meets architectural specification requirements.

**1.3 PRODUCT DELIVERY, STORAGE AND HANDLING**

- A. Deliver all materials in manufacturer's cartons, properly labeled and identified.
- B. Store wallcovering in undamaged condition as packaged by manufacturer.
- C. Take care to prevent damage during delivery, handling and storage.
- D. Store all materials flat in a clean, dry storage area where temperature shall be maintained above 40 degrees F with normal humidity. Do not store materials in an upright position.

**1.4 JOB CONDITIONS**

- A. Areas to receive wallcovering shall have a constant temperature of at least 55 degrees F for three days before and all during application period.

**1.5 SUSTAINABLE DESIGN SUBMITTALS**

- A. Section 01811 - Sustainable Design Requirements: Requirements for sustainable design submittals.
- B. Manufacturer's Certificate: Certify products meet or exceed specified sustainable design requirements.
  - 1. Materials Resources Certificates:
    - a. Certify recycled material content for recycled content products.
    - b. Certify source for local and regional materials and distance from Project site.
  - 2. Indoor Air Quality Certificates:

- a. Certify volatile organic compound content for each interior adhesive and sealant and related primer.
- C. Product Cost Data: Submit cost of products to verify compliance with Project sustainable design requirements. Exclude cost of labor and equipment to install products.
  - 1. Provide cost data for the following products:
    - a. Products with recycled material content.
    - b. Local and regional products.

#### **1.6 GENERAL WARRANTY**

- A. All products shall be guaranteed against manufacturing defects for a period of five years. If defects become evident during this period, manufacturer shall replace vinyl and assume installation cost.

#### **1.7 EXTRA MATERIALS**

- A. Section 01700 - Execution and Closeout Requirements: Spare parts and maintenance products.
- B. Supply ten percent (10%) of each size, color, and surface finish specified.

### **PART 2 - PRODUCTS**

#### **2.1 MATERIALS**

- A. Design Tex
  - 1. Style:
  - 2. Description:
- B. Maharam
  - 1. Style:
  - 2. Description:
- C. Wolf Gordn
  - 1. Style:
  - 2. Description:

#### **2.2 ACCESSORIES**

- A. Adhesive: As recommended by manufacturer with mildewcide.
- B. Primer: As recommended by manufacturer.

**PART 3 - EXECUTION**

**3.1 INSPECTION**

- A. Examine all surfaces to receive wallcovering before beginning work to determine that they are sound, dry, clean and ready to receive final finish.
- B. Correct defects that could affect quality of finished work.
- C. Plaster and masonry surfaces shall not contain more than 5.5 percent moisture.
- D. Starting wallcovering work shall be construed as evidence of acceptance of conditions under which work will be done.

**3.2 SURFACE PREPARATION**

- A. Remove all loose paint and other wallcoverings.
- B. For new drywall construction, a coat of Genon Vinyl Wall Prep shall be applied to the surface before application of wallcovering, for ease of subsequent removal.
- C. Glossy surfaces shall either be sanded to dull the surface or an application of Genon Right Arm Primer shall be applied prior to the installation of wallcovering.
- D. Remove mildew from walls and treat surface to inhibit further mildew growth.
- E. Surfaces which are in question as to condition shall have three test strips installed to ascertain any remedial work to be performed.
- F. Gypsum wallboard shall have all nails and screws recessed with all joints and depressions taped and spackled, sanded and primed with one coat of primer.

**3.3 INSTALLATION**

- A. Follow manufacturer's directions for mixing and applying adhesive and primer.
- B. Before cutting, examine pattern and color and determine that they match approved samples. Examine patterned material for repeat in design.
- C. Mix paste thoroughly. Apply paste on back of material with brush or roller in a thin, even coat over entire panel.
- D. Use panels in exact order as they are cut from roll.

- E. Trim on selvage of each panel deep enough to ensure color conformity using a straight edge on a cutting table or use the wall cutting procedures (without scoring the substrate) acceptable to the Architect.
- F. Install panels on the hanging surface, reversing every other panel of non-match patterns unless otherwise instructed by the manufacturer.
- G. Fill in over doors and windows with panels cut in consecutive order from the roll.
- H. Smooth fabric to hanging surface with stiff-bristled sweep brush or a flexible broad-knife to eliminate air bubbles and ensure adhesion.
- I. Vertical joints shall not occur less than six inches from outside or inside corners.
- J. Where applicable, install wallcovering before installation of plumbing, casing, bases, cabinets, etc.
- K. Remove excess paste from seam before making next seam. Use sponge or cloth dampened with clean water; wipe clean with dry towel.
- L. Any variation in color and/or pattern match shall be immediately communicated to the manufacturer's representative for his inspection before proceeding further with installation.

#### **3.4 CLEAN-UP**

- A. Upon completion of the work, remove surplus materials, rubbish and debris resulting from the operations under this Section, including equipment and implements of service and leave the entire structure and site insofar as the work of this Section is concerned in a neat, clean and acceptable condition.

**END OF SECTION**



**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. Exterior Substrates:
    - a. Steel.
    - b. Galvanized metal.
    - c. Aluminum (not anodized or otherwise coated).
  - 2. Interior Substrates:
    - a. Steel.
    - b. Galvanized metal.
    - c. Aluminum (not anodized or otherwise coated).
- B. Related Requirements:
  - 1. Division 5 Sections for shop priming of metal substrates with primers specified in this Section.
  - 2. Division 9 painting Sections for special-use coatings and general field painting.

**1.3 DEFINITIONS**

- A. Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.
- B. 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.
- 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.
- 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 rigid metal backing, 8 inches (200 mm) square.
  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. (3.8 L) 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. Provide high performance coatings for mockups, specified in other sections that include elements to receive high performance coatings.
- C. Before starting the work, arrange a pre-construction meeting in accordance with General Conditions. Items for discussion shall include construction procedures and scheduling, surface readiness, application requirements, material storage, and protection.
- D. Material compatibility: provide fillers, primers, finish coat materials, and related materials that are compatible with one another and the indicated substrates under conditions of service and application, as demonstrated by the manufacturer based on testing and field experience.

- E. Mockups: Apply mockups of each coating system indicated to verify preliminary selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
  - 1. Architect will select one surface to represent surfaces and conditions for application of each coating system specified in Part 3. Architect will designate items or areas required.
  - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
  - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

## 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 (7 deg C).
  - 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 (10 and 35 deg C).
- B. Do not apply coatings when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) 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. Ameron International Corporation.
  - 2. DuPont de Nemours & Co.
  - 3. ICI Paints.
  - 4. Sherwin-Williams Company (The).
  - 5. 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. MPI Standards: Provide products that comply with MPI standards indicated and are listed in "MPI Approved Products List."
- B. 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.
- C. VOC Content: Products shall comply with VOC limits of authorities having jurisdiction and, 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).
  - 1. Primers, Sealers, and Undercoaters: 200 g/L.
  - 2. Anti-Corrosive and Anti-Rust Paints Applied to Ferrous Metals: 250 g/L.
  - 3. Zinc-Rich Industrial Maintenance Primers: 340 g/L.
- D. Colors: As selected by Architect from manufacturer's full range.
- E. Manufacturers' names and product designations can be inserted into subsequent articles. Coatings in these articles are specified by reference to MPI paint categories and MPI numbers. Note that each coating category below is unique within this Section and is identical to that used in the schedules at the end of Part 3.

## 2.3 FINISH SYSTEM HPC-1:

- A. Shop primer: zinc-rich epoxy, "Amercoat 68" (Ameron), or zinc-rich polyurethane, "90/97 Tneme-Zinc" (Tnemec Company, Inc.) at minimum dry film thickness of 2.5 to 3.5 mils.
- B. Intermediate coat: two-component epoxy high solid "Amercoat 385" (Ameron), or polyamide epoxy "Series 66 High Build Epoxoline" (Tnemec Company, Inc.), at a minimum dry film thickness of 5.0 to 6.0 mils.
- C. Finish coat: two-component "Amercoat 450 S MIO" (Ameron), at a minimum dry film thickness of 2.5 to 3.5 mils, or "Enduralume 1077" (Tnemec Company, Inc.)

## 2.4 BLOCK FILLERS

- A. Block Filler, Epoxy

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- C. Proceed with coating application only after unsatisfactory conditions have been corrected.
  - 1. 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.
- C. Steel Substrates: Remove rust, loose mill scale, and 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.
- E. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied coatings.
- F. Aluminum Substrates: Remove loose surface oxidation.

### 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. Coat surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, coat surfaces behind permanently fixed equipment or furniture with prime coat only.
  3. Coat back sides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
  4. Do not apply coatings over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
- 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. Steel Substrates:
- B. Galvanized-Metal Substrates:
- C. Aluminum (Not Anodized or Otherwise Coated) Substrates:

END OF SECTION 09960

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

**SECTION 10155 - TOILET  
COMPARTMENTS**

**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 stainless-steel units as follows:
  - 1. Toilet Enclosures: Ceiling hung.
  - 2. Urinal Screens: Wall hung.
- B. Related Sections include the following:
  - 1. Division 5 Section "Metal Fabrications" for supports that attach ceiling-hung units to overhead structural system.
  - 2. Division 10 "Toilet and Bath Accessories" for toilet tissue dispensers, grab bars, purse shelves, and similar accessories.

**1.3 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: Include plans, elevations, sections, details, and attachments to other work.
  - 1. Show locations of cutouts for compartment-mounted toilet accessories.
  - 2. Show locations of reinforcements for compartment-mounted grab bars.
- C. Samples for Verification: Of each type of color and finish required for units, prepared on 6-inch- (150-mm-) square Samples of same thickness and material indicated for Work.

**1.4 PROJECT CONDITIONS**

- A. Field Measurements: Verify actual locations of walls, columns, ceilings, and other construction contiguous with toilet compartments by field measurements before fabrication and indicate measurements on Shop Drawings.
  - 1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating toilet compartments without field measurements. Coordinate wall, floor, ceilings, and other contiguous construction to ensure that actual dimensions correspond to established dimensions.



## PART 2 - PRODUCTS

### 2.1 METAL UNITS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Accurate Partitions Corporation.
  - 2. All American Metal Corp.
  - 3. American Sanitary Partition Corporation.
  - 4. Ampco.
  - 5. Bradley Corporation; Mills Partitions.
  - 6. Flush Metal Partition Corp.
  - 7. General Partitions Mfg. Corp.
  - 8. Global Steel Products Corp.
  - 9. Knickerbocker Partitions Corp.
  - 10. Metpar Corp.
  - 11. Sanymetal; a Crane Plumbing Company.
  - 12. Weis-Robart Partitions, Inc.
  
- B. Stainless-Steel Units: Facing sheets and closures fabricated from ASTM A 666, Type 302 or 304, stainless-steel sheet, leveled to stretcher-leveled flatness.
  - 1. Stainless-Steel Facing Sheet Thicknesses: Specified thicknesses as follows:
    - a. Pilasters, Unbraced at One End: Manufacturer's standard thickness, but not less than 0.050 inch (1.3 mm).
    - b. Panels: Manufacturer's standard thickness, but not less than 0.0312 inch (0.8 mm).
    - c. Doors: Manufacturer's standard thickness, but not less than 0.0312 inch (0.8 mm).
    - d. Integral-Flange, Wall-Hung Urinal Screens: Manufacturer's standard thickness, but not less than 0.0312 inch (0.8 mm).
  - 2. Finish: No. 4 bright, directional polish on exposed faces. Exposed surfaces are protected from damage by application of strippable, temporary protective covering before shipment.
  
- C. Door, Panel, and Pilaster Construction: Seamless, metal facing sheets are pressure laminated to core material. Units have continuous, interlocking molding strip or lapped and formed edge closures. Exposed surfaces are free of pitting, seam marks, roller marks, stains, discolorations, telegraphing of core material, or other imperfections. Corners are sealed by welding or clips. Exposed welds are ground smooth.
  - 1. Core Material: Manufacturer's standard sound-deadening honeycomb of resin-impregnated kraft paper in thickness required to provide finished thickness of 1 inch (25 mm) for doors and panels and 1-1/4 inches (32 mm) for pilasters.
  - 2. Grab-Bar Reinforcement: Provide concealed internal reinforcement for grab bars mounted on units.
  - 3. Tapping Reinforcement: Provide concealed reinforcement for tapping (threading) at locations where machine screws are used for attaching items to units.
  - 4. Urinal-Screen Construction: Similar to panels, with integral full-height flanges for wall attachment, and maximum 1-1/4 inches (32 mm) thick.

- D. Pilaster Sleeves (Caps): Stainless steel, ASTM A 666, Type 302 or 304, not less than 0.0312 inch (0.8 mm) specified thickness and 3 inches (75 mm) high, finished to match hardware.
- E. Brackets (Fittings):
  - 1. Stirrup Type: Ear or U-brackets, stainless steel.
  - 2. Full-Height (Continuous) Type: Manufacturer's standard design; stainless steel for use at urinal screens.

## 2.2 ACCESSORIES

- A. Hardware and Accessories: Manufacturer's standard design, heavy-duty operating hardware and accessories.
- B. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel or chrome-plated steel or brass, finished to match hardware, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use hot-dip galvanized or other rust-resistant, protective-coated steel.

## 2.3 FABRICATION

- A. Ceiling-Hung Units: Provide manufacturer's standard corrosion-resistant anchoring assemblies complete with threaded rods, lock washers, and leveling adjustment nuts at pilasters for connection to structural support above finished ceiling. Provide assemblies that support pilasters from structure without transmitting load to finished ceiling. Provide sleeves (caps) at tops of pilasters to conceal anchorage.
- B. Doors: Unless otherwise indicated, provide 24-inch- (610-mm-) wide in-swinging doors for standard toilet compartments and 36-inch- (914-mm-) wide out-swinging doors with a minimum 32-inch- (813-mm-) wide clear opening for compartments indicated to be accessible to people with disabilities.
  - 1. Hinges: Manufacturer's standard self-closing type that can be adjusted to hold doors open at any angle up to 90 degrees.
  - 2. Latch and Keeper: Manufacturer's standard recessed latch unit designed for emergency access and with combination rubber-faced door strike and keeper. Provide units that comply with accessibility requirements of authorities having jurisdiction at compartments indicated to be accessible to people with disabilities.
  - 3. Coat Hook: Manufacturer's standard combination hook and rubber-tipped bumper, sized to prevent door from hitting compartment-mounted accessories.
  - 4. Door Bumper: Manufacturer's standard rubber-tipped bumper at out-swinging doors.
  - 5. Door Pull: Manufacturer's standard unit at out-swinging doors that complies with accessibility requirements of authorities having jurisdiction. Provide units on both sides of doors at compartments indicated to be accessible to people with disabilities.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.
  - 1. Maximum Clearances:
    - a. Pilasters and Panels: 1/2 inch (13 mm).
    - b. Panels and Walls: 1 inch (25 mm).
  - 2. Stirrup Brackets: Secure panels to walls and to pilasters with not less than three brackets attached at midpoint and near top and bottom of panel.
    - a. Locate wall brackets so holes for wall anchors occur in masonry or tile joints.
    - b. Align brackets at pilasters with brackets at walls.
- B. Ceiling-Hung Units: Secure pilasters to supporting structure and level, plumb, and tighten. Hang doors and adjust so bottoms of doors are level with bottoms of pilasters when doors are in closed position.
- C. Wall-Hung Urinal Screens: Attach with anchoring devices to suit supporting structure. Set units level and plumb and to resist lateral impact.

### 3.2 ADJUSTING

- A. Hardware Adjustment: Adjust and lubricate hardware according to manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors to return doors to fully closed position.

END OF SECTION 10155

**PART 1 - GENERAL**

**1.1 WORK INCLUDED**

- A. Furnish and install complete Balco Metalines Wall Protection systems.

**1.2 REFERENCES**

- A. Publications listed herein are part of this specification to the extent referenced. The criteria established in the specifications shall take precedence over the standards referenced herein. (Sample reference standards are given below.)
  - 1. American Society for Testing and Materials (ASTM):
    - a. ASTM B 221 Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes and Tubes
    - b. ASTM E 84 Standard Test Method for Surface Burning Characteristics of Building Materials

**1.3 SYSTEM DESCRIPTION**

- A. Corner Guards shall be Flush mounted. Flush-mounted corner guards shall be standard.
  - 1. P.V.C. covers shall be textured, high-impact snap on cover having a maximum nominal wall thickness of 0.078", and shall have an ASTM D-256 impact resistance of 27.9 ft/lbs. per inch-notch.
  - 2. P.V.C. covers shall have an ASTM E-84, U.L.-723 and NFPA 255 flame spread of less than 25, and shall be self-extinguishing in accordance with ASTM D-635.

**1.4 QUALITY ASSURANCE**

- A. Manufacturer: Furnish assemblies from one (1) manufacturer with a minimum of ten (10) years of experience in the fabrication of wall protection systems.
- B. Installer: Firm with not less than three (3) years of successful experience in the installation of systems similar to those required by this project and acceptable to the manufacturer of the system.

**1.5 SUSTAINABLE DESIGN SUBMITTALS**

- A. Section 01811 - Sustainable Design Requirements: Requirements for sustainable design submittals.
- B. Manufacturer's Certificate: Certify products meet or exceed specified sustainable design requirements.
  - 1. Materials Resources Certificates:

- a. Certify recycled material content for recycled content products.
  - b. Certify source for local and regional materials and distance from Project site.
- 2. Indoor Air Quality Certificates:
  - a. Certify volatile organic compound content for each interior adhesive and sealant and related primer.
- C. Product Cost Data: Submit cost of products to verify compliance with Project sustainable design requirements. Exclude cost of labor and equipment to install products.
  - 1. Provide cost data for the following products:
    - a. Products with recycled material content.
    - b. Local and regional products.

#### **1.6 SUBMITTALS**

- A. Submit manufacturer's specifications and technical data, including Material Safety Data Sheets, installation instructions, as required, and catalog cuts and templates where required to explain construction and to provide for incorporation into the project.
- B. Submit certificates, copies of specified independent test reports or research reports showing compliance with fire resistance rating, flame and smoke development requirements and other specified performance requirements.
- C. Submit shop drawings showing complete fabrication details for wall protection, including required anchorage to surrounding construction.
- D. Submit three (3) 6" samples of the specified system.

#### **1.7 DELIVERY, STORAGE AND HANDLING**

- A. Provide temporary protective cover on finished surfaces.
- B. Deliver joint covers to job site in new, clean, unopened crates of sufficient size and strength to protect materials during transit.
- C. Store components in original containers in a clean, dry location.

#### **1.8 WARRANTY**

- A. Submit manufacturer's warranty that materials furnished will perform as specified for a period of not less than one (1) year when installed in accordance with manufacturer's recommendations.

**PART 2 - PRODUCTS**

**2.1 MANUFACTURERS**

- A. Construction Specialties
  - 1. Style:
  - 2. Description:
- B. Arden Architectural Specialties
  - 1. Style:
  - 2. Description:
- C. InPro Corporation
  - 1. Style:
  - 2. Description:
- D. Substitutions: Under the provisions of Section 01600.

**2.2 MATERIALS**

- A. P.V.C. shall be rigid, high-impact type. P.V.C. sheet shall be flexible.
- B. Aluminum shall be ASTM B 221, alloy 6061-T6 for extrusions ASTM B 209, alloy 6061-T6 for plate.
- C. Galvanized sheet shall be ASTM A 525, G90 steel
- D. Paint Grip Steel shall be phosphatized, sheet.
- E. Stainless Steel shall be ASTM A 666, type 304.
- F. Fasteners, accessories and other materials required for complete installation to manufacturer's instructions.

**2.3 FABRICATION**

- A. Fabricate corner guards and wall protection materials as detailed. Provide anchors and accessories necessary for complete installation. Mounting Brackets and End Returns shall be injected molded.
- B. Shop assemble components and package with anchors and fittings.
- C. Provide components in single lengths where possible; minimize site splicing.
  - 1. Corner guards shall be provided in 4'0", standard lengths.
  - 2. Wall protection materials shall be provided cut to length.

**2.4 FINISHES**

- A. Stainless Steel: shall be provided with a satin finish.

- B. Phosphatized Steel (Paintloc): shall be ready to paint.
- C. P.V.C. shall be provided with an embossed Finish. Color shall be as selected from manufacturer's standard colors.
- D. Aluminum shall be clear anodized.

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. Install corner guards and wall protection in accordance with the governing regulations, the industry standards applicable to the work and the manufacturer's written installation instructions.
- B. Manufacturer shall provide location drawings identifying placement of materials, shall use a mark system for correlating materials to drawings.
- C. Work shall be aligned plumb, level, and, as required, flush with adjacent surfaces.
- D. Work shall be rigidly anchored to substrate.
  - 1. Fasteners for corner guard retainers shall be spaced as recommended by the manufacturer in the details and in the installation instructions and shall be installed using hardware suitable for the conditions, which shall be provided by the manufacturer.
  - 2. The P.V.C. corner guard covers shall be snapped into place.
  - 3. Retainers for P.V.C. handrails, and bumper and crash rails shall be installed using hardware suitable for the conditions, which shall be provided by the manufacturer.
  - 4. Flush mount systems retainers shall fasten directly to the metal stud through the unexposed extruded aluminum retainer only. Fastening retainer through the outside flange and drywall shall not be acceptable.
  - 5. The void between flush mount corner guards and the wall shall be filled with grout.
  - 6. Installed fasteners for handrail mounting brackets and end returns shall be concealed.

#### **3.2 ADJUSTING AND PROTECTION**

- A. Inspect system components for proper fit.
- B. Adjust, repair or replace components not conforming to requirements. Repair or replacement of an individual unit shall be as approved by the Architect.

- C. Advise contractor of procedures required to protect installation from damage by work of other Sections.
- D. Finished units shall be without damage. Units damaged during shipping or construction shall be repaired by the contractor at the expense of the party damaging the material, in accordance with the contract requirements.

END OF DOCUMENT



**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. Locker units with hinged doors.
- B. Metal bases, tops, and filler panels.

**1.2 REFERENCES**

- A. ASTM A446/A446M - Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Structural (Physical) Quality.
- B. ASTM A526/A526M - Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Commercial Quality.

**1.3 SUBMITTALS FOR REVIEW**

- A. Section 01330 - Submittals: Procedures for submittals.
- B. Product Data: Provide data on locker types, sizes and accessories.
- C. Shop Drawings: Indicate locker plan layout, numbering plan, and combination lock code or, key codes.
- D. Samples: Submit two samples of each color; applied to specified base metal.

**1.4 SUSTAINABLE DESIGN SUBMITTALS**

- A. Section 01811 - Sustainable Design Requirements: Requirements for sustainable design submittals.
- B. Manufacturer's Certificate: Certify products meet or exceed specified sustainable design requirements.
  - 1. Materials Resources Certificates:
    - a. Certify recycled material content for recycled content products.
    - b. Certify source for local and regional materials and distance from Project site.
  - 2. Indoor Air Quality Certificates:
    - a. Certify volatile organic compound content for each interior adhesive and sealant and related primer.
- C. Product Cost Data: Submit cost of products to verify compliance with Project sustainable design requirements. Exclude cost of labor and equipment to install products.

1. Provide cost data for the following products:
  - a. Products with recycled material content.
  - b. Local and regional products.

**1.5 SUBMITTALS FOR INFORMATION**

- A. Section 01330 - Submittals: Procedures for submittals.
- B. Manufacturer's Installation Instructions: Indicate component installation assembly.

**1.6 MOCK-UP**

- A. Section 01400 - Quality Control: Requirements for mock-up.
- B. Provide mock-up of one full size locker, with sloped top, in selected colors; in accordance with Section 01400.
- C. Locate where directed.
- D. Mock-up may remain as part of the Work.

**1.7 DELIVERY, STORAGE, AND PROTECTION**

- A. Section 01600 - Material and Equipment: Transport, handle, store, and protect products.
- B. Protect locker finish and adjacent surfaces from damage.

**PART 2 - PRODUCTS**

**2.1 MANUFACTURERS**

- A. Republic Storage Systems Company, 1038 Belden Ave. NE, Canton, OH 44705.
- B. Other acceptable manufacturers offering equivalent products:
  1. DeBourgh Manufacturing Company, Airport Industrial Park, 27505 Otero Avenue, La Junta, CO 81050.
  2. Interior Medart, PO Box 658, Medart Drive, Greenwood, Mississippi 38930.
  3. Lyons Metal Products, Inc., PO Box 671, Aurora, IL 60507.
  4. Penco Products, Inc., Brower Avenue, PO Box 378, Oaks, Pennsylvania 19456.
- C. Substitutions: Under provisions of Section 01600 - Materials and Equipment.

**2.2 GENERAL**

- A. Material: All major steel parts shall be made of mild cold rolled steel, free from imperfections and capable of taking a high grade enamel finish.
- B. Finish: Before enamel is applied, the surfaces of the steel shall be thoroughly cleaned and phosphatized in a seven stage process. All parts shall then be finished with a heavy coat of enamel baked on at 300 degrees for 30 minutes.
- C. Trim and Accessories: Trim and accessories such as recess trim, sloping tops, closed bases, zee bases and fillers of all types shall be provided for a complete installation. All items are to be finished to match lockers using the same process outlined above.
- D. Hinges: Shall be 2" high, 5-knuckle, full loop, tight pin style, to be securely welded to the frame and riveted to the inside of the door flange. Hinges used on the Mondrain®, Designer, Heavy Duty Corridor, Single Point, Heavy Duty Ventilated and All Welded Ventilated Lockers shall be attached with two rivets. Locker doors 42" high and less shall have two hinges. Doors over 42" high shall have three hinges. An extra hinge shall be provided on 24" wide Heavy Duty Ventilated single and double tier doors.
- E. Pre-locking Device: All "tiered" lockers, except Single Point, shall be equipped with a positive automatic pre-locking device whereby the locker may be locked while the door is open and then closed without unlocking and without damaging the locking mechanism.
- F. Construction: Lockers shall be built on the unit principle - each locker shall have an individual door and frame, individual top, bottom, back and shelves with common intermediate uprights separating compartments.
- G. Number plates: Each locker door shall have a polished aluminum number plate with black numerals not less than 1/2" high for easy readability. Each number plate shall be attached with two blind rivets.
- H. Interior equipment: Single tier lockers shall have one hat/book shelf. Other tiered lockers shall not have shelves. All single, double and triple tier lockers shall have one double prong (single prong in 9" width) back hook and two single prong wall hooks in each compartment. All hooks shall be made of steel, formed with ball points, and zinc-plated with two bolts or rivets. Lockers under 20" high shall not be equipped with hooks.
- I. Benches and pedestals: Locker benches shall be made from laminated maple, 1-1/4" full finished thickness. All corners shall be rounded and sanded. Surfaces shall be finished with two coats of Super KEM VAR C. Bench shall be 9-1/2" wide and furnished in lengths of 3 feet through 12 feet (even foot increments). Tops shall be mounted on Pedestals

consisting of sturdy 1-1/4" OD tubing with 10 gauge steel flanges welded to each end. The overall height of bench assembly shall be 17-1/2".

### **2.3 STANDARD LOCKERS**

- A. Door Frames: Shall be 16 gauge formed into deep 1" face channel shapes with a continuous vertical door strike integral with the frame on both sides of the door opening. Cross frame members of 16 gauge channel shapes, including intermediate cross frame on double, triple and four tier lockers shall be securely welded to vertical framing members to ensure a square and rigid assembly.
- B. Door - Tiered Lockers: Shall be 16 gauge or 18 gauge steel, formed with a full channel shape on the lock side to fully conceal the lock bar, channel formation on the hinge side and right angle formations across the top and bottom. Standard single and double tier shall have a group of six louvers near the top and bottom of each door. Triple and four tier doors shall have three or six louvers near the top and/or bottom of each door.
- C. Doors - Box Lockers: Shall be 16 or 18 gauge steel, formed with right angles on all four sides. Three high doors (20" and 24") shall have a group of three louvers near the top and bottom of each door. Four, five and six high doors shall have a group of two louvers near the top and bottom of each door.
- D. Latching - Tiered Lockers: Shall be a one-piece, pre-lubricated spring steel latch, completely contained within the lock bar under tension to provide rattle-free operation. The lock bar shall be of pre-painted, double channel steel construction held laterally in the door channel by means of non-removable self-formed retainers, pierced from the door. There shall be three latching points for lockers over 42" in height and two latching points for all tiered lockers 42" and under in height.
- E. Handles - Tiered Lockers: All handle pares shall be made from sturdy zinc die cast material. The fixed case to be attached to the door with two hex head screws and a shock absorbing stud. The case shall fully shield the lifting trigger from below. The lifting trigger to have two right angle lugs that insert into the bar without the use of a fastening device. The lifting trigger to be equipped with rubber silencers at top and bottom to prevent metal-to-metal contact. Padlock attachment with 3/8" diameter hole positioned so that the fixed handle case provides a padlock strike. The handle design shall be free of openings or surfaces that permit leverage to be applied.
- F. Box Lockers: Box lockers (3,4,5 and 6 high) shall have a padlock hasp and a stainless steel strike plate with an integral handle pull. All box locker doors shall be punched to accept built-in combination locks.
- G. Frame Hooks - Silencers: Frame hooks to accept latching shall be of heavy gauge steel, set close in and welded to the door frame. Continuous

vertical door strike shall protect frame hooks from door slam damage. A soft rubber silencer shall be provided and securely installed on each frame hook.

- H. Body: The body of the locker shall consist of 24 gauge upright sheets, backs, tops, bottoms and shelves, finished in #83 Tan. Tops, bottoms and shelves shall be flanged on all four sides. Backs shall be flanged on two sides. Uprights shall be offset at the front and flanged at the rear to provide a double lapped rear corner. All bolts and nuts shall be zinc plated.

#### **2.4 HEAVY DUTY CORRIDOR LOCKERS**

- A. Door Frames: Shall be 16 gauge formed into deep 1" face channel shapes with a continuous vertical door strike integral with the frame on both sides of the door opening. Cross frame members of 16 gauge channel shapes, including intermediate cross frame on double, triple and four tier lockers shall be securely welded to vertical framing members to ensure a square and rigid assembly.
- B. Doors: Single, double, and triple tier doors shall be formed from 14 gauge cold rolled sheet steel. Formations shall consist of a full channel shape on the lock side of adequate depth to fully conceal the lock bar, channel formations on the hinge side and right angle formations across the top and bottom. Doors shall be of flush design without louvers or perforations. The top and bottom flanges of all doors shall be perforated for ventilation through Republic's Verti-Vent System.
- C. Latching: Shall be a one-piece, pre-lubricated, spring steel latch completely contained within the lock bar, under tension, to provide a rattle-free operation. The lock bar shall be of pre-painted, double-channel steel construction. The lock bar shall be securely contained in the door channel by self-lubricating polyethylene guides that isolate the lock bar from metal-to-metal contact with the door. There shall be three latching points for lockers over 42" in height and two latching points for all tiered lockers 42" and under in height. The lock bar travel shall be limited by contacting resilient high-quality elastomeric cushioning devices concealed inside the lock bar.
- D. Recessed Handle: A non-protruding 14 gauge lifting trigger shall be provided for actuating the lock bar when opening the door. It shall be contained in a formed 20 gauge stainless steel pocket with the exposed portion encased in a molded ABS thermoplastic cover that provides isolation from metal-to-metal contact. The trigger is to be integral part of the steel slide plate that transfers the lifting force to the lock bar. The stainless steel pocket shall contain a recessed mounting area for the various lock types available and also mounting for the number plate.
- E. Frame Hooks - Silencers: Frame hooks to accept latching shall be of heavy gauge steel, set close in and welded to the door frame. Continuous

vertical door strike shall protect frame hooks from door slam damage. A soft rubber silencer shall be provided and securely installed on each frame hook.

- F. Body: All locker body components except exposed end uprights shall be made of 24 gauge cold rolled steel finished in #83 Tan. Tops, bottoms and shelves shall be flanged on all four sides. Backs shall be flanged on two sides, uprights shall be offset at the front and flanged at the rear to provide a double lapped rear corner. Exposed end uprights for non-recessed lockers shall be 16 gauge steel.
- G. Assembly: Assembly of all locker components shall be accomplished by the use of low round head, slotless, fin neck machine screws with external tooth lock washer nuts producing a strong mechanical lock that opposes loosening.

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. Section 01300 – Administrative Procedures: Verification of existing conditions before starting work.
- B. Verify that prepared bases are in correct position and configuration.
- C. Verify bases and embedded anchors are properly sized.

#### **3.2 INSTALLATION**

- A. Install in accordance with manufacturer's instructions.
- B. Install lockers plumb and square.
- C. Place and secure on prepared base.
- D. Secure lockers with anchor devices to suit substrate materials. Minimum Pullout Force: 100 lb.
- E. Bolt adjoining locker units together to provide rigid installation.
- F. Install end panels, filler panels, sloped tops, and bases.
- G. Install accessories.
- H. Replace components that do not operate smoothly.

#### **3.3 CLEANING**

- A. Section 01700 - Contract Close-Out: Cleaning installed work.

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**SECTION 10505 - METAL  
LOCKERS**

- B. Clean locker interiors and exterior surfaces.

**END OF SECTION**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Fabrication and installation of EnviroSLAB epoxy terrazzo vanities and countertops with glass/porcelain matrix.
  - 2. Accessories necessary to complete work.

**1.2 SUBMITTALS**

- A. General: Submit in accordance with Section 01330.
- B. LEED Submittals:
  - 1. Credit MR 4.1 and 4.2: Product Data indicating percentages by weight of post consumer and post industrial recycled content for products having recycled content.
    - a. Include statement indicating costs for each product having recycled content.
  - 2. Credit MR 5.1 and 5.2: Certification of content complying with Regionally Manufactured or Regionally Extracted Materials.
  - 3. Credit EQ 4.1: Manufacturers' product data for adhesives and sealants, including printed statement of VOC content.
- C. Shop Drawings: Indicate profiles of members, jointing, fastening, edge treatments, and cut-outs for mechanical services, sinks, accessories, and related items.
- D. Samples: Submit following:
  - 1. Submit full range of available colors for selection purposes for Architect's selection. After initial selection, submit a maximum of four (4) samples, minimum 5" x 5" for each finished combination of Epoxy Resin Color and Glass Aggregate Color for acceptance before proceeding with Work.

**1.3 QUALITY ASSURANCE**

- A. Fabricator Qualifications: Company specializing in fabricating work specified in this Section with minimum five years experience in type work required for Project.
- B. Materials Supplier:
  - 1. Materials furnished shall follow NTMA Specifications.

**1.4 MOCK-UPS**

- A. General: Comply with Section 01400.



- B. Construct mock-up of one counter top For Architect's approval.  
Completed mock-up may remain as completed work.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Comply with Section 01600.
1. Handle, transport, and store units to prevent damage to materials or structure. Handle with care to prevent damage to corners and scratches to faces.
  2. Broken, cracked, chipped, stained or damaged stone will be rejected, whether built-in or not.

1.6 WARRANTY

- A. Warrant product to be free from defects in materials and fabrication for a period of 1 year from date of installation.

PART 2 - PRODUCTS

2.1 ACCEPTABLE FABRICATORS

- A. Subject to compliance with requirements indicated, provide products from fabricators listed below:
1. **EnviroGLAS LLC**, 5048 Tennyson Parkway, Suite 202, Plano, Texas, 75024, (972) 473-3725, (888) 523-7894) toll free voice.
  2. Other acceptable manufacturers offering equivalent products:
    - a. Vetrazzo®, Ford Point, Suite 1400, 1414 Harbour Way South, Richmond, CA 94804
    - b. IceStone®, Brooklyn Navy Yard, 63 Flushing Avenue, Unit 283, Building 12, Brooklyn, New York 11205
  3. Substitutions: Submit in accordance with Section 01600.

2.2 MATERIAL

- A. EnviroSLAB Epoxy Terrazzo with Glass Matrix Countertops: Provide sound, hard, durable, epoxy terrazzo of uniform strength, color, and texture, free of flaws, cracks, seams, or other mineral or organic defects which affect visual appearance or structural integrity.
1. Epoxy Resin blended with three volumes of EnviroSCAPE glass finished to nominal 1/4" thickness, per Manufacturer's recommendations:
  2. Performance criteria with EnviroSCAPE aggregate:

<u>PROPERTY</u>	<u>TEST METHOD</u>	<u>REQUIREMENT</u>
Flammability	ASTM D-635	Self-extinguishing, extent of burning 0.25 maximum

<u>PROPERTY</u>	<u>TEST METHOD</u>	<u>REQUIREMENT</u>
Thermal Coefficient of Linear Expansion	ASTM D-696	25 x 10 <sup>-6</sup> " per 140 degrees Fahrenheit. Temperature range: 12 degrees – 140 degrees
Bond Strength	Surface Soundness Adhesion Test	100% Concrete failure minimum 300 PSI minimum tensile strength

3. Acceptable Product: EnviroGLAS LLC; EnviroSLAB.
4. Panel Characteristics:
  - a. Dimensions: 27" x 84" maximum size.
  - b. Thickness: 1" nominal.
  - c. Profile: Profile as indicated on Drawings.
  - d. Panels: Shall conform to shop drawings with a not to exceed 1/16" tolerance in dimension.
  - e. Surface: Polished with overall uniformity in color matrix and aggregate.
- B. Grouts: Non-staining, type as recommended by manufacturer:
  1. Acceptable Manufacturer: Mapei;
    - a. Grout: Mapei; or approved equal.

### 2.3 EPOXY TERRAZZO COUNTERTOP AND VANITY FABRICATION

- A. Assemble work at shop and deliver to Project ready for installation.
  1. Design construction and installation details to allow for expansion and contraction of materials. Properly frame material with tight, hairline joints held rigidly in place.
  2. Comply with grout manufacturer's recommendations for shelf life, pot life, working life, mixing, spreading, assemble time, time under pressure and ambient temperature.
  3. Provide cut-outs for sinks, mechanical services, washroom accessories and related items. Drill holes and fabricate cut-outs from templates. Provide polished finish for cut-out edges where exposed due to under hung vanity bowl.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine conditions and proceed with work in accordance with Section 01400.
- B. Confirm that supporting construction is complete, and is level, square, true, rigid, and secure.

**3.2 INSTALLATION**

- A. Set EnviroSLAB as shown on approved shop drawings. Butt joints uniformly at 1/32".
- B. Install at locations indicated level, square, true, rigid and secure, and in strict accordance with fabricator's printed instructions.
- C. Dimensions shall not vary more than 1/8" in length, height, or width.
- D. Fill joints with color-pigmented stain proof grout.

**3.3 CLEANING**

- A. General: Comply with Section 01740.
  - 1. Keep installed work clean as work progresses.
  - 2. Leave clean and free from blemishes.
  - 3. Clean by moderate use of neutral cleaner acceptable by countertop fabricator.
  - 4. Clean and repair surfaces soiled or otherwise damaged in connection with work of this Section. Pay cost of replacing materials that cannot be satisfactorily cleaned or which have been damaged by improper cleaning materials and techniques.

**END OF SECTION**

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**SECTION 12484 – ENTRANCE  
FLOOR MATS AND FRAMES**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

- A. This Section includes the following:
  - 1. Entrance mats in recessed frames.
- B. Related Sections include the following:
  - 1. Division 3 Section "Cast-in-Place Concrete" for slab depression for recessed mats and frames.

**1.3 ACTION SUBMITTALS**

- A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: Show the following:
  - 1. Items penetrating floor mats and frames, including the following:
    - a. Door control devices.
    - b. Piping.
  - 2. Divisions between mat sections.
  - 3. Perimeter floor moldings.
- C. Samples for Initial Selection: For each type of product indicated.
- D. Samples for Verification: For each type of product indicated.
  - 1. Floor Mat: 12-inch-square, assembled sections of floor mat.
  - 2. Frame Members: 12-inch-long Sample of each type and color.

**1.4 CLOSEOUT SUBMITTALS**

- A. Maintenance Data: For floor mats and frames to include in maintenance manuals.

## 1.5 MAINTENANCE MATERIAL SUBMITTALS

- 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. Entrance Tiles: Full-size units equal to 25 percent of amount installed for each size, color, and pattern indicated, but no fewer than 2 units.

## 1.6 QUALITY ASSURANCE

- A. Source Limitations: Obtain floor mats and frames through one source from a single manufacturer.
- B. Accessibility Requirements: Provide installed floor mats that comply with Article 302 in the U.S. Access Board's "Americans with Disabilities Act and Architectural Barriers Act Accessibility Guidelines", July 23, 2004 edition.

## 1.7 PROJECT CONDITIONS

- A. Field Measurements: Indicate measurements on Shop Drawings.

## 1.8 COORDINATION

- A. Coordinate size and location of recesses in concrete with installation of finish floors to receive floor mats and frames.

# PART 2 - PRODUCTS

## 2.1 ENTRANCE MATS

- 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. Balco, Inc.
  - 2. Crown Mats and Matting, Inc.
  - 3. C/S Group.
  - 4. Mats, Inc.
  - 5. Musson, R. C. Rubber Co.
  - 6. Plastex Matting, Inc.
  - 7. Tepromark International, Inc.
- B. Vinyl Foot Grille:
  - 1. 3/8-inch-thick, with an embossed non-skid surface and carpet strips, welded in a non-hinged, semiopen, grille design to allow dirt, grit, and water to drop through.
  - 2. Color: As selected by Architect from manufacturer's full range.
  - 3. Mat Size: As indicated.

C. Recessed Frames:

1. Extruded Aluminum: ASTM B 221, Alloy 6061-T6 or Alloy 6063-T5, T6, or T52.
2. Color: As selected by Architect from manufacturer's full range.

## 2.2 CONCRETE FILL AND GROUT MATERIALS

- A. Provide concrete grout and fill equivalent in strength to cast-in-place concrete slabs for recessed mats and frames. Use aggregate no larger than one-third fill thickness.

## 2.3 FABRICATION

- A. Floor Mats: Shop fabricate units to greatest extent possible in sizes indicated. Unless otherwise indicated, provide single unit for each mat installation; do not exceed manufacturer's recommended maximum sizes for units that are removed for maintenance and cleaning. Where joints in mats are necessary, space symmetrically and away from normal traffic lanes. Miter corner joints in framing elements with hairline joints or provide prefabricated corner units without joints.
- B. Recessed Frames: As indicated, for permanent recessed installation, complete with corner pins or reinforcement and anchorage devices.
1. Fabricate edge-frame members in single lengths or, where frame dimensions exceed maximum available lengths, provide minimum number of pieces possible, with hairline joints equally spaced and pieces spliced together by straight connecting pins.
- C. Coat surfaces of aluminum frames that will contact cementitious material with manufacturer's standard protective coating.

## 2.4 ALUMINUM FINISHES

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

# PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Examine substrates and floor conditions for compliance with requirements for location, sizes, minimum recess depth, and other conditions affecting installation of floor mats and frames.
1. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Install recessed mat frames to comply with manufacturer's written instructions. Set mat tops at height recommended by manufacturer for most effective cleaning action; coordinate top of mat surfaces with bottom of doors that swing across mats to provide clearance between door and mat.
  - 1. For installation in terrazzo flooring areas, provide allowance for grinding and polishing of terrazzo without grinding surface of recessed frames. Coordinate with other trades as required.
  - 2. Install grout and fill around frames and, if required to set mat tops at proper elevations, in recesses under mats. Finish grout and fill smooth.

### 3.3 PROTECTION

- A. After completing frame installation and concrete work, provide temporary filler of plywood or fiberboard in recesses and cover frames with plywood protective flooring. Maintain protection until construction traffic has ended and Project is near Substantial Completion.

END OF SECTION 12484

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. Horizontal slat louver blinds.
- B. Operating hardware.

**1.2 SYSTEM DESCRIPTION**

- A. Horizontal metal slat louver blinds installed at window openings, manual control of raising and lowering by cord; blade angle adjustable by control wand.

**1.3 SUBMITTALS**

- A. Submit shop drawings under provisions of Section 01330.
- B. Submit shop drawings indicating opening sizes, tolerances required, installation of blind at window opening, method of attachment, clearances, and operation.
- C. Submit product data under provisions of Section 01330.
- D. Submit product data indicating physical and dimensional characteristics, and operating features.
- E. Submit samples under provisions of Section 01330.
- F. Submit manufacturer's installation instructions under provisions of Section 01300.

**1.4 SUSTAINABLE DESIGN SUBMITTALS**

- A. Section 01811 - Sustainable Design Requirements: Requirements for sustainable design submittals.
- B. Manufacturer's Certificate: Certify products meet or exceed specified sustainable design requirements.
  - 1. Materials Resources Certificates:
    - a. Certify recycled material content for recycled content products.
    - b. Certify source for local and regional materials and distance from Project site.
  - 2. Indoor Air Quality Certificates:
    - a. Certify volatile organic compound content for each interior adhesive and sealant and related primer.



- C. Product Cost Data: Submit cost of products to verify compliance with Project sustainable design requirements. Exclude cost of labor and equipment to install products.
  - 1. Provide cost data for the following products:
    - a. Products with recycled material content.
    - b. Local and regional products.

#### **1.5 QUALITY ASSURANCE**

- A. Manufacturer: Company specializing in manufacturing the products specified in this Section with three years documented experience.

#### **1.6 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver products to site under provisions of Section 01600.
- B. Deliver blinds wrapped and crated in a manner to prevent damage to components or marring of surfaces.
- C. Store and protect products under provisions of Section 01600.
- D. Store in a clean, dry area, laid flat and blocked off ground to prevent sagging, twisting, or warping.

### **PART 2 - PRODUCTS**

#### **2.1 MANUFACTURERS**

- A. Draper
  - 1. Style:
  - 2. Description:
- B. Hunter Douglas
  - 1. Style:
  - 2. Description:
- C. Levelor
  - 1. Style:
  - 2. Description:

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. Verify that openings are ready to receive the work.
- B. Do not commence fabrication until field measurements are confirmed.

- C. Ensure structural supports are correctly placed.
- D. Beginning of installation means installer accepts existing substrate.

**3.2 INSTALLATION**

- A. Install blinds in accordance with manufacturer's instructions.
- B. Secure in place with concealed fasteners.

**3.3 TOLERANCES**

- A. Maximum Variation of Gap at Window Opening Perimeter: 1/4 inch.
- B. Maximum Offset From Level: 1/8 inch.

**3.4 ADJUSTING**

- A. Adjust work under provisions of Section 01700.
- B. Adjust blinds for smooth operation.

**3.5 CLEANING**

- A. Clean work under provisions of 01700.

**END OF SECTION**

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

**SECTION 13050 - FIRE PROTECTION  
GENERAL REQUIREMENTS**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

**A. Work Included:**

1. The system shall include all fire department connections, roof manifolds, hose stations, fire department outlets, fire, jockey pumps & controllers valves, wet sprinklers, dry sprinklers, etc. sprinkler heads, piping drain risers, cabinets, alarms as required for a complete system. Building or area will be fully sprinkled (exception only as per local code).
2. All areas will be supplied from a combination standpipe sprinkler riser system.
3. Areas exposed to freezing will have a dry type sprinkler system.
4. Before any work is commenced, shop drawings shall be carefully prepared and submitted for approval. It is required that the sprinkler systems be sized hydraulically in accordance with NFPA standards. Submit hydraulic calcdelivery, and balanced supply and demand for the appropriate hazard class as defined in NFPA 13, latest edition accepted by local authority having jurisdiction. Such drawings and calculations must be reviewed and approved by all governing authorities, Fire Department, Owners Insurance Underwriters, Factory Mutual and/or Industrial Risk Insurers before any work is commenced at the jobsite.

**1.2 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.**
- B. Related Work**
1. Division 2, Section 02200, EARTHWORK
  2. Division 2, Section 03300, CAST-IN PLACE CONCRETE.
  3. Division 5, Section 05500, METAL FABRICATIONS.
  4. Division 7, Section 07841, FIRESTOPPING.
  5. Division 7, Section 07920, SEALANTS AND CAULKING.
  6. Division 9, Section 09900, PAINTING.
  7. This section is part of each Division 13000 - "Fire Protection" Section
  8. Division 16, ELECTRICAL
  9. Other Sections where applicable.

**1.3 DEFINITIONS**

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. Exposed: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Concealed: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.
- D. Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions.
- E. Interior Installations: Protected from weather conditions and not subject to outdoor ambient temperatures.
- F. Piping: Pipe, fittings, flanges, valves, controls, hangers, drains, insulation, and items customarily required in connection with the transfer of gaseous and fluid mediums.
- G. By Other Trades: By persons or parties responsible for work at the project other than the party or parties who have been duly awarded the contract for the work of this Trade. In the event that this document is used to acquire work as part of a general construction contract the words "by other trades" shall mean by persons or parties who are not anticipated to be the sub-contractor for this trade working together with the general contractor. In this context the words "by other trades" shall not be interpreted to mean not included in the overall contract.

#### 1.4 SUBMITTALS

- A. In accordance with Division 1, Section 01330, SUBMITTAL PROCEDURES, prior to purchasing any equipment or materials and prior to assembling or installing the work, the following shall be submitted for approval:
  - 1. Scale drawings indicating insert and sleeve locations if required by Architect or Structural Engineer.
  - 2. Scale drawings showing all piping and duct runs with sizes, elevations and appropriate indication of coordination with other trades. This submission to us shall consist of one (1) original and six (6) prints.
  - 3. Catalog information, factory assembly drawings and field installation drawings as required for a complete explanation and description of all items of equipment. List all manufacturers and certifications. Submit min. six (6) copies.
- B. Documents will not be accepted for review unless:
  - 1. They include complete information in accordance with local code and with the applicable sections of NFPA including 10, 13, 14, 20 and 415 pertaining to appurtenances and accessories.
  - 2. They are submitted as a package where they pertain to related items.

3. They are properly marked with service or function, project name, where they consist of catalog sheets displaying other items which are not applicable.
4. They indicate the project name and address along with the Contractor's name, address and phone number.
5. They are properly marked with external connection identification as related to the project where they consist of standard factory assembly or field installation drawings.

C. Shop Drawing Review

1. The purpose of the review of shop drawings is to maintain integrity of the design. Unless the contractor clearly points out changes, substitutions, deletions or any other differences between the submission and the Contract Documents in writing on the Contractor's letterhead, approval by the Engineer or Architect does not constitute acceptance. It is not to be assumed that the engineer has read the text nor reviewed the technical data of a manufactured item and its components except where the Vendor has pointed out differences between his product and the specified model.
2. It is the responsibility of the contractor to confirm all dimensions, quantities, and the coordination of materials and products supplied by him with other trades. Approval of shop drawings containing errors does not relieve the contractor from making corrections at his expense.
3. Substitutions of equipment, systems, materials, must be coordinated by the Contractor with his own or other trades which may be involved with the item, such as, but not limited to, equipment substitutions which change electrical requirements, or hanging or support weights or dimensions.
4. Any extra charges or credits which may be generated by other trades due to substitutions will not be accepted unless the Contractor has an agreement in writing with the Owner.
5. Substitutions of equipment, systems, etc. requiring approval of local authorities must comply with such regulations and be filed at the expense of the Contractor (should filing be necessary). Substitutions are subject to approval or disapproval by the Engineer. The Contractor in offering substitutions shall hold the Owner and Engineer harmless if the substituted item is an infringement of patent held by the specified item.
6. Shop drawings shall show all data required by NFPA and Authorities having Jurisdiction.

D. Explanation of Shop Drawing Stamp

1. Approval indicates that we have not found any reason why this item should not be acceptable within the intent of the documents.
2. Approved As Noted indicates that we have found questionable components which if corrected or otherwise explained make the product acceptable.

3. Resubmit indicates that this item should be resubmitted for approval before further processing.
  - a. If both "Approved As Noted" and "Resubmit" are checked, the resubmittal is for record purposes only.
4. Disapproved indicates that the item will not meet the intent of the Contract
5. No shop drawing stamp or note shall constitute an order to fabricate or ship. Such notification can only be performed by the Project Manager for Construction, the Contractor scheduling his own work, or the Owner.

E. Maintenance Data and Operating Instructions:

1. Maintenance and operating manuals in accordance with Division 1, Section 01400, QUALITY REQUIREMENTS, Paragraph, INSTRUCTIONS, for systems and equipment.
2. After all final tests and adjustments have been completed, fully instruct the proper Owner's Representative in all details of operation for equipment installed. Supply qualified personnel to operate equipment for sufficient length of time to assure that Owner's Representative is properly qualified to take over operation and maintenance procedures. Supply qualified personnel to operate equipment for sufficient length of time as required to meet all governing authorities in operation and performance tests.
3. Furnish required number of manuals, in bound form containing data covering capacities, maintenance of operation of all equipment and apparatus. Operating instruction shall cover all phases of control and include the following:
  - a. Performance Curves: For pumps, and similar equipment at the operating conditions.
  - b. Lubrication Schedule: Indicating type and frequency of lubrication required.
  - c. List of Spares: Recommended for normal service requirements.
  - d. Parts List: Identifying the various parts of the equipment for repair and replacement purposes.
  - e. Instruction Books may be standard booklets but shall be clearly marked to indicate applicable equipment.
  - f. Wiring Diagrams: Generalized diagrams are not acceptable, submittal shall be specifically prepared for this Project.
  - g. Automatic Controls: Diagrams and functional descriptions.

4. Where applicable, one set of operating and maintenance instructions shall be neatly hung adjacent to the equipment concerned.

F. Product Data: For the following:

1. Transition fittings.
2. Dielectric fittings.
3. Mechanical sleeve seals.
4. Escutcheons.

G. Welding certificates.

## 1.5 QUALITY ASSURANCE

- A. Applicator: Company specializing in piping installation with seven years minimum experience.
- B. Systems, installation, equipment and materials shall conform to requirements of the local Building Code, Owners Insurance Underwriters, Factory Mutual, Industrial Risk Insurers, local Fire Department, N.F.P.A., ANSI/ASME B31.9 "Building Service Piping" and all authorities having jurisdiction. Equipment and materials Underwriters listed, labeled and approved as required.
- C. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."
- D. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
  1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
  2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.
- E. Products Criteria
  1. All equipment and materials shall be new and without blemish or defect.
  2. New equipment and materials shall be Underwriters Laboratories, Inc. (U.L.) labeled and/or listed where specifically called for or where normally subject to such U.L. labeling and/or listing services.
  3. Asbestos
    - a. All equipment and materials shall be free of asbestos.
  4. Electrical equipment and materials shall be products which will meet with the acceptance of the agency inspecting the electrical work. Where such acceptance is contingent upon having the products examined, tested and certified by Underwriters or other recognized testing laboratory, the product shall be examined, tested and certified. Where no specific indication as to the type or quality of materials or equipment is indicated, a first class standard article shall be furnished.

5. Electrical Characteristics for Mechanical Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.
6. It is the intent of these specifications that wherever a manufacturer of a product is specified, and the terms "other approved" or "or approved equal" or "equal" are used, the substituted item must conform in all respects to the specified item. Consideration will not be given to claims that the substituted item meets the performance requirements with lesser construction. Performance as delineated in schedules and in the specifications shall be interpreted as minimum performance. In many cases equipment is oversized to allow for pick-up loads which cannot be delineated under the minimum performance.
7. All equipment of one type shall be the products of one manufacturer.
8. Substituted equipment or optional equipment where permitted and approved, must conform to space requirements. Any substituted equipment that cannot meet space requirements, whether approved or not, shall be replaced at the Contractor's expense. Any modifications of related systems as a result of substitutions shall be made at the Contractor's expense.
9. Note that the approval of shop drawings, or other information submitted in accordance with the requirements hereinbefore specified, does not assure that the Engineer, Architect, or any other Owner's Representative, attests to the dimensional accuracy or dimensional suitability of the material or equipment involved or the ability of the material or equipment involved or the mechanical performance of equipment. Approval of Shop Drawings does not invalidate the plans and specifications if in conflict, unless a letter requesting such change is submitted and approved on the Engineer's letterhead.
10. Substitutions of equipment for that shown on the schedules or designated by model number in the specifications will not be considered if the item is not a regular cataloged item shown in the current catalog of the manufacturer.

#### 1.6 DELIVERY, STORAGE, HANDLING AND PROTECTION

- A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
- B. Store plastic materials in a location protected from direct sunlight or extreme heat. Support to prevent sagging and bending.



- C. This trade shall be responsible for its work and equipment until finally inspected, tested and accepted. Carefully store materials and equipment which are not immediately installed after delivery to site. Close open ends of work with temporary covers or plugs during construction to prevent entry of obstructing material.
- D. This trade shall protect work and material of other trades from damage that might be caused by its work or workmen and make good damage thus caused.

## 1.7 COORDINATION

- A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for mechanical installations.
- B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
- C. Coordinate requirements for access panels and doors for mechanical items requiring access that are concealed behind finished surfaces.
- D. Provide all designating signs for shutoff valves, control vales, alarms, and the like, as required by the agencies having jurisdiction.

## 1.8 COORDINATION DRAWINGS

- A. Prepare coordination drawings in accordance with Division 1 Section "PROJECT COORDINATION," to a scale of 3/8"=1'-0" or larger; detailing major elements, components, and systems of mechanical equipment and materials in relationship with other systems, installations, and building components. Indicate locations where space is limited for installation and access and where sequencing and coordination of installations are of importance to the efficient flow of the Work, including (but not necessarily limited to) the following:
  - 1. Indicate the proposed locations of piping, equipment, and materials. Include the following:
    - a. Planned piping layout, including valve and specialty locations and valve stem movement.
    - b. Clearances for servicing and maintaining equipment, including space for equipment disassembly required for periodic maintenance.
    - c. Equipment connections and support details.
    - d. Exterior wall and foundation penetrations.
    - e. Fire-rated wall and floor penetrations.
    - f. Sizes and location of required concrete pads and bases.
    - g. Clearances as required by Electric Code.
  - 2. Indicate scheduling, sequencing, movement, and positioning of large equipment into the building during construction.
  - 3. Prepare reflected ceiling plans to coordinate and integrate sprinkler installations, air outlets and inlets, light fixtures, communication systems components and other ceiling-mounted items.

## B. Fire Protection Coordination Drawings

1. This trade shall add to Coordination Drawings prepared by the HVAC Contractor showing all of the fire protection work (equipment, piping, conduit, etc.) to be installed as part of the work of this section of the specifications.
2. This Trade after showing all of the fire protection work shall forward the reproducible Coordination Drawings to the Electrical Contractor.
3. The sequence of coordination drawings shall be HVAC-PLBG- C-FP-ELEC-CM.
4. The Fire Protection Contractor shall attend a series of meetings arranged by the General Contractor/Construction Manage to resolve any real or apparent interferences or conflicts with the work of the other Contractors.
5. The Fire Protection Contractor shall then make adjustments to his work on the Coordination Drawings to resolve any real or apparent interferences or conflicts.
6. After any real or apparent interferences and conflicts have been incorporated into the Coordination Drawings, the Fire Protection Contractor shall "sign-off" the final Coordination Drawings.
7. The Fire Protection Contractor shall not install any of his work prior to "sign-off" of final Coordination Drawings. If the fire protection work proceeds prior to sign-off of Coordination Drawings, any change to the fire protection work to correct the interferences and conflicts which result will be made by the Fire Protection Contractor at no additional cost to the project.
8. Coordination Drawings are for the Contractor's and Architects use during construction and shall not be construed as replacing any shop "as-built", or Record Drawings required elsewhere in these Contract Documents.
9. Architect's review of Coordination Drawings shall not relieve Contractor from his overall responsibility for coordination of all work performed pursuant to the Contract or from any other requirements of the Contract.

## C. Record Drawings

1. As part of the required fire protection work, a complete set of "as-built" or record drawings shall be made up and delivered to the architect.
2. The drawings shall show:-
  - a. All work installed exactly in accordance with the original design.
  - b. All installed as a modification or addition to the original design.
  - c. The dimensional information necessary to delineate the exact location of all piping runs which are so concealed as to be untraceable by inspection through the regular means of access established for inspection and maintenance.

3. Where shop drawings have been prepared and approved, the "as-built" drawings shall be cross referenced to the respective shop drawing.
4. As-built record drawings shall include the updating of all equipment schedule sheets.
5. The record drawings shall be of legible reproducible and durable type.
6. The Contractor shall make arrangements with the Engineer to obtain design drawings on DVD or compact diskettes in AutoCad 2005 format for use as a basis for the "as-built" drawings. These documents remain the property of Cosentini Associates and shall be used for no other purpose without expressed, written consent. The contractor shall assume all liabilities resulting from unauthorized use or modifications to the drawings.
7. Prior to developing any "as-built" drawings, the contractor shall coordinate with the Owner and the Architect Engineer the drawing layers, colors, etc., of the CAD drawings.
8. "As-built" information shall be submitted as follows:
  - a. CAD drawing files on DVD or compact diskettes in AutoCad 2005 format.
  - b. One (1) set of reproducible drawings.
9. The quantity of design drawings which are made available shall in no way be interpreted as setting a limit to the number of drawings necessary to show the required "as-built" information.
10. Progress prints of record drawings shall be submitted monthly during the construction period for Architect's approval.
11. This trade shall submit the "as-built" set for approval by the Engineer in a form acceptable to the Engineer.
12. Final acceptance of the fire protection systems by the authority having jurisdiction will not be implemented until "as-built" drawings are on site.

## 1.9 INTERPRETATION OF THE DRAWINGS AND SPECIFICATIONS

- A. As used in the drawings and specifications, certain non technical words shall be understood to have specific meanings as follows:
  1. "Furnish"-----Purchase and deliver to the project site complete with every necessary appurtenance and support.
  2. "Install"-----Unload at the delivery point at the site and perform every operation necessary to establish secure mounting and correct operation at the proper location in the project.
  3. "Provide"-----"Furnish" and "Install".

- B. Except where modified by a specific notation to the contrary, it shall be understood that the indication and/or description of any item, in the drawings or specifications or both, carries with it the instruction to furnish and install the item, regardless of whether or not this instruction is explicitly stated as part of the indication or description.
- C. It shall be understood that the specifications and drawings are complementary and are to be taken together for a complete interpretation of the work. Where there are conflicts between the drawings and specifications or within the specifications or drawings themselves, the items of higher standard shall govern.
- D. No exclusions from, or limitations, in the language used in the drawings or specifications shall be interpreted as meaning that the appurtenances or accessories necessary to complete any required system or item of equipment are to be omitted.
- E. The drawings of necessity utilize symbols and schematic diagrams to indicate various items of work. Neither of these have any dimensional significance nor do they delineate every item required for the intended installations. The work shall be installed, in accordance with the diagrammatic intent expressed on the drawings, and in conformity with the dimensions indicated on final architectural and structural working drawings and on equipment shop drawings.
- F. No interpretation shall be made from the limitations of symbols and diagrams that any elements necessary for complete work are excluded.
- G. Certain details appear on the drawings which are specific with regard to the dimensioning and positioning of the work. These details are intended only for the purpose of establishing general feasibility. They do not obviate field co-ordination for the indicated work.
- H. Information as to the general construction shall be derived from structural and architectural drawings and specifications only.
- I. The use of words in the singular shall not be considered as limiting where other indications denote that more than one item is referred to.
- J. In the event that extra work is authorized, and performed by this trade, work shown on drawings depicting such work, and/or described by Bulletin is subject to the base building specifications in all respects.

#### 1.10 SEPARATION OF WORK BETWEEN TRADES

- A. The Specifications for the overall construction delineate various items of work under separate trade headings. The list below sets forth this delineation to the extent that it affects the Fire Protection Work.
- B. In the absence of more detailed information, this list shall be taken as a specific instruction to the Fire Protection trade to include the work assigned to it.

- C. Indications that the Fire Protection trade is to perform an item of work mean that it is to perform the work for its own accommodation only, except as specifically noted otherwise.
- D.
- |      |   |   |
|------|---|---|
| Oth  | = | Other than electrical or mechanical     |
| Plb  | = | Plumbing                                |
| FP   | = | Fire Protection                         |
| Htg  | = | Heating, Ventilating & Air Conditioning |
| Elec | = | Electrical                              |
| F    | = | Furnished                               |
| I    | = | Installed                               |
| P    | = | Provided (furnished and installed)      |

Item	Oth	Plb	FP	Htg	Elec	Notes
Motor for plumbing equipment			p			
Motor controls for fire protection equipment.			f		i	Specifications and drawings delineate detailed exceptions.
Wiring for plumbing equipment motors and motor controls.					p	Specifications and drawings delineate detailed exceptions.
Temporary heat	p					
Temporary water	p					
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  
DULUTH INTERNATIONAL AIRPORT  
DULUTH, MINNESOTA**

**SECTION 13053 - FIRE PROTECTION  
GENERAL MATERIALS AND METHODS**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

A. This Section includes the following:

1. Piping materials and installation instructions common to most piping systems.
2. Transition fittings.
3. Dielectric fittings.
4. Mechanical sleeve seals.
5. Sleeves.
6. Escutcheons.
7. Grout.
8. Access doors.
9. Equipment installation requirements common to equipment sections.
10. Painting.
11. Concrete bases.
12. Supports and anchorages.

**1.2 RELATED DOCUMENTS**

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

B. Related Work

1. Division 2, Section 02200, EARTHWORK
2. Division 2, Section 03300, CAST-IN PLACE CONCRETE.
3. Division 5, Section 05500, METAL FABRICATIONS.
4. Division 7, Section 07841, FIRESTOPPING.
5. Division 7, Section 07920, SEALANTS AND CAULKING.
6. Division 9, Section 09900, PAINTING.
7. Division 13, Section 13050 - BASIC FIRE PROTECTION REQUIREMENTS.
8. Division 16, ELECTRICAL
9. Other Sections where applicable.

**1.3 DEFINITIONS**

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.



- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.
- F. Piping: Pipe, fittings, flanges, valves, controls, hangers, drains, insulation, and items customarily required in connection with the transfer of fluids.
- G. By Other Trades: By persons or parties responsible for work at the project other than the party or parties who have been duly awarded the contract for the work of this Trade. In the event that this document is used to acquire work as part of a general construction contract the words "by other trades" shall mean by persons or parties who are not anticipated to be the sub-contractor for this trade working together with the general contractor. In this context the words "by other trades" shall not be interpreted to mean not included in the overall contract.

#### 1.4 SUBMITTALS:

- A. See Section 13050, "Basic Fire Protection Requirements" for requirements.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified. Substitutions will not be permitted unless approved by the Engineer.

#### 2.2 PIPE, TUBE, AND FITTINGS

- A. Refer to individual Division 13 Sections 13915 "Fire Suppression Piping" for pipe, tube, and fitting materials and joining methods.

#### 2.3 JOINING MATERIALS

- A. Refer to individual Division 13 piping Sections 13915 "Fire Suppression Piping" for joining methods and materials.

## 2.4 DIELECTRIC FITTINGS

- A. Refer to individual Division 13 Section 13915 "Fire Suppression Piping" for dielectric fittings.

## 2.5 MECHANICAL SLEEVE SEALS

- A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
  - 1. Manufacturers:
    - a. Advance Products & Systems, Inc.
    - b. Calpico, Inc.
    - c. Metraflex Co.
    - d. Pipeline Seal and Insulator, Inc.
  - 2. Sealing Elements: NBR interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
  - 3. Pressure Plates: Stainless steel. Include two for each sealing element.
  - 4. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

## 2.6 SLEEVES

- A. General:
  - 1. Provide sleeves for each pipe passing through walls, partitions, floors, and roofs. Penetrations in fire/smoke rated components shall be by UL listed assembly.
- B. Galvanized-Steel Sheet: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.
- C. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.
- D. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- E. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
  - 1. Underdeck Clamp: Clamping ring with set screws.
- F. Molded PVC: Permanent designed to be embedded in concrete, with nailing flange for attaching to wooden forms.

## G. Sleeve Materials

## Type Designation

1	Galvanized steel sheet.
2	Standard weight galvanized steel pipe.
3	Standard weight galvanized steel pipe 1/4" steel plate extending from outside of sleeve a minimum of 2" all around, similar to F&S Mfg. Corp. Fig. 204.
4	Cast iron pipe sleeve with center flange, similar to James B. Clow & Sons No. F-1430 and F-1435.
5	Standard weight galvanized steel pipe with flashing clamp device welded to pipe sleeve or watertight sleeves, similar to Zurn 195-10 with oakum and lead caulking as required.
6	Metal deck and wall sleeves. Similar to Adjust-to-Crete Manuf., Co.

## H. Sleeve Sizes

1. Floors and required fire rated partitions - 1/2" maximum clearance between outside of pipe (or insulation on insulated pipes) and inside of sleeve.
2. Partitions not fire rated - 1-1/2" maximum clearance between outside of pipe (or insulation on insulated pipes) and inside of sleeve.

## I. Sleeve Lengths

Location	Sleeve Length
Floors	Equal to depth of floor construction including finish. In waterproof floor construction sleeves to extend minimum of 2" above finished floor level.
Roofs	Equal to depth of roof construction including insulation.
Walls & Partitions	Equal to depth of construction and terminated flush with finished surfaces.

## J. Sleeve Caulking &amp; Packing

Type Designation	Caulking & Packing Requirements
A	Space between pipe and sleeve packed with oakum or hemp and caulked watertight with lead.
B	Space between pipe or pipe covering and sleeve shall be caulked with an incombustible permanently plastic, waterproof non-staining smooth appearance or pack with mineral wool or other equally approved fire resistive material to within ½" of both wall faces and provide caulking compound as per above.

## K. Sleeve Application

Sleeve Type Thru Required Fire Rated Construction	Sleeve Type Thru Non-Fire Rated Construction	Location	Sleeve Caulking & Packing Type Designation	Sleeve Caulking & Packing Type Thru Fire Rated Construction
5	5	Membrane waterproof floor, roof & wall construction.	B	B
5	5	Non-membrane waterproof floor, roof & wall construction where flashing is required.	A or B	B
2	1, 2	Interior walls, partitions & floors.	B	B
3 or 4	3 or 4	Exterior walls.	A	A
2	6	Cellular metal deck floors.	B	B
Sleeve Type	Sleeve Type		Sleeve	Sleeve Caulking & Packing Type

Thru Required Fire Rated Construction	Thru Non-Fire Rated Construction	Location	Caulking & Packing Type Designation	Thru Fire Rated Construction
1	1	Precast concrete floor with poured con- crete topp- ing. Note: Sleeves to have flat flanges and/ or guides which rest on top of precast slab.	B	B

## 2.7 ESCUTCHEONS

- A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
- B. One-Piece, Stamped-Steel Type: With set screw or spring clips and chrome-plated finish.
- C. Split-Plate, Stamped-Steel Type: With concealed or exposed-rivet hinge, set screw or spring clips, and chrome-plated finish.

## 2.8 GROUT

- A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
  - 1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
  - 2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
  - 3. Packaging: Premixed and factory packaged.

## 2.9 FIRESTOPPING

- A. In addition to fire protection means specified elsewhere in this specification, this trade shall comply with the following:
  - 1. All pipe penetrations requiring Fire Stopping shall be “UL” approved thru-wall fire stop assemblies.
  - 2. Contractor shall provide assembly for each type of pipe material thru fire-rated wall thickness.

3. Fire Stopping assemblies shall be installed as approved by local authority having jurisdiction.
4. Fire stop assemblies shall be Rectorseal, 3M, Hilti, Tremco, or approved equal.

## 2.10 PIPE AND EQUIPMENT SUPPORTS AND RESTRAINTS

- A. See Division 13, Section 13060 "Fire Suppression Supports and Hangers".

## 2.11 TOOLS AND LUBRICANTS

- A. Furnish special tools not readily available commercially, that are required for disassembly or adjustment of equipment and machinery furnished.
- B. Lubricants: A minimum of one quart of oil, and one pound of grease, of equipment manufacturer's recommended grade and type, in unopened containers and properly identified as to use for each different application.

## 2.12 ACCESS DOORS IN FINISHED CONSTRUCTION

- A. Access Doors
  1. Access doors as required for operation and maintenance of concealed equipment, valves, controls, etc. will be provided by another trade.
  2. This Trade is responsible for access door location, size and its accessibility to the valves or equipment being served.
  3. Coordinate and prepare a location, size, and function schedule of access doors required and deliver to a representative of the installing trade.
  4. Access doors shall be of ample size, minimum of 16" x 16"..

## 2.13 FOUNDATIONS

- A. General
  1. All equipment, piping, etc., mounted on/or suspended from approved foundations and supports, as shown on the drawings and as specified in Section 13060, "Fire Protection Supports and Hangers".

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Coordinate location of piping, sleeves, inserts, hangers, ductwork and equipment. Locate piping, sleeves, inserts, hangers, and equipment clear of windows, doors, openings, light outlets, and other services and utilities. Follow manufacturer's published recommendations for installation methods not otherwise specified.

### 3.2 PROTECTION AND CLEANING:

- A. See Section 13050 - "Fire Protection Basic Requirements" for requirements.

### 3.3 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. Install piping according to the following requirements and Division 13 Sections specifying piping systems.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping to permit valve servicing.
- G. Install piping at indicated slopes.
- H. Install piping free of sags and bends.
- I. Install fittings for changes in direction and branch connections.
- J. Install piping to allow application of insulation as required.
- K. Select system components with pressure rating equal to or greater than system operating pressure.
- L. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:
  - 1. One-piece, stamped-steel type with spring clips.
- M. Sleeves are not required for core-drilled holes or for holes formed by removable PE sleeves.
- N. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.
  - 1. Cut sleeves to length for mounting flush with both surfaces.
    - (a) Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas **2 inches (50 mm)** above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
  - 2. Install sleeves in new walls and slabs as new walls and slabs are constructed.

3. Install sleeves that are large enough to provide **1/4-inch (6.4-mm)** annular clear space between sleeve and pipe or pipe insulation. Use the sleeve materials as specified in paragraph 2 of this section:
  - (a) Steel Pipe Sleeves: For pipes smaller than **NPS 6 (DN 150)**.
  - (b) Steel Sheet Sleeves: For pipes **NPS 6 (DN 150)** and larger, penetrating gypsum-board partitions.
4. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing: Secure flashing between clamping flanges. Install sleeve to extend sleeve to **2 inches (50 mm)** above finished floor level. Refer to Division 7 Section "Sheet Metal Flashing and Trim" for flashing.
5. Seal space outside of sleeve fittings with grout.
6. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 7 Section "Joint Sealants" for materials and installation.
7. For exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for **1-inch (25-mm)** annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- O. Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- P. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to paragraph 2 of this section and Division 7 Section "Through-Penetration Firestop Systems" for materials.
- Q. Verify final equipment locations for roughing-in prior to installing sleeves.
- R. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

### 3.4 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 13 Sections specifying piping systems - Section 13915, "Fire Suppression Piping".

### 3.5 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.
- B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.



- C. Install mechanical equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
- D. Install equipment to allow right of way for piping installed at required slope.

### 3.6 CONCRETE BASES

- A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to Division 13 Section 13060 "Fire Protection Supports and Hangers".

### 3.7 ERECTION OF WOOD METAL SUPPORTS AND ANCHORAGES

- A. Refer to Division 5 Section 05500 "Metal Fabrications" for structural steel.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.
- C. Refer to Division 13 Section 13060 "Fire Protection Supports and Hangers" for additional requirements.
- D. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor mechanical materials and equipment.

### 3.8 GROUTING

- A. Mix and install grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors.
- B. Clean surfaces that will come into contact with grout.
- C. Provide forms as required for placement of grout.
- D. Avoid air entrapment during placement of grout.
- E. Place grout, completely filling equipment bases.
- F. Place grout on concrete bases and provide smooth bearing surface for equipment.
- G. Place grout around anchors.
- H. Cure placed grout.

### 3.9 PAINTING

- A. Painting of mechanical systems, equipment, and components is specified in Division 9 Section.
- B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

- C. All electrical motors, pump casings, and other apparatus shall be provided with factory applied protective coating and after installation shall be carefully cleaned, rubbed down and oiled.
- D. For protective coatings of other equipment such as hangers, etc., refer to that section of the specification wherein construction data is described.
- E. Provide prime coat painting for the following:-
  - 1. Miscellaneous steel and iron provided by this trade.
  - 2. Hangers and supports.

### 3.10 DRIP PANS

- A. Examine the drawings and in cooperation with the Electrical Trade confirm the final location of all electrical equipment to be installed in the vicinity of piping. Plan and arrange all overhead piping no closer than two feet from a vertical line to electric motors and controllers, switchboards, panelboards, or similar equipment. Piping is not permitted in Electric Equipment, Transformer, Switch Gear, Telephone Rooms. Except as required by the authority having jurisdiction to provide fire suppression.
- B. Where the installation of piping does not comply with the requirements of foregoing paragraph, the piping shall be relocated.
- C. Furnish gutters as follows:
  - 1. Provide and erect a gutter of 16 ounce cold rolled copper or 18 gauge galvanized steel, under every pipe which is within 2'-0" from a vertical line to any motor, electrical controllers, switchboards, panelboards, or the like.
  - 2. Each gutter shall be reinforced, rimmed, soldered and made watertight, properly suspended and carefully pitched to a convenient point for draining. Provide a 3/4" drain, with valve as directed, to nearest floor drain or slop sink, as approved.
  - 3. In lieu of such separate gutters, a continuous protecting sheet of similar construction adequately supported and braced, properly rimmed, pitched and drained, may be provided over any such motor, and extending 2'-0" in all directions beyond the motor, over which such piping has to run.

END OF SECTION 13053

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**SECTION 13055 - FIRE PROTECTION MOTORS**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

- A. This Section includes basic requirements for factory-installed and field-installed motors.
- B. Related Sections include the following:
  - 1. Division 13 Section Fire Protection Vibration and Seismic Controls for mounting motors and vibration isolation and seismic-control devices.
  - 2. Division 13 Sections 13921, 13922, 13926, or 13927 Fire Pumps for application of motors and reference to specific motor requirements for motor-driven equipment.

**1.3 DEFINITIONS**

- A. Factory-Installed Motor: A motor installed by motorized-equipment manufacturer as a component of equipment.
- B. Field-Installed Motor: A motor installed at Project site and not factory installed as an integral component of motorized equipment.

**1.4 SUBMITTALS**

- A. Product Data for Field-Installed Motors: For each type and size of motor, provide nameplate data and ratings; shipping, installed, and operating weights; mounting arrangements; size, type, and location of winding terminations; conduit entry and ground lug locations; and information on coatings or finishes.
- B. Shop Drawings for Field-Installed Motors: Dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Include the following:
  - 1. Each installed unit's type and details.
  - 2. Nameplate legends.
  - 3. Diagrams of power and control wiring. Provide schematic wiring diagram for each type of motor and for each control scheme.

- C. Coordination Drawings: Floor plans showing dimensioned layout, required working clearances, and required area above and around field-installed motors. Show motor layout, mechanical power transfer link, driven load, and relationship between electrical components and adjacent structural and mechanical elements. Show support locations, type of support, and weight on each support. Indicate field measurements.
- D. Manufacturer Seismic Qualification Certification: Submit certification that motors, accessories, and components will withstand seismic forces defined in Division 13 Section "Fire Protection Vibration and Seismic Controls." Include the following:
  - 1. Basis of Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
    - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
    - b. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
  - 2. Dimensioned Outline Drawings of Motorized Equipment: Identify center of gravity and locate and describe mounting and anchorage provisions.
  - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- E. Qualification Data: For testing agency.
- F. Test Reports: Written reports specified in Parts 2 and 3.
- G. Operation and Maintenance Data: For field-installed motors to include in emergency, operation, and maintenance manuals.

## 1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, with the experience and capability to conduct the testing indicated, as documented according to ASTM E 548 and NFPA.
- B. Source Limitations: Obtain field-installed motors of a single type through one source from a single manufacturer.
- C. Product Options for Field-Installed Motors: Drawings indicate size, profiles, and dimensional requirements of motors and are based on the specific system indicated. Refer to Division 1 Section 01600 Product Requirements.
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- E. Comply with NFPA 70.

## 1.6 PROJECT CONDITIONS

- A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
  - 1. Notify Architect at least two days in advance of proposed utility interruptions. Identify extent and duration of utility interruptions.
  - 2. Indicate method of providing temporary utilities.
  - 3. Do not proceed with utility interruptions without Architect's written permission.

## 1.7 COORDINATION

- A. Coordinate features of motors, installed units, and accessory devices. Provide motors that are:
  - 1. Compatible with the following:
    - a. Reduced-voltage controllers.
  - 2. Matched to torque and horsepower requirements of the load.
  - 3. Matched to ratings and characteristics of supply circuit and required control sequence.
- B. Coordinate motor support with requirements for driven load; access for maintenance and motor replacement; installation of accessories, belts, belt guards; and adjustment of sliding rails for belt tensioning.
- C. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 3 Section.

## PART 2 - PRODUCTS

### 2.1 DRIVE GUARDS:

- A. For machinery and equipment provide guards.
- B. Materials: Sheet steel, cast iron, expanded metal or wire mesh rigidly secures so as to be removable without disassembling pipe, or electrical connections to equipment.
- C. Access for Speed Measurement: One inch diameter hole at each shaft center.

## 2.2 ELECTRICAL MOTORS, MOTOR CONTROLS, AND WIRING:

- A. Provide all electric motors for driving fire protection equipment. All motors shall be of proper power and speed to suit the specified makes of equipment; if other makes of equipment (other than specified) are accepted in any case, the proper adjustment of motor speed and power must be included without additional cost to Owner. Sizes and type shall be submitted for approval before the equipment is purchased.
- B. All motors and accessories shall comply in all respects with the most recent practice of the I.E.E.E., the National Board of Fire Underwriters and National Fire Protection Association.
- C. Motors shall be thoroughly ventilated. When running continuously at full load and full speed, temperature rise above surrounding air shall not exceed 40 degrees C.
- D. All motors shall be of proper power and speed to suit the specified working condition under which they will function, the proper adjustment of motor speed and power must be included without additional cost to Owner. Motors shall have a service factor of 1.15.
- E. Motors shall be suitable for use at the available supply voltage. Nameplate voltage ratings shall be as follows:

- 1. Single phase motors 115 volts
- 2. Three phase motors:
  - a. Supplied at 208 volts 200 volts
  - b. Supplied at 460 or 480 volts 460 volts

Note that 208 volt or 208-230 volt or 208- 230/460 Volt Motors Will Not be acceptable.

- F. Each motor shall be equipped with suitable electric lead wire positioning gasket at the point where such leads pass through the motor frame into the motor terminal box. Such gaskets shall be arranged to insure that under no condition will the lead wires be subjected to abrasion against the metal of the motor frame.
- G. All motors and special apparatus, as required, shall be equipped with suitable undervoltage time delaying tripping mechanisms for protection against sustained undervoltage and to avoid automatic interruption of equipment as a result of momentary voltage disturbances. All three phase motors shall also be equipped with suitable protection to prevent single phase operation. Wiring to equipment shall be arranged to prevent improper direction of rotation and excessive heating.

## 2.3 MOTOR REQUIREMENTS

- A. Motor requirements apply to factory-installed and field-installed motors except as follows:
  - 1. Different ratings, performance, or characteristics for a motor are specified in another Section.

2. Manufacturer for a factory-installed motor requires ratings, performance, or characteristics, other than those specified in this Section, to meet performance specified.

## 2.4 MOTOR CHARACTERISTICS

- A. Motors 3/4 HP and larger: Three phase.
- B. Motors Smaller Than 3/4 HP: Single phase.
- C. Frequency Rating: 60 Hz.
- D. Voltage Rating: NEMA standard voltage selected to operate on nominal circuit voltage to which motor is connected.
- E. Service Factor: 1.15 for open dripproof motors; 1.0 for totally enclosed motors.
- F. Duty: Continuous duty at ambient temperature of 105 deg F (40 deg C) and at altitude of 3300 feet (1005 m) above sea level.
- G. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.
- H. Enclosure: Open dripproof.

## 2.5 POLYPHASE MOTORS

- A. Description: NEMA MG 1, Design B, medium induction motor.
- B. Efficiency: Standard efficiency according to NEMA MG 1, Para. 12.59 and Table 12-10
- C. Stator: Copper windings, unless otherwise indicated.
  1. Multispeed motors shall have separate winding for each speed.
- D. Rotor: Squirrel cage, unless otherwise indicated.
- E. Bearings: Double-shielded, prelubricated ball bearings suitable for radial and thrust loading.
- F. Temperature Rise: Match insulation rating, unless otherwise indicated.
- G. Insulation: Class F, unless otherwise indicated.

## 2.6 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

- A. Motors Used with Reduced-Inrush Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.
- B. Rugged-Duty Motors: Totally enclosed, with 1.25 minimum service factor, greased bearings, integral condensate drains, and capped relief vents. Windings insulated with nonhygroscopic material.
  - 1. Finish: Chemical-resistant paint over corrosion-resistant primer.
- C. Source Quality Control: Perform the following tests on each motor according to NEMA MG 1:
  - 1. Measure winding resistance.
  - 2. Read no-load current and speed at rated voltage and frequency.
  - 3. Measure locked rotor current at rated frequency.
  - 4. Perform high-potential test.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas to receive field-installed motors for compliance with requirements, installation tolerances, and other conditions affecting performance.
- B. Examine roughing-in of conduit systems to verify actual locations of conduit connections before motor installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 MOTOR INSTALLATION

- A. Anchor each motor assembly to base, adjustable rails, or other support, arranged and sized according to manufacturer's written instructions. Attach by bolting. Level and align with load transfer link.
- B. Install motors on concrete bases complying with Division 3 Section 03300 Concrete.
- C. Comply with mounting and anchoring requirements specified in Division 13 Section 13071 "Mechanical Vibration and Seismic Controls."



### 3.3 FIELD QUALITY CONTROL

- A. Prepare for acceptance tests as follows:
  - 1. Run each motor with its controller. Demonstrate correct rotation, alignment, and speed at motor design load.
  - 2. Test interlocks and control features for proper operation.
  - 3. Verify that current in each phase is within nameplate rating.
- B. Testing: Owner will engage a qualified testing agency to perform the following field quality-control testing:
- C. Testing: Engage a qualified testing agency to perform the following field quality-control testing:
- D. Testing: Perform the following field quality-control testing:
  - 1. Perform each electrical test and visual and mechanical inspection stated in National Electrical Testing Association ATS, Section 7.15.1. and NFPA 20. Certify compliance with test parameters.
  - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
- E. Manufacturer's Field Service: Engage a factory-authorized service representative to perform the following:
  - 1. Inspect field-assembled components, equipment installation, and piping and electrical connections for compliance with requirements.
  - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
  - 3. Verify bearing lubrication.
  - 4. Verify proper motor rotation.
  - 5. Test Reports: Prepare a written report to record the following:
    - a. Test procedures used.
    - b. Test results that comply with requirements.
    - c. Test results that do not comply with requirements and corrective action taken to achieve compliance.

### 3.4 ADJUSTING

- A. Align motors, bases, shafts, pulleys and belts. Tension belts according to manufacturer's written instructions.

### 3.5 CLEANING

- A. After completing equipment installation, inspect unit components. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.
- B. Clean motors, on completion of installation, according to manufacturer's written instructions.

END OF SECTION 13055

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**SECTION 13060 - FIRE PROTECTION  
HANGERS AND SUPPORTS**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

- A. This Section includes hangers and supports for mechanical system piping and equipment.
- B. Related Sections include the following:
  - 1. Division 5 Section 05500 "Metal Fabrications" for materials for attaching hangers and supports to building structure.
  - 2. Division 13 Section 13915 on fire-suppression piping for fire-suppression pipe hangers.

**1.3 DEFINITIONS**

- A. MSS: Manufacturers Standardization Society for the Valve and Fittings Industry.
- B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

**1.4 PERFORMANCE REQUIREMENTS**

- A. Design channel support systems for piping to support multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.
- B. Design heavy-duty steel trapezes for piping to support multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.
- C. Design seismic restraint hangers and supports for piping and equipment.
- D. Design and obtain approval from authorities having jurisdiction for seismic restraint hangers and supports for piping and equipment.

**1.5 SUBMITTALS**

- A. Product Data: For each type of pipe hanger, channel support system component, and thermal-hanger shield insert indicated.

- B. Shop Drawings: Signed and sealed by a qualified professional engineer for multiple piping supports and trapeze hangers. Include design calculations and indicate size and characteristics of components and fabrication details.
- C. Welding Certificates: Copies of certificates for welding procedures and operators.

## 1.6 QUALITY ASSURANCE

- A. Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
- B. Engineering Responsibility: Design and preparation of Shop Drawings and calculations for each multiple pipe support and trapeze by a qualified professional engineer.
- C. Systems, installation, equipment and materials shall conform to requirements of the local Building Code, Owners Insurance Underwriters, Factory Mutual, Industrial Risk Insurers, local Fire Department, NFPA, ANSI/ASME B31.9 "Building Service Piping" and all authorities having jurisdiction. Equipment and materials Underwriters listed, labeled and approved as required.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements of Factory Mutual, Underwriters Laboratory; provide products by one of the following:
  - 1. Pipe Hangers:
    - a. AAA Technology and Specialties Co., Inc.
    - b. B-Line Systems, Inc.
    - c. Carpenter & Patterson, Inc.
    - d. Empire Tool & Manufacturing Co., Inc.
    - e. Globe Pipe Hanger Products, Inc.
    - f. Grinnell Corp.
    - g. GS Metals Corp.
    - h. Michigan Hanger Co., Inc.
    - i. National Pipe Hanger Corp.
    - j. PHD Manufacturing, Inc.
    - k. PHS Industries, Inc.
    - l. Piping Technology & Products, Inc.
  - 2. Channel Support Systems:
    - a. B-Line Systems, Inc.
    - b. Grinnell Corp.; Power-Strut Unit.
    - 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-joist construction to attach to top flange of structural shape.
  3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
  4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.

5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
  6. C-Clamps (MSS Type 23) (Provide retainer clip with each C-Clamps): For structural shapes.
  7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
  8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
  9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
  10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
  11. Malleable Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
  12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:
    - a. Light (MSS Type 31): 750 lb (340 kg).
    - b. Medium (MSS Type 32): 1500 lb (675 kg).
    - c. Heavy (MSS Type 33): 3000 lb (1350 kg).
  13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
  14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
  15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where head room is limited.
- H. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
1. Steel Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
  2. Protection Shields (MSS Type 40): Of length recommended by manufacturer to prevent crushing insulation.
  3. Thermal-Hanger Shield Inserts: For supporting insulated pipe, 360-degree insert of high-density, 100-psi (690-kPa) minimum compressive-strength, water-repellent-treated calcium silicate or cellular-glass pipe insulation, same thickness as adjoining insulation with vapor barrier and encased in 360-degree sheet metal shield.
- I. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
  2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches (32 mm).
  3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41 roll hanger with springs.
  4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
  5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from hanger.



6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from base support.
7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from trapeze support.
8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:
  - a. Horizontal (MSS Type 54): Mounted horizontally.
  - b. Vertical (MSS Type 55): Mounted vertically.
  - c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.

### 3.2 HANGER AND SUPPORT INSTALLATION

- A. Pipe Hanger and Support Installation: Comply with Factory Mutual, Underwriters Laboratory, NFPA and MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.
- B. Channel Support System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled channel systems.
  1. Field assemble and install according to manufacturer's written instructions.
- C. Heavy-Duty Steel Trapeze Installation: Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated, heavy-duty trapezes.
  1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
  2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D-1.1.
- D. Install building attachments within concrete slabs or attach to structural steel. Space attachments within maximum piping span length indicated in Factory Mutual, Underwriters Laboratory, NFPA, and MSS SP-69. Install additional attachments at concentrated loads, including valves, flanges, guides, strainers, and expansion joints, and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- E. Install powder-actuated drive-pin fasteners in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
- F. Install mechanical-anchor fasteners in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- G. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

- H. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- I. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- J. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by Factory Mutual, Underwriters Laboratory, NFPA, and ASME B31.9, "Building Services Piping," is not exceeded.

### 3.3 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure above or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment and make smooth bearing surface.

### 3.4 METAL FABRICATION

- A. Cut, drill, and fit miscellaneous metal fabrications for heavy-duty steel trapezes and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field-weld connections that cannot be shop-welded because of shipping size limitations.
- C. Field Welding: Comply with Factory Mutual, Underwriters Laboratory, and AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:
  - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  - 2. Obtain fusion without undercut or overlap.
  - 3. Remove welding flux immediately.
  - 4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

### 3.5 ADJUSTING

- A. Hanger Adjustment: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

### 3.6 PAINTING

- A. Touching Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
- B. Apply paint by brush or spray to provide a minimum dry film thickness of **2.0 mils** (0.05 mm).

- C. Touching Up: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 9 Section "Painting."
- D. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 13060

**NEW PASSENGER TERMINAL  
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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 13520 - FIRE PROTECTION  
CABINETS**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. This Section includes the following:
  - 1. Fire-protection cabinets for the following:
    - a. Fire hose valves.
    - b. Fire hoses and racks.
    - c. Fire extinguishers and fire hoses cabinets.
  - 2. Fire-protection accessories.

**1.2 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Related Sections include the following:
  - 1. Division 7 Section 07200 "Firestopping" for firestopping sealants at fire-rated cabinets.
  - 2. Division 9 Section 09910 "Painting" for field-painting fire-protection cabinets.
  - 3. Division 10 Section "Signs" for directional signage to out-of-sight fire extinguishers and cabinets.
  - 4. Division 11 Section "Food Service Equipment" for fire extinguishing systems provided as part of exhaust hoods.
  - 5. Division 13 Section 13975 "Standpipe and Sprinkler Systems" for hose systems and racks.

**1.3 SUBMITTALS**

- A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for fire-protection specialties.
  - 1. Cabinets: Include roughing-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type, trim style, and panel style.
  - 2. Show location of knockouts for hose valves.
  - 3. Fire rating of assembly.
- B. Samples for Initial Selection: Manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available for each type of cabinet finish indicated.

- C. Samples for Verification: For each type of exposed cabinet finish required, prepared on Samples of size indicated below and of same thickness and material indicated for the Work. If finishes involve normal color and texture variations, include sample sets showing the full range of variations expected.

- 1. Size: ~~6-by-6-inch-~~ (150-by-150-mm-) square Samples.

#### 1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain fire cabinets through one source from a single manufacturer.

#### 1.5 COORDINATION

- A. Coordinate size of cabinets to ensure that type and capacity of fire extinguishers indicated and provided by Owner under separate Contract are accommodated.
- B. Coordinate size of cabinets to ensure that type and capacity of hoses, hose valves, and hose racks indicated are accommodated.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Fire-Protection Cabinets:
    - a. Croker Corporation.
    - b. Potter-Roemer; Div. of Smith Industries, Inc.
- C. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the products specified in the Fire-Protection Cabinet Schedule at the end of Part 3.
- D. Products: Subject to compliance with requirements, provide one of the products indicated for each designation in the Fire-Protection Cabinet Schedule at the end of Part 3.

## 2.2 MATERIALS

- A. Cold-Rolled Steel Sheet: Carbon steel, complying with ASTM A 366/A 366M, commercial quality, stretcher leveled, temper rolled.
- B. Aluminum: Alloy and temper recommended by aluminum producer and manufacturer for type of use and finish indicated, and as follows:
  - 1. Sheet: **ASTM B 209** (**ASTM B 209M**).
  - 2. Extruded Shapes: **ASTM B 221** (**ASTM B 221M**).

## 2.3 FIRE-PROTECTION CABINETS

- A. Cabinet Construction: Provide manufacturer's standard box (tub), with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated. Weld joints and grind smooth. Miter and weld perimeter door frames.
  - 1. Fire-Rated Cabinets: Listed and labeled to meet requirements of ASTM E 814 for fire-resistance rating of wall where it is installed.
    - a. Construct fire-rated cabinets with double walls fabricated from **0.0478-inch- (1.2-mm-)** thick, cold-rolled steel sheet lined with minimum **5/8-inch- (16-mm-)** thick, fire-barrier material.
    - b. Provide factory-drilled mounting holes.
  - 2. Cabinet Metal: Enameled-steel sheet.
  - 3. Shelf: Same metal and finish as cabinet.
- B. Cabinet Type: Suitable for the following:
  - 1. Fire extinguisher and fire hose valve.
- C. Cabinet Mounting: Suitable for the following mounting conditions:
  - 1. Recessed: Cabinet box recessed in walls of sufficient depth to suit style of trim indicated.
- D. Cabinet Trim Style: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.
  - 1. Trimless: Surface of surrounding wall finishes flush with exterior finished surface of cabinet frame and door, without overlapping trim attached to cabinet.
    - a. Provide recessed flange, of same material as box, attached to box to act as plaster stop.
- E. Cabinet Trim Material: Manufacturer's standard, as follows:
  - 1. Same metal and finish as door.

- F. Door Material: Manufacturer's standard, as follows:
  - 1. Steel sheet.
- G. Door Glazing: Manufacturer's standard, as follows:
  - 1. Clear Float Glass: ASTM C 1036, Type I, Class 1, Quality q3, as follows:
    - a. Thickness: 3 mm.
  - 2. Tempered Float Glass: ASTM C 1048, Kind FT, Condition A, Type I, Quality q3, as follows:
    - a. Class 1 (clear).
  - 3. Break Glass: Clear float glass, ASTM C 1036, Type I, Class 1, Quality q3, 1.5 mm, single strength.
  - 4. Tempered Break Glass: ASTM C 1048, Kind FT, Condition A, Type I, Quality q3, 1.5 mm.
  - 5. Wire Glass: ASTM C 1036, Type II, Class 1, Form 1, Quality q8, Mesh m1 (diamond), 6 mm thick.
  - 6. Mirror Glass: ASTM C 1036, Type I, Class 1, Quality q2, 3 mm thick, double strength.
  - 7. Acrylic: Smooth or textured sheet, as follows:
    - a. Thickness: 1.5 mm.
    - b. Color: Clear.
  - 8. Bubble: One-piece clear break acrylic.
  - 9. Bubble: One-piece molded acrylic.
    - a. Color: Clear.
- H. Door Style: Manufacturer's standard design, as follows:
  - 1. Fully glazed, frameless, backless, acrylic panel.
  - 2. Fully glazed panel with frame.
  - 3. Full bubble, frameless.
  - 4. Full bubble with frame.
  - 5. Full bubble with frameless, rotating turntable.
  - 6. Horizontal duo panel with frame.
  - 7. Vertical duo panel with frame.
  - 8. Center glass panel with frame.
  - 9. Solid opaque panel with frame.
  - 10. Flush opaque panel, frameless, with no exposed hinges.
- I. Door Construction: Fabricate doors according to manufacturer's standards, of materials indicated, and coordinated with cabinet types and trim styles selected.
  - 1. Provide minimum ~~1/2-inch-~~(13-mm-) thick door frames, fabricated with tubular stiles and rails, and hollow-metal design.
  - 2. Provide inside latch and lock for break-glass panels.
- J. Door Hardware: Provide manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated. Provide either lever

handle with cam-action latch, or exposed or concealed door pull and friction latch. Provide concealed or continuous-type hinge permitting door to open 180 degrees.

## 2.4 ACCESSORIES

- A. Mounting Brackets: Manufacturer's standard steel, designed to secure extinguisher, of sizes required for types and capacities of extinguishers indicated, with plated or baked-enamel finish.
  - 1. Provide brackets for extinguishers not located in cabinets.
  - 2. Provide brackets for extinguishers located in cabinets.
- B. Break-Glass Strike: Provide manufacturer's standard metal strike, complete with chain and mounting clip, secured to cabinet.
- C. Lettered Door Handle: Provide one-piece, cast-iron door handle with the word "FIRE" embossed into face.
- D. Door Locks: Provide cylinder lock, with all cabinets keyed alike.

## 2.5 COLORS AND TEXTURES

- A. Colors and Textures: Match Architect's samples.
- B. Colors and Textures: As indicated by referencing manufacturer's designations.
- C. Colors and Textures: As selected by Architect from manufacturer's full range for these characteristics.

## 2.6 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- D. Cabinet and Door Finishes: Provide manufacturer's standard baked-enamel paint for the following:
  - 1. Exterior of cabinets and doors, except for those surfaces indicated to receive another finish.
  - 2. Interior of cabinets and doors.

## 2.7 ALUMINUM FINISHES

- A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
- B. Class II, Clear Anodic Finish: AA-M12C22A31 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.010 mm or thicker) complying with AAMA 607.1.
- C. Class I, Color Anodic Finish: AA-M12C22A42/A44 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker) complying with AAMA 606.1 or AAMA 608.1.
  - 1. Color: As selected by Architect from the full range of industry colors and color densities.
- D. Baked-Enamel Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Apply baked enamel complying with paint manufacturer's specifications for cleaning, conversion coating, and painting.
  - 1. Organic Coating: Thermosetting, modified-acrylic enamel primer/topcoat system complying with AAMA 603.8 except with a minimum dry film thickness of 1.5 mils (0.04 mm), medium gloss.
  - 2. Color: As indicated by manufacturer's designations.
  - 3. Color: Match Architect's sample.
  - 4. Color: As selected by Architect from manufacturer's full range.

## 2.8 STEEL FINISHES

- A. Surface Preparation: Clean surfaces of dirt, oil, grease, mill scale, rust, and other contaminants that could impair paint bond using manufacturer's standard methods.
- B. Factory Priming for Field-Painted Finish: Apply shop primer specified below immediately after surface preparation and pretreatment.
  - 1. Shop Primer: Manufacturer's or fabricator's standard, fast-curing, lead- and chromate-free, universal primer, selected for resistance to normal atmospheric corrosion, for compatibility with substrate and field-applied finish paint system indicated, and for capability to provide a sound foundation for field-applied topcoats despite prolonged exposure.
- C. Baked-Enamel Finish: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-enamel finish consisting of prime coat and thermosetting topcoat. Comply with paint manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils (0.05 mm).
  - 1. Color and Gloss: As selected by Architect from manufacturer's full range.

## 2.9 STAINLESS-STEEL FINISHES

- A. General: Remove or blend tool and die marks and stretch lines into finish. Grind and polish surfaces to produce uniform, directionally textured polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.
- B. Finish:
  - 1. Polished and Buffed Finish: Oil-ground, 180-grit finish followed by buffing.
  - 2. Bright, Cold-Rolled, Unpolished Finish: No. 2B finish.
  - 3. Bright, Directional Polish: No. 4 finish.
  - 4. Satin, Directional Polish: No. 6 finish.
  - 5. Satin, Reflective, Directional Polish: No. 7 finish.
  - 6. Mirrorlike Reflective, Nondirectional Polish: No. 8 finish.
- C. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine roughing-in for hose valves, hose racks, and cabinets to verify actual locations of piping connections before cabinet installation.
- B. Examine walls and partitions for suitable framing depth and blocking where recessed and semirecessed cabinets are to be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Comply with manufacturer's written instructions for installing fire-protection specialties.
- B. Install in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.
  - 1. Prepare recesses for cabinets as required by type and size of cabinet and trim style.
  - 2. Fasten mounting brackets to structure and cabinets, square and plumb.
  - 3. Fasten cabinets to structure, square and plumb.

### 3.3 INSTALLATION OF FIRE-RATED HOSE OR VALVE CABINETS

- A. Install cabinet with not more than **1/16-inch (1.5-mm)** tolerance between pipe OD and knockout OD. Center pipe within knockout.
- B. Seal through-penetrations with firestopping sealant specified in Division 7 Section "Firestopping."

### 3.4 ADJUSTING, CLEANING, AND PROTECTION

- A. Adjust cabinet doors that do not swing or operate freely.
- B. Refinish or replace cabinets and doors damaged during installation.
- C. Provide final protection and maintain conditions that ensure that cabinets and doors are without damage or deterioration at the time of Substantial Completion.

END OF SECTION 13520



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

**SECTION 13700 – PART 1542 COMPUTER  
CONTROLLED ACCESS  
SYSTEM (CCAS) AND CCTV SYSTEM**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. The scope of the work includes complete and integrated 49 CFR Part 1542 Computer Controlled Access System (CCAS). The integrated CCAS shall include access controls, CCTV and other systems as specified herein and indicated on the drawings.
- B. The work includes furnishing all labor, materials, tools, and equipment, and the performance of all operations necessary for coordinating, detailing, fabricating, inspecting, documenting, delivering, installing and testing the hardware, software and firmware for a complete and integrated CCAS in accordance with this section, including but not limited to the following:
  - 1. Operator Consoles and Photo Identification System.
    - a. Security Center Security Control Console (SCC) as indicated on drawings.
    - b. Photo Identification Subsystem (PIDS) Terminal and Badging.
  - 2. Paging and E-mail notifications
    - a. All alarms shall be transmitted via paging and e-mail system in addition to the SCC. The intent is to alert assigned personnel. Provide system necessary for remote notification as specified in paragraph 2.3.E.
  - 3. Data Processing Subsystem (DPS)
    - a. Fault Tolerant Servers, as indicated on the drawings and specified herein.
  - 4. Data Transmission Subsystem (DTS).
    - a. Network Based Intelligent Field Panels (IFPs).
  - 5. Controlled Access Subsystem (CAS).
    - a. Card Readers with PINpads.
    - b. Electronics Interface Boxes (EIB).
    - c. Exit Pushbuttons.
    - d. Interface with door locking sub-system.
    - e. Interface with delayed egress Panic Hardware.
    - f. Gate Control Panel for vehicle gates.
    - g. Signage.
  - 6. Intrusion Detection Subsystem (IDS).
    - a. Tamper Switches.
    - b. Door and Gate Position Switch (Balanced Magnetic Switch).
    - c. Duress Alarm Devices.
    - d. Vehicle Presence Sensor (ground loops).
  - 7. Surveillance and Assessment Subsystem (SAS).
    - a. Complete Integrated Video Management System.
    - b. Day / night IP Fixed Cameras.
    - c. Day / night IP Autodome PTZ Cameras.
    - d. Camera Mounting.
    - e. Camera Power Supply and Cabling.
    - f. Video Servers and Storage.

- g. Intelligent Video Analytics: Intelligent Video Analytics (IVA) is a separate system that is not required to be integrated with the Video Servers and Storage (NVR) and CCAS other than to transmit alarms to CCAS. References throughout the specifications for integration of the IVA apply only if the selected products normally offer those features.
- 8. Other CCAS Components.
  - a. Battery Backup Units (BBU).
  - b. Workstations.
  - c. Color Video Camera.
  - d. Photographic Lighting Unit.
  - e. Signature Input Unit.
  - f. ID Badge Printer.
  - g. ID Badges.
  - h. ID Badge Programmer.
  - i. ID Badge Encoder / Decoder.
  - j. Die Cutter.
  - k. Laminator.
  - l. Wireless transmitter / receiver.
- 9. Electrical Power Communication and Control Wiring and Conduit System.
  - a. Provide all conduit and wiring required to provide a complete and operational system.
- 10. Miscellaneous Provisions.
  - a. Nonstandard Test Equipment, Tools, Adaptors and Fittings.
  - b. Portable Intelligent Field Panel Analyzer shall include a laptop computer similar in capacity of administrative workstation.
- 11. Other Items.
  - a. Connections to existing perimeter gates as indicated on drawings.

## 1.2 RELATED WORK

- A. All Division 16 Electrical sections apply to the work specified in this section.
- B. The CCAS shall interface with the following Contract items to be provided in other sections:
  - 1. Network Electronics. (Provided under this contract).
  - 2. Uninterruptible Power Supplies. (Provided under this contract).

## 1.3 REFERENCES, CODES AND REGULATIONS

- A. It is not the intention of this section to provide all details of design and fabrication. The Contractor shall ensure that the equipment has been designed and fabricated in accordance with applicable engineering codes and standards. When specific requirements are stated in this section that exceed and / or overlap those requirements of the codes and standards referenced herein, this section shall govern.
- B. This section is based on the latest applicable codes and standards in force at the time the Specification is issued for bid. Should the applicable codes or standards listed herein be revised before or after the award of the Contract, the Contractor shall inform the Architect / Engineering (A/E) immediately, in writing, upon receipt of such information. Before adoption of any subsequent issue, the Contractor shall identify the changes in writing and shall not proceed with engineering, material and / or fabrication changes without A/E's written permission.

- C. Design, material, fabrication, testing, inspection, certification, documentation and operation shall conform to the following referenced codes, regulations, standards and specifications.
1. Regulations Transportation Security Administration 49 CFR:
    - a. Part 1520 - Protection of Sensitive Security Information.
    - b. Part 1540 - Civil Aviation Security.
    - c. Part 1542 - Airport Security.
    - d. Part 1544 - Aircraft Operator Security.
  2. Guidelines.
    - a. Recommended Security Guidelines for Airport Planning, Design and Construction - DOT/FAA/AR-00-52 June 2001.
    - b. RTCA/DO-230 Standards for Airport Security Access Control Systems.
  3. American National Standards Institute (ANSI):
    - a. C2 - National Electrical Safety Code.
    - b. C37.90A - Guide for Surge Withstand Capability Tests.
    - c. C62.41 - Guide for Surge Voltage in Low Voltage AC Power Circuits.
    - d. C63.12 - Recommended Practice on Procedures for Control of System Electromagnetic Compatibility.
    - e. X3.4 - American Standard Code for Information Interchange (ASCII).
  4. American Society of Testing and Materials (ASTM):
    - a. ASTM B 8 - Concentric-Lay Stranded Copper Conductors.
    - b. ASTM D 635 - Rate of Burning and / or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position.
  5. Federal Communications Commission (FCC):
    - a. FCC Rules and Regulations, Part 15 and 68.
  6. General Services Administration (GSA):
    - a. FS W-A-450B - Federal Specification (Interim): Components for Interior Security Alarm Systems.
  7. Institute of Electrical and Electronics Engineers (IEEE):
    - a. IEEE Transaction Volume COM-21 - Lightning Surges in Open Wire, Coaxial and Paired Cables.
    - b. IEEE C62-1990 - Guides and Standards for Surge Protection.
    - c. IEEE 802 - Standard for Local Area Networks.
    - d. IEEE 802.2 - Standards for Local Area Networks: Media Access Control (MAC) Bridges.
    - e. IEEE 802.3 - Ethernet local area network.
    - f. IEEE 802.11a - Wireless local area network.
  8. International Standards Organization (ISO):
    - a. ISO/IEC 8802-3 - Information Processing System - Local Area Networks - Part 3.
    - b. ISO/IEC 8802-4 - Information Processing System - Local Area Networks - Part 4.
  9. Insulated Cable Engineer Association (ICEA):
    - a. S-19-81 - Rubber Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.
  10. National Electrical Manufacturers Association (NEMA):
    - a. NEMA 250 (1985) - Enclosures for Electrical Equipment.
  11. National Fire Protection Association (NFPA):
    - a. NFPA 70 (1996) - National Electrical Code (NEC).
  12. Occupational Safety and Health Act (OSHA):
    - a. OSHA 2206 - General Industry Safety and Health Standards.
  13. Underwriters' Laboratories (UL):
    - a. UL 6 - Rigid Metal Electrical Conduit.
    - b. UL 198 (1988) - Fuses.

- c. UL 294 (1987) - Standard for Access Control Systems.
- d. UL 437 - Key Locks.
- e. UL 512 (1987) - Fuse Holders.
- f. UL 634 (1985) - Connectors and Switches for Use with Burglar Alarm Systems.
- g. UL 639 (1986) - Intrusion Detection Units.
- h. UL 796 (1984) - Printed Circuit Boards.
- i. UL 1076 (1988) - Proprietary Burglar-Alarm Units and Systems.
- j. UL 1449 (1985) - Standard for Safety Transient Voltage Surge Suppressors.

14. Applicable Federal, state and local laws, regulations, ordinances and codes.

- D. In the event of conflicting requirements between the authorities cited above or between authorities cited and those specified, such disagreements shall be resolved by the A/E or Owner.
- E. Nothing in this section, including invocation of certain specific codes, standards or specifications, shall relieve the Contractor of the responsibility for compliance with the codes, standards or specifications which are generally recognized to be applicable to the work specified herein.

#### 1.4 SYSTEM DESCRIPTION

- A. The Computer Controlled Access System (CCAS) as outlined in this section and detailed in Part 2 of this document is the key central component for managing physical security and the bridge between physical and logical security for this project. The system shall provide a variety of integral functions including the ability to regulate access and egress; provide identification credentials; monitor, track and interface alarms; and view, record and store digital surveillance video linked to CCAS events.
- B. The CCAS shall utilize a single seamlessly integrated relational database for all functions utilizing a fully multi-tasking multithreading Microsoft Windows 2000/2003 or Windows XP Operating System. CCAS software shall be written so that all modules (Access Control, Alarm Monitoring, ID / Credential Management, Visitor Management and Digital Video Management) are developed and built from a unified single 32-bit source code set.
- C. Upgrades or expansion of the CCAS to a larger size system in scale shall not require installation of a different and / or new CCAS application or require the administrator / operator to learn a different and / or new interface from the previous version.
- D. CCAS software shall be written using Unicode format. Unicode enables a single software product to be targeted across multiple platforms and languages without re-engineering and allows for data to be transported through different systems without corruption.
- E. CCAS software shall be written to Microsoft's published standards for User Interface Design, Secure Coding Practices and Database Implementation Guidelines (Microsoft<sup>7</sup> Open Database Connectivity (ODBC) interface).
- F. CCAS software shall be written to ISO Standards on Software Development for C++ and C##.

- G. CCAS and its software shall seamlessly interface with and monitor intelligent system controllers, reader interface modules, I/O panels, burglar alarm panels, burglar alarm panel receivers, biometric devices, personal protection devices, intercom systems, fire alarm panels (secondary monitoring only), building management systems and digital video recorders approved for use by the CCAS manufacturer.
- H. The CCAS shall be able to communicate via RS-485, RS-232, TCP-IP/Ethernet and dial-up via modem.
- I. All tasks shall be accessible from any compatible client workstation on the network utilizing one or all of the following.
  - 1. Traditional client server architecture.
  - 2. N-tier architecture where the CCAS shall support the expansion of the system architecture and allow for end-user deployment based upon their system architecture needs. The CCAS shall allow but not require the separation of the database, application server, web server and client interface. The system shall require that all connections to the database are performed through a trusted link from the client or internet browser interface.
  - 3. Centralized distribution (publishing) of applications using Windows Terminal Server and Citrix on Windows, Unix, Linux or Apple Macintosh based systems through any compatible internet browser application and / or by means of a mobile computing platform using a wearable computer, Tablet PC or PDA device.
- J. The CCAS shall utilize an open architecture where all data must reside on a single database and must be accessible in real time to every / any CCAS workstation or web based client connected to the network. The system shall be configurable to support all of the following databases: Microsoft SQL Server 2000 Personal and Standard editions with SP3a, Microsoft SQL Server 2005 Standard and Enterprise editions and Microsoft SQL Server 2005 Express, Oracle Server 9.i. and Oracle Server 10g. Oracle data may reside on Windows or UNIX platforms.
- K. The system architecture shall support Microsoft Windows Clustering, Hot-Standby, Fault Tolerant Servers and Fault Tolerant Hot Standby Servers.
- L. The CCAS shall support an unlimited number of Access Control Readers, an unlimited number of Inputs / Outputs, an unlimited number of Client Workstations, and an unlimited number of Cardholders

#### 1.5 SUBMITTALS

- A. The Contractor shall submit all items in accordance with the requirements of, Section 01300 - SUBMITTALS.
- B. Unless noted otherwise in General Conditions, within thirty (30) days of award of Contract, the Contractor shall submit manufacturer's specification or data sheets for all subsystem equipment to be utilized in the CCAS.
- C. The Contractor shall submit the following:
  - 1. Shop Drawings: Provide complete shop drawings which include the following:
    - a. Indicate all system device locations on 1/8" scale architectural floor plans. No other system(s) shall be included on these plans.

- b. Include full schematic wiring information on these drawings for all devices. Wiring information shall include cable type, conductor routings, quantities, and connection details at device.
  - c. Include a complete CCAS one-line, block diagram.
  - d. Include a statement of the system sequence of operation of each access control portal and overall system performance.
  - e. Include a statement indicating seamless integration of various systems.
- 2. Product Data: Provide complete product data that includes the following:
  - a. Manufacturer's technical data for all material and equipment at the system and sub system level to be provided as part of the CCAS.
  - b. A system description including analysis and calculations used in sizing equipment required by the CCAS. The description shall show how the equipment will operate as a system to meet the performance requirements of the CCAS. The following information shall be supplied as a minimum:
    - 1) Server(s) processor(s), disk space and memory size.
    - 2) Description of site equipment and its configuration.
    - 3) Network bandwidth, latency and reliability requirements.
    - 4) Backup / archive system size and configuration.
    - 5) Start up operations.
    - 6) System expansion capability and method of implementation.
    - 7) System power requirements and UPS sizing.
    - 8) Device / component environmental requirements (cooling and or heating parameters).
    - 9) A description of the operating system and application software.
- 3. Contract Close-Out Submittals: Provide three sets of hard copy manuals and three sets electronic format manuals in PDF format including operating instructions, maintenance recommendations and parts list. Include wiring and connection diagrams modified to reflect as-built conditions as part of this submittal.
- 4. Manuals: Final copies of the manuals shall be delivered within thirty (30) days after completing the installation test. Each manual's contents shall be identified on the cover. The manual shall include names, addresses, and telephone numbers of the contractor responsible for the installation and maintenance of the system and the factory representatives for each item of equipment for each system. The manuals shall have a table of contents and labeled sections. The final copies delivered after completion of the installation test shall include all modifications made during installation, checkout, and acceptance testing. The manuals shall consist of the following:
  - 1) Functional Design Manual: The functional design manual shall identify the operational requirements for the system and explain the theory of operation, design philosophy, and specific functions. A description of hardware and software functions, interfaces, and requirements shall be included.
  - 2) Hardware Manual: The manual shall describe all equipment furnished including:
    - a) General description and specifications.
    - b) Installation and check out procedures.
    - c) Equipment layout and electrical schematics to the component level.
    - d) System layout drawings and schematics.
    - e) Alignment and calibration procedures.

- f) Manufacturers' repair parts list indicating sources of supply.
  - 3) Software Manual: The software manual shall describe the functions of all software and shall include all other information necessary to enable proper loading, testing, and operation. The manual shall include:
    - a) Definition of terms and functions.
    - b) System use and application software.
    - c) Initialization, start up, and shut down.
    - d) Reports generation.
    - e) Details on forms customization and field parameters.
  - 4) Operators Manual: The operators' manual shall fully explain all procedures and instructions for the operation of the system including:
    - a) Computers and peripherals.
    - b) System start up and shut down procedures.
    - c) Use of system, command, and applications software.
    - d) Recovery and restart procedures.
    - e) Graphic alarm presentation.
    - f) Use of report generator and generation of reports.
    - g) Data entry.
    - h) Operator commands.
    - i) Alarm messages and reprinting formats.
    - j) System permissions functions and requirements.
  - 5) Maintenance Manual: The maintenance manual shall include descriptions of maintenance for all equipment including inspection, periodic preventive maintenance, fault diagnosis, and repair or replacement of defective components.
- D. As-Built Drawings: During system installation, the Contractor shall maintain a separate hard copy set of drawings, elementary diagrams, and wiring diagrams of the CCAS to be used for record drawings. This set shall be accurately kept up to date by the Contractor with all changes and additions to the CCAS. Copies of the final as-built drawings shall be provided to the A/E in DXF or DWG format.

## 1.6 ABBREVIATIONS

- A. The following abbreviations are used in this document:
- ABA - American Banking Association
  - ANSI - American National Standards Institute
  - AOA - Air Operations Area
  - AOT - Accumulated Outage Time
  - ARFF - Airport Rescue and Fire Fighting
  - ASCII - American Standard Code for Information Interchange
  - ASTM - American Society for Testing and Materials
  - AWG - American Wire Gauge
  - BMS - Balanced Magnetic Switch
  - bps - Bits Per Second
  - CAS - Controlled Access Subsystem
  - CCAS - Integrated Computer Controlled Access Controls and CCTV System
  - CCD - Charged Coupled Device
  - CCTV - Closed Circuit Television
  - CFR - Code of Federal Regulations
  - CPU - Central Processing Unit
  - DPS - Data Processing Subsystem
  - DTS - Data Transmission Subsystem
  - DVR - Digital Video Recorder

EIA	-	Electronic Industries Association
EIB	-	Electronics Interface Box
FAA	-	Federal Aviation Administration
FAR	-	Federal Aviation Regulation
FCC	-	Federal Communications Commission
FM	-	Factory Mutual
F/O	-	Fiber Optics
FS	-	Federal Specification
GDT	-	Graphics Display Terminal
GSA	-	General Services Administration
HVAC	-	Heating, Ventilation and Air Conditioning
ICEA	-	Insulated Cable Engineer Association
ID	-	Identification
IDS	-	Intrusion Detection Subsystem
IEEE	-	Institute of Electrical and Electronics Engineers
IFP	-	Intelligent Field Panel
I/O	-	Input / Output
ISA	-	Instrument Society of America
KCS	-	Key Control Subsystem
KVA	-	Kilo-Volt-Ampere
LED	-	Light Emitting Diode
NCTA	-	National Cable Television Association
NEC	-	National Electrical Code
NEMA	-	National Electrical Manufacturers Association
NFPA	-	National Fire Protection Association
OSHA	-	Occupational Safety and Health Act
PIDS	-	Photo Identification Subsystem
PIN	-	Personal Identification Number
PTZ	-	Pan / Tilt / Zoom
PVC	-	Polyvinyl-Chloride
RF	-	Radio Frequency
SA	-	Secured Area
SAS	-	Surveillance and Assessment Subsystem
SCC	-	Security Control Console
PIA	-	Peoria International Airport (the Owner)
STS	-	Signal Transmission Subsystem
TDT	-	Test Duration Time
TSA	-	Transportation Security Administration
UL	-	Underwriters' Laboratories
UPS	-	Uninterruptible Power Supply
VCS	-	Voice Communications Subsystem
VDT	-	Video Display Terminal

## 1.7 GLOSSARY OF TERMS

For the purpose of this document, the following terms are defined:

- A. Access Mode - The mode of operation in which the CCAS shall only annunciate tamper and trouble conditions at a monitored point. Alarm conditions shall not be annunciated in this mode. (Also referred to as alarm shunting or masking.)
- B. Accountability - A feature of the CCAS which keeps track of an individual's last use of a card reader.



- C. Acknowledge - The action taken by a SCC operator to indicate that they are aware of a specific off-normal event. Acknowledging an event shall silence the audible enunciator at the SCC.
- D. Advisory - An off-normal event providing information about controlled access, key control and data processing functions.
- E. Alarm - An off-normal event at a secured, monitored point indicating the supervision circuitry has detected a condition for which the sensor was designed to react.
- F. Card Reader - A device located at selected AOA/SA access points that shall automatically decode the information from an ID badge / keycard and process the access request locally.
- G. Cipher Code - A code number, between 5 and 9 digits in length (site-selectable), associated with an access point and used by an airline / airport group to request access at that point when it is controlled via the PIN pad only.
- H. Clear - The action taken by a SCC operator to remove an off-normal event display from the Video Display Terminal (VDT) at the SCC. Clearing an event shall allow the operator to annotate the alarm record with the cause of the alarm and a summary of the action taken.
- I. Control Level - 1 of 2 additional measures (keyswitch activation or password input) that may be assigned to a keyboard control function to further restrict its use.
- J. False Alarm - An alarm received for which there is no apparent cause (reason unknown). A false alarm may be due to system malfunction, environmental changes or electromagnetic/radio frequency (RF) interference.
- K. Inactive Mode - The mode of operation during which a point shall not be monitored, and alarm, tamper and trouble conditions at that point shall not be annunciated.
- L. ID Badge / keycard - An encoded device that will be presented at a card reader for automatic verification that the access request is authorized at the associated access point.
- M. Keyboard Control Function - An operator-initiated system command, such as securing or accessing a monitored point, entered via a console / terminal keyboard.
- N. Keycard Number - A number assigned to each ID badge / keycard user and linked by the system to the internal coding of the ID badge / keycard. After being linked, the keycard number shall be used by console / terminal operators when performing keyboard control functions associated with the Controlled Access Subsystem, such as, modifying database records and requesting displays, printouts and historical logs.
- O. Line Supervision - The monitoring of subsystem signal paths to verify their integrity.
- P. Nuisance Alarm - An alarm caused by the system detecting changes in its operating environment that it was designed to detect, but that do not represent a security threat. A nuisance alarm may be caused by wildlife, vegetation or weather conditions.

- Q. Off-Normal Event - A change of status signal from a monitored point to include alarm, tamper and trouble conditions and advisories.
- R. Operator Level - A number assigned to each console/terminal operator authorizing access to all keyboard control functions and database fields associated with that number.
- S. Password - A code or word or number, between 5 and 9 alphanumeric characters (site-selectable) in length, used by authorized console / terminal operators to sign on and off the system and to perform keyboard control functions with a Control level 2 restriction.
- T. Personal Identification Number (PIN) - A code number, between 4 and 9 digits in length, assigned to each ID badge / keycard user for use at access points equipped with PIN pads.
- U. Reset - A signal indicating that the status of a monitored point has returned to normal after the occurrence of an alarm, tamper or trouble condition and can be cleared by an operator.
- V. Secure Mode - The mode of operation during which a point shall be monitored for alarm, tamper and trouble conditions and shall annunciate them as specified herein.
- W. Security Area - An area with 1 or more card reader-controlled access points. Security areas shall be assigned individually or in groups to each ID badge / keycard user to authorize access to all access points associated with each area (subject to time zone constraints).
- X. Shall - Whenever the word "shall" is used in this section, it indicates a mandatory requirement that the Contractor must provide or fulfill to comply with the intent of this section.
- Y. Stop List - A computer-generated listing of all ID badges / keycards that have been deleted, deactivated or flagged to preclude their use (e.g., lost, stolen, etc.).
- Z. Tamper - An off-normal event at a secured or access monitored point indicating the tamper switch has been activated.
- AA. Time Zone - A pre-determined (programmable) schedule, consisting of the days of the week and the hours in each day, when an -ID badge / keycard user is authorized access to a particular security area or when the card readers / PINpads associated with a security area are operational.
- BB. Trouble - An off-normal event at a secured or accessed monitored point indicating an equipment malfunction; a loss of power; a loss of communications; and / or a single break, a single ground fault or a wire-to-wire short in signal wiring.
- CC. Will - Whenever the word "will" is used in this section, it indicates a mandatory requirement that the Contractor must provide or fulfill to comply with the intent of this section.

## 1.8 OPERATIONAL REQUIREMENTS

- A. General

1. The CCAS shall be accessible and controllable via the SCC located in the airport Security Center so as to perform the security-related functions described herein.
2. The desired goal is operation of the CCAS by security and operations personnel with minimal technical training.
3. The CCAS shall provide continuous year-round, twenty-four (24) hours-per-day, seven (7) days-per-week operation.
4. The CCAS shall differentiate between group types of AOA/SA access points as indicated on the drawings and specified herein, and shall provide controlled access, intrusion detection, visual surveillance and data / video / audio signal communication as specified in the specifications and drawings.

B. System Capabilities

1. The CCAS shall perform the following functions:
  - a. Continuously collect and process status information from all monitored points.
  - b. Build and maintain monitored point, ID badge / keycard user and other system databases.
  - c. Electronically supervise wiring to and from all monitored points.
  - d. Regulate personnel and vehicle access and maintain accountability at controlled access points.
  - e. Detect alarm, tamper and trouble conditions and advisories at monitored points, as appropriate.
  - f. Initiate and annunciate duress alarms.
  - g. Visually monitor selected remote locations.
  - h. Automatically / manually display / record CCTV camera outputs. Display alarm event CCTV camera output. Record all alarm events by multiple cameras as indicated on the drawings.
  - i. Audibly and visibly annunciate all alarm, tamper and trouble conditions, advisories and keyboard control function input errors.
  - j. Print all alarm, tamper, and trouble conditions, advisories, executed keyboard control functions and keyboard control function input errors.
  - k. Regulate mechanical key issue / return.
  - l. Display and / or print system status information on demand and automatically on a pre-determined (programmable) time schedule.
  - m. Store all alarm, tamper and trouble conditions, advisories, executed keyboard control functions, subsystem test results and access control information.
  - n. Dump / reload historical records, system programs and database information.
  - o. Display and / or print historical logs on demand and automatically on a pre-determined (programmable) time schedule.
  - p. Perform specified keyboard control functions on demand and automatically on a pre-determined (programmable) time schedule.
  - q. Communicate with selected remote locations.
  - r. Provide a continuous source of power for subsystem operation.
  - s. Produce a combination photo ID badge / keycard.
  - t. Perform system reprogramming and regeneration and background processing.
  - u. Interface with related items by others as specified.
  - v. Allow the operator to call up and view CCTV video from within the CCAS by selection of an alarm event on screen without having to manually access event in CCTV client application
  - w. Automatically send real time alarm event metadata to the CCTV application database.

2. The CCAS shall meet the following response requirements:
  - a. Control shall be transferred from the primary central processor to the hot-standby secondary central processor (or FT server) within 1 second.
  - b. All Intelligent Field Panels (IFPs) in the system shall be polled for status changes at least once every second.
  - c. With a local database of at least 5,000 ID badge / keycard users, the CCAS shall be able to process access requests at each card reader-controlled access point within .5 second. No automated controlled access function shall delay the reporting of an off-normal event beyond 1 second.
  - d. The elapsed time between the occurrence of a single alarm, tamper or trouble condition and its annunciation as an off-normal event at the appropriate monitoring location(s) shall not exceed 2 seconds. When additional conditions occur before a previous condition has been annunciated, the subsequent conditions shall be annunciated as specified at intervals not exceeding 2 seconds each.
  - e. System response to any valid operator control request shall be initiated and visually indicated within 2 seconds.
  - f. System response to any valid operator request for demand displays shall typically be completed within 2 seconds and in all cases less than 5 seconds.
  - g. New and updated ID badge user data files shall be automatically transferred between the CCAS and the Photo Imaging System Upon validation at the initiating location.
  - h. Historical log printouts shall begin printing within 5 minutes of operator request.
  - i. ID badge / keycard inserts containing both textual and image data will be printed within 3 minutes.
  - j. The PIDS will be available for additional image capturing within 15 seconds after a print command is executed.
3. The CCAS design shall permit additional subsystem equipment to be added by inserting appropriate interfaces and entering minor parameter modifications into the software. The CCAS shall provide for a minimum growth capability of 50 percent of its initial capacity without the necessity for the replacement or addition of major hardware or software items.
4. Intelligent field panels shall be configured not to exceed 75 percent capacity in terms of card reader capacity. For example: if the proposed intelligent field panel is capable of supporting 8 card readers, only 6 of the available card reader inputs shall be used, the remaining 2 card reader inputs shall be designated as spares. Total available spare card reader inputs, at a minimum, shall equal 30 percent of initial quantity of card readers to be installed.

#### C. System Status

1. Monitored points within the system shall be in 1 of 2 modes: SECURE or INACTIVE.
  - a. In the SECURE mode, the system shall be sensitive to alarm, tamper and trouble conditions and shall annunciate them as specified.
  - b. In the INACTIVE mode, the system shall be insensitive to alarm, tamper and trouble conditions.
2. Monitored point status changes shall be initiated on demand via the SCC, Programmer's Terminal and the PIDS Terminal or automatically based on a pre-determined (programmable) time schedule. Local accessing shall be reported to the SCC as an advisory.

3. The CCAS shall provide the capability to selectively enable / disable operation of the following devices on demand via the SCC and the Programmer's Terminal or automatically based on a pre-determined (programmable) time schedule, without affecting the operation or status of other CCAS devices at the same point / location:
    - a. Card Readers.
    - b. Electrified Door Hardware.
    - c. Vehicle Gate Operators.
    - d. Automatic Roll-up Doors.
- D. System Monitoring and Control
1. CCAS equipment necessary for performing specified functions shall be incorporated in the Security Control Console (SCC). The console shall be located in the airport Security Center. The SCC layout and equipment arrangement shall be ergonomically engineered to present an efficient and organized appearance and facilitate operation.
  2. The SCC shall be the focal point for all specified functions associated with the monitoring and control of all CCAS and specified existing equipment. The SCC shall be provided with a VDT and keyboard as the primary man-machine interface. The VDT screen shall be formatted to permit simultaneous display of off-normal event annunciations, operator requested status information and keyboard control function request entries.
  3. A Programmer's terminal shall be provided in the airport Security Center to run diagnostic routines, initiate DPS maintenance utilities, perform system reprogramming and regeneration, enter/edit system database information, generate special reports and logs and perform specified keyboard control functions (site-configurable).
  4. ID badge / keycard preparation and encoding shall be monitored and controlled via the PIDS terminal located in the airport badging area.
  5. The man-machine interface portions of the SCC, Programmer's terminal and PIDS terminal shall be identical to facilitate training and operation.
  6. The specific off-normal events that shall be reported at the SCC: and the specific keyboard control functions that can be performed at the SCC, the Programmer's terminal and the PIDS terminal shall be site-configurable. The Programmer's terminal will also serve as an alternate monitoring location to automatically annunciate off-normal events in the event that the SCC is not operable.
  7. The PIDS terminal shall be equipped with a card reader and PIN pad. The card reader PIN pad at the PIDS terminal will be used to verify operation of a newly issued ID badge / keycard and to demonstrate proper use.
  8. A key issue / return panel (box) shall be provided at the airport badging Area to control mechanical key issue and return.
- E. Access Control Software
1. Contractor shall state in their technical submittal that transmittal of the software license transfers ownership of the Peoria International Airport CCAS software to Peoria International Airport for the purpose of operation of the CCAS at Peoria International Airport only. It is understood by the owner that any additional software for installations other than at Peoria International Airport will require purchase of additional licenses for each site.
- F. Signal Collection and Transmission
1. The central processors shall interface with CCAS equipment via Intelligent Field Panels (IFPs). The IFPs shall be connected to all card readers and monitored points collect and transmit status information to the primary central

processor for processing. Each IFP shall be interrogated at least once every second to verify its status and / or report off-normal events and monitored point resets.

- a. The IFPs shall buffer and retain status change information until transfer of data to the primary processor is verified.
  - b. In the event communications with the central processors is disrupted, each IFP shall have provisions to store a minimum of 4,000 authorized access transactions, off-normal events and monitored point resets locally. Upon restoration of communications, the IFPs shall upload the stored data. Data uploading shall not interfere with the real-time reporting of subsequent off-normal events and resets.
2. The CCAS shall provide a communication backbone for the collection and transmission of data, control, video and audio signals via metallic conductor (hardwire) and fiber optic (F/O) data path utilizing multiplexers with appropriate network equipment as specified below.
- a. Card readers shall be hardwired to a Reader Module contained in an EIB within 50 feet of the card reader. The EIBs shall utilize a RS-422/485 multi-drop architecture to connect the reader module to the IFP. No more than 3 EIB locators shall be in a single multi-drop unless approved by A/E.
  - b. The EIB shall be hardwired to an IFP within 500 feet of the point as indicated on the drawings.
  - c. Ethernet TCP/IP architecture shall be used for connecting IFPs to the CCAS. An alternate Ethernet or serial to Ethernet port shall be provided as a backup communication in the event the primary communication fails. The backup communication shall be restored automatically with notification that primary communication has failed.
3. Transmission of CCTV video and data signals from cameras as indicated on the drawings, shall be transmitted via TCP/IP to the CCTV controlling equipment in the airport Security Center. Network based CCTV system shall use fiber and Category 6 cabling system.
4. Reliable data transmission shall be utilized between the IFPs and the central processors. The IFP message format will include its unique address to assure a properly directed response to the primary central processor poll. Accurate reception of error-free data will be ensured by the use of redundant message transmission or by the use of error detecting / correcting codes. Transmission failures will be annunciated as trouble conditions.

#### G. Controlled Access

1. The CCAS shall monitor and control personnel and vehicle access at AOA/SA access points in accordance with the Airport Security Plan FAR 1542 Amendment. Authorized access shall be granted based on the following criteria in combination or individually as determined by Peoria International Airport:
  - a. Possession of a valid ID badge / keycard.
  - b. Knowledge of a valid personal identification number (PIN) corresponding to the valid ID badge / keycard.
2. AOA/SA access points shall be controlled via card reader PINpads and related controlled access and intrusion detection equipment.
3. Operation of an access point via card reader only, PIN pad only, or card reader and PIN pad shall be configurable via the SCCs or Programmer's terminal.
4. The CCAS will provide the capability to selectively enable/disable all automated controlled access operations at a card reader-controlled access

- point on demand from the SCC, Programmer's terminal or automatically based on a pre-determined (programmable) time schedule.
5. Access shall be controlled by assigning any combination of security areas to each ID badge / keycard user for authorized access. Each security area shall consist of 1 or more card reader-controlled access points. A minimum of 128 user-defined security areas shall be provided.
  6. Access may be further controlled by assigning a time zone for access at each security area to each ID badge / keycard user. Each time zone shall define the days of the week and the hours in each day when access is authorized. A minimum of 128 time zones shall be provided.
  7. Access authorization decisions will be made locally at the card reader or its associated IFP. Sufficient local memory will be provided to store all access authorization data for up to 5,000 individuals. Access authorization data will be automatically downloaded from the central processors to each access point, as appropriate (i.e., after the addition, modification or deletion of an authorized ID badge / keycard user file or upon restoration of communications between an IFP and the central processors). Authorized access transactions will be reported to the primary central processor individually or in groups. The downloading of access authorization data and the uploading of groups of authorized access transactions will not interfere with the real-time operation of the system. Unauthorized access requests will be reported as off-normal events as they occur.
  8. Card readers shall operate in a proximity detection mode. When an ID badge / keycard is presented at a card reader, the encoded information shall be compared with the stored data for authorized access. If a PIN is required for access at that access point at that time, the user shall be prompted to enter the number. Each card reader shall be provided with separate visual indications that an ID badge / keycard has been decoded; a PIN entry is required (initial or retry); an incorrect PIN code has been entered; and access has been granted or denied.
    - a. Unauthorized access requests and / or the presentation of an inactive, expired, lost, stolen, unreturned or an improperly encoded ID badge / keycard shall be annunciated as an alarm. Access will not be granted.
    - b. In the event a PIN is not entered within a pre-determined (programmable) time period after the user is prompted (initially or for a retry), the card reader shall reset and an advisory shall be annunciated.
    - c. The number of consecutive incorrect PIN attempts accepted by the system shall be site-configurable (up to 4). After the maximum number of incorrect entries has been made, the card reader shall reset and an alarm shall be annunciated. An alarm shall also be annunciated if the maximum number of incorrect entries associated with the same ID badge / keycard user occurs consecutively at several card readers within a pre-determined (programmable) time period.
    - d. At the Automatic Vehicle Gate (Type 12) an access request must be accompanied by a signal from the associated vehicle presence sensor. In the event this signal is not received, an advisory will be annunciated. Access will not be granted.
  9. The system shall provide the capability to initiate the access sequences described on drawings at any access point via the SCC or Programmer's terminal. The format for performing this keyboard control function shall require the inputting of the ID card number of the individual requesting

- access. This information shall be stored with the record for control function execution.
10. The specific intrusion detection devices that are placed in the ACCESS mode for an authorized access request shall be site-configurable.
  11. The time periods for activating a local locking device and ACCESSING the intrusion detection device(s) shall be independently programmable from the SCC or Programmer's terminal. In the event 2 or more individuals utilize the same card reader or exit pushbutton, each valid request shall reset the time durations for unlocking and ACCESS status to allow sufficient time for the unalarmed entry / exit of each subsequent individual.
    - a. In the event an access point is not closed within the pre-set ACCESS time, an advisory shall be annunciated.
    - b. In the event an access point is not accessed within a predetermined (programmable) time after an entry request is granted, either locally via a card reader or remotely via the SCC, an advisory shall be annunciated and the event shall be recorded by the CCTV system.
  12. Failure to depress the exit pushbutton prior to exiting a security area will be annunciated as an alarm. Doors equipped with an exit pushbutton will be posted to inform the individual of this requirement.
  13. The CCAS shall have provisions to selectively print, at a specified data printer, all authorized automated access transactions at designated card readers or by designated ID badge / keycard users as they occur. All authorized automated access transactions, whether or not printed, shall be stored on the DPS hard disk units. As a minimum, the printed and / or stored information will include the individual's name and keycard number (except when an exit pushbutton is used), the date, the time, and the card reader or access point location or number.
  14. All access points equipped with electrical locking devices (magnetic locks or other locking devices as shown on drawings), automatic roll-up door operators, and gate operators will be remotely controllable from the SCC individually or in groups. These provisions will also allow the access point to remain in a permanently locked / unlocked or open/closed mode for a pre-determined (programmable) time period. An advisory shall be initiated when this time period expires.
  15. Signs shall be provided on the egress side of access points to advise individuals to press the exit pushbutton before opening the door. Signs shall be posted on the public side of door access points to advise individuals to contact the airport Security Center for nonemergency matters or to push on door panic hardware until alarm sound and that door will open in 15 seconds (time duration will be determined by the airport). Exact verbiage for signs shall be coordinated with the owner.
  16. A local gate controller will be provided within the associated gate operator enclosure to permit local operation by an authorized user. Operation of the gate via the controller will be annunciated as an alarm.
  17. ID badge / keycard encoding will include a facility code unique to Peoria International Airport, an individual code unique to each user and an issue number. An encoder will be provided with the PIDS to permit on-site encoding of the ID badges / keycards.
  18. Each ID badge / keycard user will be assigned a keycard number for use by the console / terminal operators when performing keyboard control functions associated with the CAS and PIDS and requesting displays, printouts and historical logs. The keycard number will be linked by the system to the internal coding of the ID badge / keycard during the badge issue process. The system will allow for linking an existing keycard number and associated database record with a new ID badge / keycard by using a subsequent issue



number for continuity when a damaged, stolen or lost ID badge / keycard is replaced.

19. Individual ID badge / keycards and PINS will be assigned via the PIDS. All personal database information associated with each ID badge / keycard user (name, address, etc.) and access authorization data (security areas and time zones) will be transferred from the photo information microprocessor to the CCAS central processors upon entry via the PIDS terminal. (Note: The operator level required to add / modify access authorization data will be higher than the one used to enter / modify of personal information.)
20. Existing personnel database files will be modified and / or deleted from the PIDS, SCC or the Programmer's terminal. When an ID badge / keycard is deleted from the system, the user data will be retained in the on-line databases until transferred to long-term storage.
21. The CCAS will provide the ability to automatically deactivate an ID badge / keycard if it has not been used to access a card reader-controlled access point for a pre-determined (programmable) time period. The user data for an inactive ID badge / keycard will be retained in the on-line DPS database. Provisions to reactivate an ID badge / keycard from the SCC, Programmer's terminal and the PIDS terminal will be provided.
22. The CCAS will provide the ability to flag a particular issue of an ID badge / keycard as lost, stolen or inactive. Additional information shall be recorded in a notes or user definable fields from the SCC, Programmer's terminal and the PIDS terminal.
23. An override command will be provided via the SCC to permit all ID badge / keycard users to enter and exit selected security area access points during emergency situations (i.e., access will be based on a valid facility code only).
24. Each ID badge / keycard user will have the ability to discreetly communicate a duress alarm -via a PINpad during the entry of the PIN. The alarm signal will be transmitted to the primary central processor while the access request is processed as specified heretofore.

#### H. Intrusion Detection

1. All intrusion detection equipment shall be capable of sensing the stimuli for which they are designed to react with at least a 90 percent probability with 95 percent confidence when the sensitivity is adjusted to produce not more than 1 false alarm per week.
2. Selected access points as shown on drawings shall be equipped with balanced magnetic switches to detect authorized and unauthorized openings.
  - a. Each balanced magnetic switch will initiate an alarm signal whenever the door, gate or hatch is opened more than one (1) inch while in the SECURE mode.
  - b. Each balanced magnetic switch shall initiate an alarm signal upon increase, decrease or attempted substitution of an external magnetic field while it is in the SECURE mode.
3. Card reader-controlled access points shall be provided with a door status sensor to detect authorized and unauthorized openings and tampering attempts.
  - a. Each door status sensor shall initiate an alarm signal whenever the door is moved more than 1 inch while in the SECURE mode.
4. The Automated Vehicle Gate shall be equipped with a gate position switch to detect authorized and unauthorized openings.
  - a. Any attempt to force a gate open or open a gate via the local gate controller shall be annunciated as an alarm condition.

5. The Automated Vehicle Gate shall be equipped with vehicle presence sensors (ground loop) on the public and AOA/SA side to detect authorized and unauthorized entrée / exit attempts.
  - a. A signal from the vehicle presence sensor on the public or AOA/SA side of a gate without a concurrent signal from the associated card reader shall be annunciated as an alarm.
6. Tamper switches shall be provided inside all CCAS equipment cabinets, consoles, termination boxes and enclosures to detect unauthorized opening or tampering.
  - a. Tamper switches shall be installed and baffled to prevent defeat by deforming or opening the cover and to initiate a signal whenever the cover is displaced more than 1/4 of an inch from the closed position.
7. A manually-initiated flex-response (duress) call button device shall be provided at the airport security screening point as required by TSA.
  - a. A signal from the call button device shall be annunciated as an alarm at the SCC.
  - b. A signal from the call button device shall not be annunciated locally.
  - c. The call button shall be located to enable surreptitious activation.
  - d. The flex-response alarm shall only be reset at the initiating location.
8. Manually-initiated duress alarm devices shall be located at the airport Security Center SCC and other locations shown on the drawings.
  - a. A signal from the duress alarm device shall not be annunciated as an alarm at the initiating location.
  - b. The duress alarm will be located to enable surreptitious activation.
  - c. The duress alarm shall be reset at the initiating location.
  - d. The duress alarm from the Security Center will be annunciated at the Administration reception area or other locations approved by the airport director. The facility annunciation shall be via flashing blue light.
  - e. The duress alarm from check point screening area shall be annunciated in the security area by a flashing blue light as well as at SCC.
  - f. The duress alarm from administration area shall be annunciated at the SCC.
9. End-of-line termination networks shall be provided for all alarm and tamper contacts to provide the appropriate end-of-line impedance for signal line supervision.

#### I. Surveillance and Assessment

1. Solid-state Closed Circuit Television (CCTV) color cameras shall be provided for visual surveillance of selected areas. Each camera shall be mounted on either a free-standing pole, building exterior / interior wall, roof or hung from the ceiling. The complete system shall be provided as indicated on the drawings and specified herein.
2. Camera locations will be selected so that an individual 6 feet tall standing at the farthest end of the viewing area will be displayed at a height equal to or greater than 10 percent of the CCTV monitor screen.
3. All exterior cameras shall be housed in an environmental enclosure to provide a stable operating environment and to discourage tampering. Exterior cameras shall also be provided with a thermostatically controlled heating and blower system.
4. Display monitors as indicated on the drawings shall be provided for the surveillance and assessment subsystem.
5. Visual identification of which camera output is being displayed on each monitor, whether sequentially, manually or automatically, shall be provided.

6. The SAS shall provide sequence capability at all CCTV monitors. Switching sequence at each monitor shall be independent of the others. The console operators shall have provisions to adjust the sequencing interval and omit or add any camera(s) from the sequence.
7. Digital Video Storage System shall be provided at the airport SCC to automatically record alarm-associated camera outputs and manually record the outputs of any camera displayed on the alarm monitor. Each recording will include the time, the date and the associated camera identification.
8. The SCC will have provisions via a control unit (independent of the VDT keyboard) to manually pan, tilt, zoom and focus any camera. The Surveillance and Assessment Subsystem (SAS) will include provisions to assign up to 10 pre-set positions to each camera equipped with a pan/tilt unit. Upon manual or automatic (alarm condition) selection of a pre-set position, the associated camera will automatically pan, tilt and zoom to the appropriate view. After a pre-determined (programmable) time period, these cameras will automatically return to a pre-set "home" position.
9. The SAS will be designed such that a camera can be displayed on all monitors at the SCC concurrently without degradation of the picture.

J. Off-Normal Event Reporting

1. Alarm, tamper and trouble conditions and advisories shall be annunciated so that there is a visually discernible (color) difference between them. The CCAS shall have the capability to display a minimum of 5 off-normal events simultaneously on the VDTs. The CCAS shall continue to print off-normal events when additional VDT display space is not available. The SCC operators shall be advised via the VDT of pending off-normal events. Provisions for independent call up (scrolling and paging) of those alarm, tamper and trouble conditions and advisories that cannot be initially displayed due to VDT line limitations shall be provided. The VDT displays shall be automatically updated as space becomes available.
2. Off-normal events shall be prioritized by type (alarm, tamper, trouble or advisory) and category (see below) for reporting and historical logging. A minimum of 64 priority groups (programmable) shall be provided. Provisions to assign priority groups to the SCC for primary annunciation will be provided. (Note: Priority grouping will be used to assign monitoring responsibility to the SCC and is not intended to cause one priority group to "bump" a previously displayed priority group at a given VDT.)
3. No alarm, tamper or trouble condition or advisory shall be lost during switchover from normal to backup power (either at the SCC or at a field installed device) or from the primary to hot-standby central processor.
4. The following conditions shall be annunciated as an alarm (alarm categories are shown in parentheses):
  - a. Receipt of a signal from any detector / sensor performing intrusion monitoring functions at a monitored point (intrusion Alarm).
  - b. Unauthorized opening of any SECURED access point (intrusion Alarm).
  - c. Receipt of a flex-response signal from security screening point (Flex-Response Alarm).
  - d. Receipt of a duress signal (Duress Alarm).
  - e. Presentation of an unauthorized, inactive, lost, stolen, unreturned, expired or improperly encoded ID badge / keycard at a card reader controlled access point (Access Alarm).
  - f. Consecutive incorrect PIN entries exceeding the maximum number of tries (Access Alarm).
5. The following condition shall be annunciated as tamper:

- a. Unauthorized opening of a CCAS equipment cabinet, console, box or enclosure (Tamper Alarm).
- 6. The following conditions shall be annunciated as trouble (trouble categories are shown in parentheses):
  - a. CCAS equipment malfunction or failure (Equipment Failure).
  - b. Loss of any source supplying power to the CCAS (Power Failure).
  - c. Failure at any portion of the CCAS power conversion or distribution equipment to include equipment power supplies (Power Failure).
  - d. Low battery indication from a UPS or battery backup unit (Low Battery).
  - e. Any attempt to disable or compromise wiring between any monitored point and the IFPs, and between the IFPs and the central processors.
  - f. A single break, a single ground fault, a wire-to-wire short, or any combination of these in the signal wiring between any monitored point and the IFPs, and between the IFPs and the central processors (Line Supervision).
  - g. Signal transmission failure (Communications Failure).
  - h. Automatic switchover from the primary to the hot standby central processor (Processor Failure).
  - i. Loss of video signal (Loss-of-Video).
- 7. The following conditions shall be annunciated as an advisory (advisory categories are shown in parentheses):
  - a. Failure of a temporarily ACCESSED card reader-controlled access point to close within a specified time after authorized opening (Access Advisory).
  - b. Failure of a temporarily ACCESSED card reader-controlled access point to be opened within a specified time (Access Timeout).
  - c. The time period for an access point opened / unlocked from the SCC has expired (Access Advisory).
  - d. ID badge / keycard user still has an issued key (Key Advisory).
  - e. Manual switchover from the primary to the hot standby central processor (Manual Switchover Advisory).
  - f. Resynchronization of central processors databases started / completed (Resync Started / Complete Advisory).
  - g. DPS historical logging storage capacity 85 percent full/about to be overwritten 98 percent full (Historical Storage Advisory).
  - h. ID badge / keycard accountability drops below 95 percent or a predetermined percentage, to include expired, reported lost and stolen ID badge / keycard (Accountability Advisory).
  - i. Failure to enter a PIN within a specified time after being prompted by the card reader (Access Timeout).
  - j. Receipt of an access request from the automated vehicle gate without a signal from the respective vehicle presence sensor (Unauthorized Access Request).
- 8. Each alarm, tamper or trouble condition and each advisory at a monitored point shall cause an audible annunciator to be sounded and an off-normal event text message to be displayed on the SCC VDTs and printed at the event printer located in the airport Security Center. The displayed and printed text messages shall be in full-word English and shall, as a minimum, include the time of occurrence, the point identification code, the point description, the type and category of event and the required operator response. VDT displays shall contain a minimum of 2 lines per event. The SCC operator shall have provisions to selectively display additional text information (up to 6 lines) for each off-normal event.

- a. The audible annunciator shall be capable of being heard throughout console area. When the console is manned, the volume shall be capable of being reduced not more than 90 percent of its rated output to permit local alarming only. The SCC shall be provided with a momentary silencing switch for the audible annunciator. The audible annunciator shall be capable of being reset but not permanently silenced. The silencing of an audible annunciator in the presence of other unacknowledged off-normal events shall not interfere with the subsequent reporting of these events as specified. The silencing switch shall operate independently of the keyboard control function to acknowledge off-normal events. In addition, the audible annunciator shall be provided at another CCAS workstation as selected by PIA.
  - b. The printed message shall include the time and date and shall be readily distinguishable from other messages printed at the printers.
  - c. Duress alarms shall not be annunciated at the initiating location.
  - d. Subsequent alarm, tamper or trouble conditions at the same point received after the initial signal but prior to operator disposition (clearing) shall not be displayed (i.e., there shall be only 1 VDT text message for each alarm, tamper or trouble condition at the same point regardless of the number of signals received prior to disposition).
  - e. In the event the primary monitoring location is inoperable, an off normal event shall be automatically annunciated at its alternate monitoring location (Programmer's terminal).
9. Upon acknowledgment by any authorized SCC operator, the audible annunciator shall be silenced and cleared at all monitoring locations. The VDT displays shall be updated to indicate an off-normal event has been acknowledged.
- a. The CCAS shall assign each monitored point to a computer-generated color graphic display. Each display shall include a map or floor plan depicting the location of the point, the point identification code and a color-coded flag to identify the status of the point. Upon acknowledgment of an off-normal event, the associated graphic display shall be automatically presented on the GDT at the acknowledging console. This display shall override any previously displayed graphics at the GDT. In the absence of alarms, the SCC operators shall be able to manually display the graphic associated with a specific point.
  - b. The CCAS shall interlock monitored points with a camera output and pre-set position. Upon acknowledgment of an off-normal event, the associated cameras shall be automatically panned, tilted and zoomed (or fixed camera) to the appropriate scene and the output displayed on one of the color CCTV monitor at the acknowledging console. In the absence of alarms, the SCC operators will be able to manually display the camera output associated with a specific point.
10. When the cause of an alarm, tamper or trouble condition or advisory has been removed, a reset message shall be displayed and printed at the SCC (or alternate monitoring location on the third floor if the SCC is inoperable). The printed message shall include the time and date of reset, the point identification code, and the point description. Events returning to normal shall not require a separate acknowledgment by the console operators.
11. After a point has been reset, it shall be capable of being individually cleared by any authorized SCC operator. Clearing a point shall remove the displays from all VDTs and GDTs and print an event-cleared message on the event printer. Clearing a point interlocked with an associated video output shall

remove the automatically displayed camera output from the CCTV monitor; return the camera to its "home" position.

- a. As part of the clearing function, each monitoring location shall have provisions to enter an explanation of the event (a minimum of 1 line) for storage with the event data and for printing with the event-cleared message.
- b. No alarm, tamper or trouble condition or advisory shall be cleared from the VDTs without being stored on the DIPS hard disk units.

K. Test Reporting

1. Individual equipment operation and overall system performance shall be verified periodically by simulating or duplicating alarm, tamper and trouble conditions and advisories at each monitored point, as applicable. After annunciation, acknowledgment and reset, as described above, each monitoring location shall have provisions to clear and store these events on the DIPS hard disk units as tests via the keyboard. These provisions shall include at least 2 independent, operator-initiated actions so that a bona fide alarm, tamper or trouble condition or advisory is not accidentally stored as a test.

L. Mechanical Key Control

1. A system to monitor and control mechanical key issue and return shall be provided as part of the CCAS. Selective issuing of mechanical keys to authorized ID badge / keycard users shall be performed via PIDS terminal. The operator shall input the respective mechanical key number in the individual's database file and shall log the time, date and mechanical key number. A similar sequence shall be provided for mechanical key return."

M. Demand Display and Printing Functions

1. The console terminal operators shall have provisions to display and / or print system status information on a real-time basis. Paging and scrolling capability shall be provided for multi-page displays. Previously displayed information shall be automatically cleared when a new display is requested.
2. Status information shall be displayed on the VDT at the location initiating the request.
3. Status summary requests from the SCC and Programmer's terminal shall be capable of being directed to any printer. If the selected printer is an event printer, off-normal event printing shall be buffered until the printout is completed. Report sorts shall be performed alphabetically or numerically on all fields, as appropriate.
4. The following demand printouts shall be provided at the SCC and Programmer's terminal, as a minimum:
  - a. All INACTIVE monitored points.
  - b. All SECURE monitored points.
  - c. All monitored points in ACCESS.
  - d. All monitored points in ALARM.
  - e. All monitored points in TAMPER.
  - f. All monitored points in TROUBLE.
  - g. All current ADVISORIES.
  - h. All current off-normal events.
  - i. Status of all monitored points.
  - j. All data associated with all monitored points.
  - k. All data associated with all ID badge / keycard users (sort by any set of parameters).
  - l. All data associated with all access points.

- m. All assigned ID badge / keycards.
- n. All active, inactive, lost, unreturned, expired or deleted ID badge / keycards (select by type and sort by any set of parameters).
- o. All access points assigned to each security area.
- p. The days and times associated with all time zones.
- q. All ID badge / keycard users assigned to each security area and / or card reader-controlled access point (sort by name and keycard number).
- r. All ID badge / keycard users assigned to a particular security area and / or card reader-controlled access point (sort by name and keycard number).
- s. Last card reader used by all ID badge / keycard users (sort by any set of parameters).
- t. Last ID badge / keycard used at all card readers.
- u. All unassigned IFP points.
- v. All mechanical keys assigned to all ID badge / keycard users.
- w. All mechanical keys issued by key number.
- x. All keyboard control functions scheduled for automatic execution.
- y. All ID badge / keycard users sorted by company / tenant.
- z. All ID badge / keycard users sorted by a company / tenant.
- aa. Ratio of the number of ID badge / keycards deleted and unreturned or reported as stolen or lost to the number of assigned ID badge / keycards.
- bb. All Airport and company/tenant personnel with signature authorization.
- cc. All data associated with all company tenant files.
- dd. All ID badge / keycards set to expire by a particular date.
- ee. Sort and print list of ID holder's last training by name or company.
- 5. The following demand printouts will be provided at the report printer at the PIDS terminal, as a minimum:
  - a. All data associated with all ID badge / keycard users (sort by any set of parameters).
  - b. All assigned ID badge / keycards (sort by any set of parameters).
  - c. Status of all assigned ID badge / keycards (select by type (active, inactive, lost, stolen, unreturned, expired, deleted) and sort by any set of parameters).
  - d. All data associated with all company tenant files.
  - e. Time periods of data stored on storage device.
  - f. All ID badge / keycards set to expire by a particular date.
- 6. The console terminal operators shall have provisions to print the data displayed on their VDT screen at any time.

#### N. Logging Functions

- 1. Historical logs shall be requested from the hard disk units or other approved storage devices for a particular date or sequence of dates. When a log is requested, the date and the time of day shall be printed along with the log identification.
- 2. Capacity to store up to 500,000 events on-line on the hard disks shall be provided. Historical log data may be transferred to a magnetic tape cartridge for long term storage at any time.
- 3. The CCAS shall monitor the status of all remaining available on-line historical storage space. Routines shall be provided which respond to operator requests to display remaining storage space available and which automatically generate a visual indication when the system's historical

- storage space capacity is close to being exhausted (e.g. 85 percent full) and when stored data is about to be overwritten (e.g. 98 percent full).
4. A file management subsystem shall be provided for maintaining, cataloging and retrieving any historical files with minimum operator interaction. The subsystem shall be designed to accept an operator request specifying the type of data to be retrieved and the associated time period. For data that is stored permanently, the subsystem shall advise the operator which magnetic tape cartridge must be loaded for data retrieval. Upon notification that the appropriate tape cartridge has been loaded, the subsystem shall transfer the data on-line, sort it and generate the requested log.
  5. Historical logs requests from the SCC, Programmer's terminal, and PIDS terminal shall be capable of being directed to any printer. If the selected printer is an event printer, off-normal event printing shall be buffered until the printout is completed. Historical log sorts shall be performed alphabetically or numerically on all fields, as appropriate.
  6. The following historical logs shall be provided at the SCC and Programmer's terminal, as a minimum. Provide Crystal Reports or other 3<sup>rd</sup> party software as required to meet the specifications. The intent is to provide historical log for audit trail and meet TSA reporting requirements. It is recognized that different approved manufacturers may provide the logs in slight variations than as indicated.
    - a. ALARM conditions (sort by point and category).
    - b. TAMPER conditions (sort by point).
    - c. TROUBLE conditions (sort by point and category).
    - d. ADVISORIES (sort by point, category, name and keycard number, as applicable).
    - e. Test results at monitored points (sort by point).
    - f. Access attempts at card reader-controlled access points (sort by point, keycard number and name).
    - g. Authorized automated access transactions (sort by point, keycard number and name).
    - h. Authorized access transactions through the keyboard (sort by point, key / card number and name).
    - i. SCC, Programmer's terminal and PIDS terminal operators on duty (sort by console / terminal and operator).
    - j. Operator-initiated keyboard control functions and associated data (sort by control function, console / terminal and operator).
    - k. Database changes (sort by database, console terminal and operator).
    - l. Keyboard control function input errors (sort by console / terminal and operator).
    - m. Keyboard control functions and associated data initiated automatically on a time schedule (sort by control function).
    - n. Mechanical keys issued and returned (sort by individual or key number).
    - o. A stop list of all access authorized changes at each card reader controlled access point and all ID badge / keycards that have been inactivated, deleted or flagged to preclude use (sort by access point and name).
    - p. A list of all ID badge / keycards that have not been used / presented at an access point for a specified time period (sort by individual).
    - q. Number of ID badge / keycards assigned, returned, deleted or reported as stolen or lost (accountability).
    - r. The following historical logs will be provided at the report printer at the PIDS terminal, as a minimum:
    - s. PIDS terminal operators on duty (sort by operator).



- t. Operator-initiated keyboard control functions and associated data (sort by control function and operator).
  - u. Database changes (sort by database and operator).
  - v. Number of ID badge / keycards assigned, returned, deleted or reported as stolen or lost.
7. A report generator, accessible via the Programmer's terminal or PIDS terminal shall be provided for special reports and logs. After a report has been developed, it shall be available for use by all authorized operators.
  8. The capabilities required by this section shall be strictly background mode and shall not interfere with the real-time functions of the system or diminish system throughput or response times.

P. Keyboard Control Functions

1. All SCC and Programmer's terminal control functions, except operation of the master intercom station and CCTV equipment, will be performed through the VDT keyboards. The keyboard at the PIDS terminal will be used to perform selected control functions associated with badge preparation and issue.
  - a. The specific keyboard control functions that can be performed at the SCC and the Programmer's terminal shall be site-configurable.
  - b. All keyboard control function requests shall be checked to verify the correctness of all inputted data prior to execution and the operator shall be advised accordingly. Keyboard control function input errors at all consoles / terminals shall be displayed and printed locally and stored on the DPS hard disk units. Input error messages shall be appropriately descriptive and consistent for each control function.
  - c. Keyboard control functions shall be implemented in a manner which minimizes the number of keystrokes required. If the keystrokes are in the form of characters, these characters shall be intuitively obvious for the function they are to perform. If a menu-driven or prompt approach is utilized, provisions to by-pass the menu or prompt shall be provided to allow for efficient operation of the system by experienced operators.
  - d. On-line help data for each keyboard control function shall be available to all console / terminal operators.
2. A system of operator levels shall be provided at all console / terminals to restrict operator use of keyboard control functions and access to database fields. A minimum of 8 levels shall be provided. Keyboard control functions and database fields shall be assigned to 1 or more operator levels which, in turn, shall be assigned to a console / terminal operator. The operator shall be permitted to perform all keyboard control functions and access all database fields associated with his assigned level (subject also to SCC, PIDS terminal and Programmer's terminal keyboard control function assignment). If the system is menu or prompt-driven, operators shall only have access to those menus / prompts for which they are authorized use.
3. Each console and terminal operator shall be assigned a unique password, between 5 and 9 alphanumeric characters in length. This password shall be utilized to log on and off the system and perform keyboard control functions with a Control level 2 restriction. Passwords shall not appear on any system VDT, nor shall they be printed on any system printer.
  - a. An operator shall be automatically logged-off when another operator logs on at that console / terminal.
  - b. An operator shall be automatically logged-off if there has not been any keyboard activity for a pre-determined (programmable for each console terminal) time period.

4. Provisions to abort any keyboard control function prior to completion of execution shall be provided. In addition, an "escape" feature shall be provided to cancel a keyboard control function request before execution is initiated.
5. The DIPS shall have provisions to automatically initiate keyboard control functions, to include report and historical log printing, based on a predetermined (programmable) time schedule. This schedule shall include both the day(s) and the time(s) when the control function is to be executed. At the time of execution, the keyboard control function shall be displayed at the SCC, printed at the event printer and stored on the DIPS hard disk units.
6. Keyboard control functions performed at the SCC, Programmer's terminal, and PIDS terminal shall be displayed at the console / terminal initiating the request at the time of execution and printed on the event printer. All completed keyboard control functions shall be stored on the DPS hard disk units. If keyboard control function request execution is not immediate or obvious, the operators shall be advised when the control function is completed.
7. The following keyboard control functions shall be provided at the SCC and Programmer's terminal, as a minimum:
  - a. A command to set and / or reset the internal time and date reference of the central processors.
  - b. A command to selectively define or modify monitored point descriptions.
  - c. A command to interlock a monitored point with a camera output.
  - d. A command to interlock a monitored point with a graphics display.
  - e. A command to selectively define or modify security area identification.
  - f. A command to selectively define or modify time zones.
  - g. A command to selectively assign a keyboard control function to a SCC or Programmer's terminal.
  - h. A command to selectively assign any combination of control levels to a keyboard control function.
  - i. A command to selectively assign keyboard control functions / database fields to any operator level.
  - j. A command to assign or change the operator level for a console / terminal operator on an individual basis.
  - k. A command to assign or change the unique password for a console / terminal operator on an individual basis.
  - l. Commands to selectively enable / disable CCAS device operation on an individual basis.
  - m. A command to inactivate monitored points (individually or in groups).
  - n. A command to change the status of monitored points to SECURE (individually or in groups).
  - o. A command to selectively change the status of monitored points to ACCESS (individually or in groups).
  - p. A command to modify ID badge / keycard user data (individually or in groups).
  - q. A command to delete ID badge / keycards (individually or in groups).
  - r. A command to reactivate ID badge / keycards (individually or in groups).
  - s. A command to initiate the automated access sequence at a card reader-controlled access point. The format for initiating this command shall include inputting the keycard number of the individual requesting access.

- t. A command to program, on an individual basis, the length of time a card reader-controlled access point may remain open without alarm after an authorized access request is granted.
  - u. A command to selectively print all automated access transactions at designated card readers or for designated ID badge / keycard users, as they occur.
  - v. A command to allow / disallow all active ID badge / keycard users to enter and exit selected card reader-controlled access points based on a valid facility code only.
  - w. Commands to lock / unlock access points equipped with electrical locking devices for a pre-determined (programmable) time period (individually or in groups).
  - x. A command to selectively acknowledge an alarm, tamper or trouble condition or an advisory.
  - y. A command to selectively clear an alarm, tamper or trouble condition or advisory and enter an explanation of the event.
  - z. A command to selectively clear and store an alarm, tamper or trouble condition or an advisory as a test.
  - aa. Commands to request selected demand displays and printouts.
  - bb. A command to selectively clear VDT demand displays.
  - cc. A command to print the data displayed on the VDT screen.
  - dd. Commands to request selected historical logs.
  - ee. A command to halt a historical log in progress.
  - ff. Commands to transfer data between the DIPS hard disk units and a DPS magnetic tape cartridge.
  - gg. A command to assign a keyboard control function to a time schedule for automatic execution.
  - hh. A command to display the graphic display associated with a specified point. This command shall override any manually or automatically displayed graphic previously displayed on the GDT.
  - ii. A command to display the camera output associated with a specified point. This command will override any manually or automatically displayed camera output previously displayed on the monitor.
  - jj. Commands to configure an access point for controlled access via a card reader only, a PINpad only or both card reader and PINpad.
8. The following keyboard control functions will be provided at the PIDS terminal, as a minimum (Note: Any or all of these functions may be performed via a mouse):
- a. A command to set and / or reset the internal time and date reference of the photo imaging microprocessor.
  - b. A command to selectively assign keyboard control functions / database fields to any operator level.
  - c. A command to assign or change the operator level for a terminal operator on an individual basis.
  - d. A command to assign or change the unique password for a terminal operator on an individual basis.
  - e. A command to modify ID badge / keycard user data (individually or in groups).
  - f. A command to delete ID badge / keycards (individually or in groups).
  - g. A command to reactivate ID badge / keycards (individually or in groups).
  - h. A command to modify company / tenant file data (individually or in groups).
  - i. A command to capture an individual's video image.
  - j. A command to capture an individual's signature.

- k. A command to print a badge insert (individually or in groups).
- l. Commands to interrupt, re-order, restart and cancel a badge insert print queue.
- m. Commands to reformat a badge insert layout.
- n. A command to encode an ID badge / keycard.
- o. Commands to calibrate image color, hue, contrast and sharpness.
- p. Commands to use the PIDS terminal card reader and digital keyboard to test an assigned ID badge / keycard and PIN and train an individual in the proper use of the reader and PINpad.
- q. Commands to request selected demand displays and printouts.
- r. A command to selectively clear VDT demand displays.
- s. A command to print the data displayed on the VDT screen.
- t. Commands to request selected historical logs.
- u. A command to halt a historical log in progress
- v. Commands to transfer data between the PIDS hard disk unit and the magnetic tape cartridge unit.
- w. Command to transfer data between fingerprinting equipment and PIDS hard disk.

Q. Power Supply

- 1. Power for all CCAS equipment shall be provided as indicated on the drawings.
- 2. An Uninterruptible Power Supply (UPS) unit shall be provided at the PIA Security Center for the SCC: and other CCAS equipment located there to assure continued operation upon loss of normal ac power for a period of at least 15 minutes. The Airport diesel generators will provide backup power for this equipment during extended power outages.
- 3. The UPS shall be sized to support the following equipment at a minimum. Provide 50 percent space capacity in the UPS for future loads.
  - a. All the CCAS equipment located in SCC, PIDS and EOC.
- 4. Battery backup units will be provided for field-installed devices not equipped with integral backup batteries to assure continued operation upon loss of normal ac power for a period of at least 4 continuous hours.
  - a. Battery backup units shall be incorporated into the field equipment cabinets or a separate, adjacent tamper-protected enclosure.
  - b. During normal operation, the battery backup units will be maintained at full charge. In the event of a loss of normal and emergency ac power, the associated load will be automatically transferred to the battery backup unit. Upon restoration of ac power, the load will be automatically re-transferred and the batteries will be recharged to capacity at a rate not to exceed 10 times the discharge time.
  - c. When power is being supplied from its batteries, a battery backup unit will monitor battery voltage and will disconnect the load if the voltage drops below 85 percent of its rated output. Upon restoration of ac power, the load will be automatically re-transferred.
- 5. The status of the UPS unit and battery backup or integral back up unit batteries will be monitored by the CCAS. A low battery condition will be annunciated as trouble.

R. ID Badge / keycard Preparation

- 1. A PIDS will be provided to produce ID badge / keycards for issue to authorized users. Badge preparation will include the inputting of personal and access authorization data, the capture of an individual's video image and signature, the printing of the badge insert, the cutting and laminating of the badge insert to the keycard and the encoding of the keycard.

2. Personal and access authorization data will be entered via the PIDS keyboard. Database fields with limited input options (e.g., sex, race, etc.) will utilize pop-up windows with mouse selection to facilitate data entry and minimize input errors.
3. A high resolution digital video camera will be utilized to capture a continuous tone color image of an individual. Subject placement will be displayed in a preview window on the PIDS VDT during the capture process and may be moved, via software, for proper centering. Provisions for freezing an image and immediate recapture of an image will be provided. During the capture process, photographic lighting will be controlled by the photo imaging microprocessor.
  - a. The PIDS will support transfer and storage of video images captured via a portable Digital Camera
  - b. The PIDS will be provided with a stored reference frame to calibrate image color, hue, contrast and sharpness.
4. The PIDS will support variable size badge inserts and multiple insert formats. The badge insert layout may include a portion or all of the text and image data contained in an individual's database file (site configurable). Text and image arrangements, insert colors (text and background), fonts, typestyles and image sizes will be site-selectable. Background color will be automatically selected by the system based on the badge type (employee visitor), employer affiliation or access authority. Image sizes will be proportionally variable.
5. Individual badge inserts with all associated text and image data will be capable of being previewed simultaneously on the PIDS VDT prior to printing (either initially or for reissue). The display will be in a "What You See Is What You Get" format.
6. The PIDS will support single and two-sided printing in a horizontal or vertical alignment. Badge inserts will be printed individually or in groups. The system will be capable of printing a minimum of 100 badge inserts while operating unattended. The print queue will be capable of being interrupted, re-ordered and restarted or canceled.
7. Badge encoding shall include a facility code unique to the airport, an individual code unique to each user and an issue number.
8. The laminating process will be tamper-resistant and will securely bond the badge insert to the keycard in such a manner that any attempt to alter or extract the data will be visibly obvious or render the ID badge / keycard unusable.
9. Video image fingerprint data and signature data will be stored on the PIDS hard disk unit. All other data will be transferred to the DPS for storage. An interactive data link will be provided between the PIDS and DPS for the bidirectional exchange of information.
10. The PIDS will support the display and printing of full size video images.

S. Miscellaneous Provisions

1. Physical Barriers
  - a. Bollards will be provided around field-installed equipment at Type 12 access points to preclude accidental damage from vehicles. These bollards will consist of 6" concrete-filled pipes appropriately anchored.
2. Maintenance Aids
  - a. To facilitate routine preventive and corrective service of the CCAS by Airport Maintenance personnel, the CCAS will be provided with a set of all special or nonstandard test equipment, tools, adaptors and fittings to maintain and service the supplied equipment to include

card extenders for each different type of printed circuit card, tools for removing tamper-proof screws and a portable IFP analyzer (laptop computer work station).

## 1.9 QUALIFICATIONS

- A. The system contractor / integrator responsible for providing the CCAS shall have at least ten (10) years experience in furnishing and installation of such systems.
- B. The system contractor integrator shall have previous experience in installation of systems of similar scope for at least 2 projects in the past five (5) years and airport security system under PART 1542 (or FAR 107.14) for at least one (1) project in the past five (5) years. Contractor shall provide names of the project, year completed and references to the A/E for review and approval with bid.
- C. The system contractor's project manager and on-site superintendent shall have a minimum of fifteen (15) years experience each and shall have worked on the projects listed in Art. 1.9B in similar capacity. Submit name with bid.
- D. Manufacturer Qualifications (submit with product submittal)
  - 1. Manufacturer of the CCAS shall be an established organization with referenced and documented experience delivering and maintaining Security Systems of equal or higher sophistication and complexity as compared to the system detailed in this specification.
  - 2. CCAS Manufacturer's manufacturing facilities shall be certified ISO-9000:2000 operations, utilize ISO-9000:2000 manufacturing procedures and maintain their ISO certifications.
  - 3. CCAS Manufacturer shall employ at a minimum the following methods for Quality Control of component and assembly devices.
    - a. Visual inspection of devices shall be performed to verify assembly according to defined procedures.
    - b. End of line operational tests shall be performed to ensure product functionality has been correctly configured.
    - c. A system burn-in period shall be utilized to screen for early life failures of electronic components.
  - 4. Individual functionality and system level regression testing shall be performed to ensure compliance with product specifications. Single and multiple unit system tests shall be performed to mimic end-user installation configurations. Automated hardware and software testing shall be utilized to verify system performance under published operational loads and shall be compared to published system capabilities.
- E. Access controls and CCTV software experience: The access controls and CCTV system integrator / contractor shall have factory trained personnel from the approved manufacturer with a minimum of five (5) years experience in system integration and a minimum of two (2) years experience in the proposed access controls and CCTV systems for this project. Submit name of the qualified personnel with bid.

## 1.10 MAINTENANCE SERVICES - WARRANTY

- A. General Requirements: The Contractor shall provide all services required and equipment necessary to maintain the entire CCAS in an operational state as specified for a period of two (2) year(s) after formal written acceptance of the system, and shall provide all necessary material required for performing scheduled service or other unscheduled work.

- B. Personnel: Service personnel shall be factory certified in the maintenance and repair of the equipment installed under this section of the specification. The owner shall be advised in writing of the name of the designated service representative, and of any change in personnel.
- C. Routine Inspection and Warranty Maintenance: This work shall be scheduled in advance with Peoria International Airport.
  - 1. Inspections: The Contractor shall perform two minor inspections at six (6) month intervals (or more often if required by the manufacturer), and two major inspections offset equally between the minor inspections to effect quarterly inspection of alternating magnitude.
  - 2. Minor Inspections: These inspections shall include:
    - a. Visual checks and operational tests of all console equipment, peripheral equipment, field hardware, sensors, and electrical and mechanical controls.
    - b. Mechanical adjustments if required on any mechanical or electromechanical devices.
  - 3. Major Inspections: These inspections shall include all work described under paragraph Minor Inspections and the following work:
    - a. Clean all CCAS equipment, including interior and exterior surfaces.
    - b. Perform diagnostics on all equipment.
    - c. Check, walk test, and if required by the manufacturers' maintenance procedures, calibrate each sensor.
    - d. Run all system software diagnostics and correct all diagnosed problems.
- D. Operation: Performance of scheduled adjustments and repair shall verify operation of the CCAS as demonstrated by the applicable tests of the performance verification test.
- E. Emergency Service: The owner will initiate service calls when the CCAS is not functioning properly. Qualified personnel shall be available to provide service to the complete CCAS. The owner shall be furnished with a telephone number where the service supervisor can be reached at all times. Service personnel shall be at site within four (4) hours after receiving a request for service. The CCAS shall be restored to proper operating condition within 8 hours after service personnel arrive on site.
- F. Records and Logs: The Contractor shall keep records and logs of each task, and shall organize cumulative records for each component, and for the complete system chronologically. A continuous log shall be maintained for all devices. The log shall contain all initial settings. Complete logs shall be kept and shall be available for inspection on site, demonstrating that planned and systematic adjustments and repairs have been accomplished for the CCAS.
- G. Work Requests: The Contractor shall separately record each service call request on a service request form. The form shall include the model and serial number identifying the component involved, its location, date and time the call was received, specific nature of trouble, names of service personnel assigned to the task, instructions describing what has to be done, the amount and nature of the materials used, the time and date work started, and the time and date of completion. The Contractor shall deliver a record of the work performed within five (5) days after work is accomplished.

- H. System Modifications: The Contractor shall make any recommendations for system modification in writing to the Owner. No system modifications, shall be made without prior approval of the Owner. Any modifications made to the system shall be incorporated into the operations and maintenance manuals, and other documentation affected.
- I. Software: The Contractor shall provide all software updates during the period of the warranty and verify operation in the system. These updates shall be accomplished in a timely manner, fully coordinated with CCAS operators, shall include training for the new changes / features enabled, and shall be incorporated into the operations and maintenance manuals, and software documentation.

## PART 2 - PRODUCTS

### 2.1 GENERAL DESIGN REQUIREMENTS

- A. Operating Environment
  - 1. All indoor equipment shall be capable of operating in an environment of 50 to 95 degrees F with 20 to 80 percent relative humidity, non-condensing.
  - 2. All outdoor-installed components shall include electric heaters and forced ventilation as required for operation in an ambient environment of:
    - a. Temperatures between -20 degrees F and +115 degrees F.
    - b. Relative humidity's up to 100 percent at +100 degrees F.
    - c. Wind gusts up to 100 miles / hour.
    - d. Rainfall rates up to 6 inches / hour for periods up to 60 minutes.
- B. Cabinets and Terminals
  - 1. All cabinets and terminals shall be free-standing assemblies with leveling provisions and rear access doors. Where rear access cannot be accommodated, cabinet and terminal equipment shall be provided on racks that slide out from the front. Each cabinet and terminal shall be completely modular, physically and electronically. Each module shall be capable of passing through an opening 2 feet 8 inches wide by 6 feet high, maximum. Racks, shelves, and other structural parts shall be constructed to prevent warping or distortion.
  - 2. Cabinet and terminal doors shall open a minimum of 170 degrees to avoid blocking personnel movement. Each door shall be equipped with a UL-approved cylinder lock (per UL 437, "Key Locks" a tamper switch and a piano-type hinge with welded tamperproof pins. All cabinet, console and terminal locks shall be master-keyed by type. Four keys of each type shall be supplied.
  - 3. Racks for the plug-in circuit cards shall permit access to the interconnecting wiring. Initial rack space capacity for circuit cards shall accommodate the requirements specified in Paragraph 1.8B.3. Circuit card identification shall be stenciled or permanently marked on the panel structure adjacent to its location with a minimum letter height of 1/4-inch. All backplane wiring and program allocation for spare slots reserved for future expansion shall be provided so that additional points can be implemented by simply inserting a card into the spare slot and defining the points in central processor memory.
  - 4. Each cabinet and terminal shall contain a copper ground bus running the entire length of the cabinet or console with the enclosure connected to the bus so as to effectively ground the entire structure. A bolted compression-type terminal shall be installed at each end of each ground bus for connection to the facility ground cable.



5. All cabinet, console and terminal materials and paint shall be nonflammable (as defined by ASTM D 635, "Rate of Burning and / or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position"). No preparation or material shall release toxic gases or dense smoke or propagate flames when heated or exposed to open flame.
6. Provisions shall be made for field wiring to enter the cabinets, consoles and terminals at the top and the bottom, except as specified. All cable openings shall be provided with flame-resistant grommets. All wiring for field connections shall terminate on terminal blocks or plug sockets.
7. All unshielded cabinet and terminal wiring, except for off-the shelf equipment, shall be stranded 600 volt Class C stranding in accordance with ASTM B8, "Concentric-Lay Stranded Copper Conductors," or PIA-approved equal. All wiring shall be capable of passing the applicable flame-resistance tests specified in ICEA S-19-81 I A Rubber Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.®
8. Low level signal wiring (100 mV and under) which is designated as having twisted and shielded field wiring shall also have twisted and shielded wiring within the cabinets, consoles and terminals. Each shield shall be connected to a separate terminal point immediately adjacent to the signal wire. Connection to the ground bus, when required, shall be made with insulated No. 12 AWG wire.
9. Each wire shall be identified at both ends with the wire designation corresponding to the wire numbers shown on the wiring diagrams. The wires shall be marked with a sleeve-type, smear-proof, nonconductive, flame-resistant, embossed wire marker or approved equivalent (chlorine or other halogen compounds shall not be used).
10. All exposed wiring within the cabinets, consoles and terminals shall be formed neatly with wires grouped in bundles using non-metallic, flame resistant wiring cleats or bands and with groups substantially supported along their length. Wires shall not be spliced, taped or joined with wire nuts between terminal points. Wiring which crosses hinged joints shall be flexible hinge-type wire. No wiring shall be routed across the face or rear of an instrument, junction box or other device in a manner that will prevent or hinder the opening of covers or will obstruct access to leads, terminals, devices or instruments. Wiring shall not cross a door opening or be fixed to a door. Where wiring must cross sharp metal edges, protection in the form of grommets or equivalent devices shall be provided.
11. Thermostatic control shall be provided for each cabinet, console and terminal equipped with a cooling fan. All fans shall be shaded pole type with fuses and guarded blades. Motor units shall be provided with permanently lubricated bearings for continuous duty and overload protection devices. Replaceable filters shall be provided for all fan vents. These filters shall be removable from outside the cabinet, console and terminal.
12. Nameplates shall be provided for each cabinet, console and terminal. Nameplates for indoor-mounted equipment shall be three-ply laminate, black face, and white core. Outdoor-mounted equipment shall be provided with an engraved metal nameplate.
  1. Where practical, nameplates shall be attached to equipment with two self-tapping stainless steel screws in holes drilled in the equipment.
  2. Where installation of screws is not practical, such as for small nameplates or where equipment cannot be drilled, a permanent adhesive shall be used. The Contractor shall prepare the surface according to the adhesive manufacturer's recommendations.

13. Each cabinet, console and terminal shall be provided with at least one polarized duplex receptacle to facilitate maintenance. Receptacles shall be connected to a separate terminal block with a disconnect switch for the 120 V ac supply. Connect the outlet to a non-UPS circuit.

C. Surge Protection

1. All CCAS power lines shall be equipped with surge protection provisions in accordance with ANSI C62.41, "Guide for Surge Voltage in Low Voltage AC Power Circuits," and UL 1449, "Standard for Safety Transient Voltage Surge Suppressors," as applicable.
2. All data communications lines and sensor inputs shall be equipped with surge protection provisions in accordance with IEEE Transaction Volume COM-21, "Lightning Surges in Open Wire, Coaxial and Paired Cables," as applicable.
3. All protection devices shall be self-restoring and non-destructing and online at all times. Protection devices shall respond within 1 nanosecond on data circuits and within 5 nanoseconds on power circuits.

D. Electromagnetic Interferences

1. Noise suppression shall be provided as required for total system immunity from internally and externally generated sources of electromagnetic and RF interference including that from portable two-way radios. Noise suppression provisions shall comply with ANSI C63.12, "Recommended Practice on Procedures for Control of System Electromagnetic Compatibility," as applicable.
2. All CCAS equipment shall comply with the standards for electromagnetic interference in FCC Rules and Regulations, Part 15, Subpart J, "Class A Computing Devices," as applicable.

E. Fabrication

1. All metalwork shall be free of sharp edges, burrs, and other imperfections.
2. The interior and exterior surfaces of all enclosures shall be thoroughly cleaned so that the surfaces are free of all rust, mill, scale, oil, and foreign matter. All nonpermanent marks and coatings shall be removed.

## 2.2 CONSOLES AND EQUIPMENT

A. Operator Consoles and Terminals

1. General.
  - a. All console / terminal equipment shall be as indicated on the drawings. VDTs, GDTs and CCTV monitors shall be located to minimize distortion from angular line-of-sight and glare due to reflected light. PIDS equipment shall be mounted in a manner to facilitate the badge generation process.
  - b. Console / terminal control switches, pushbuttons, indicating lights and nameplates shall be provided on insert modules suitable for rack mounting. These modules shall be located to facilitate visibility and operability. Front mounted modules shall be held in place with tamper-resistant screws that require a special tool for removal. Indicating lights shall be selected to provide long bulb life and ease of bulb replacement. Lamp test capabilities shall be provided. All switches shall be selected and installed to provide protection against contamination that may block operation of the switches or contacts.
  - c. Front cover panels shall be provided for console terminal modules reserved for existing radio and other equipment. The required cutouts

in these panels shall be provided to incorporate the equipment neatly and to give the appearance of a single integral unit.

- d. The consoles / terminals shall have provisions at both ends for terminating printer power and signal wiring. Pre-fabricated cables (10 feet each, minimum) with connectors at both ends shall be provided for the printers.
- e. Console / terminal cooling provisions shall be sized to accommodate existing radio and other equipment to be integrated into the console terminal layouts.

## 2.3 MANUFACTURERS

### A. CCAS Software.

The integrated Security System software shall be manufactured by the following manufacturers. The specifications are based on products of multiple manufacturers, the products from the approved manufacturers with integrated or 3<sup>rd</sup> party software to achieve the functionality is acceptable. This shall not be construed to indicate that the approved manufacturers are not required to meet the specifications; however, it recognizes the fact that the approved manufacturers may use 3<sup>rd</sup> party software to provide specified performance. The specified performance must be met by the approved manufacturers.

- 1. Access Control.
  - a. Genetec Synergis.
  - b. AMAG Symmetry Enterprise.
  - c. Lenel OnGuard 2009 Enterprise.
  - d. Software House, CCURE 9000.
  - e. HIRSCH Velocity.
  - f. S2 Enterprise.
  - g. Or Approved Equal.
- 2. CCTV Storage & Analytics.
  - a. 3VR SmartRecorders.
  - b. iOmniscient.
  - c. Genetec Omnicast.
  - d. ONSSI NDVMS.
  - e. Intransa.
  - f. Pivot3.
  - g. or approved equal.

### B. CCAS Field Hardware as specification indicates Genetec. Equivalent products from approved equal manufacturer may be used.

- 1. Intelligent Field Panel (IFP) Vertx V1000.
- 2. Dual Reader Interface Module (DRM) Vertx V100.
- 3. Input Modules (ICM) Vertx V200.
- 4. Output Modules (OCM) Vertx V300.
- 5. Ancillary devices as required to provide a complete and operational system.

### C. CCAS Authentication Hardware

- 1. HID I-Class Readers.
- 2. L1-Identity Biometric Readers.
- 3. or approved equal.

### D. CCAS Credential Printers

- 1. The CCAS credential management module shall be compatible with printers and printer / encoders from Fargo, Eltron, Magicard and Nisca that support Windows 2000, 2003 and XP drivers.

- E. CCAS Third Party Integrated Devices
  - 1. The CCAS shall interface with third party devices and applications. The Third Part integration shall be accomplished by:
    - a. Direct Serial Interface.
    - b. Virtual Serial Interface (Lantronix controller).
    - c. TCP/IP (DLL, XML, etc).
    - d. Software Development Kit w/ Scripts shall be provided.
- F. Computer Work Stations:
  - 1. The computer work stations shall be as manufactured by Dell. HP or IBM using specified processor. However, all work stations shall be from the same manufacturer.

## 2.4 DATA PROCESSING SUBSYSTEM (DPS)

- A. General.
  - 1. The DPS shall integrate all access control, credential management, digital video management and functionality into a single database in a networked environment. The DPS shall allow the incorporation and integration of servers, access control client workstations, badging client workstations, digital video management client workstations, remote access level management client workstations and integrated client workstations sharing the same database on local area or wide area networks. The DPS shall allow future expansion to include additional client workstations without losing functionality.
  - 2. DPS administrative operations shall be available from any client workstation on the DPS that is configured and licensed to do so. System Administrator functions include the creation of maps, alarm response instructions, access levels, time zones, holidays, reports, area control, outputs and all required DPS configurations. System Administration operations shall include changes / configuration to the CCTV image comparison screen, cardholder window, employee capture, and cardholder look-up screen.
- B. Fault Tolerant CCAS Server
  - 1. The CCAS Fault Tolerant Server shall be a NEC Express 5800 320 Series server with Intel Xeon series processors. The Server shall be a self-contained fully redundant system (dual module / mirrored components) with on-line serviceability and hot-swappable replacement of all major subsystems including processors, power supplies, PCI bus and SCSI controllers. The server shall provide 99.999% system up time and include the following list of features / hardware:
    - a. NEC Express5800-320Fd-MR Rack mount with Redundant dual Xeon processors, 3.0GHz, 6MBx2 L2 cache.
    - b. Operating Temperature from 50 to 95 degrees F (10 to 35 degrees C) with relative humidity from 20% to 80% (no condensation)..
    - c. Redundant ECC DDR2 SDRAM memory (minimum of 1 GB per module.
    - d. Redundant dual channel Ultra 160 SCSI controllers. (minimum two drives per module, three drives maximum) utilizing 10K RPM Ultra SCSI Disk Drives RAID0/1 configured.
    - e. External 3.5" USB floppy drive, 3 PCI expansion slots, redundant integrated 10/100 and 1000 Ethernet NIC Copper cards, redundant integrated PCI video cards, redundant 24xCDROM drives, 2 serial

- ports, 2 USB ports, keyboard, mouse and surge suppression strip, USB to PS/2 Converter for KVM Connectivity.
  - f. Windows 2003 Server operating system software with 25 user licenses, ESM PRO system management software suite, Management Workstation Application software (MWA) for remote systems management, VERITAS Volume Manager software for storage management, RDR.
- C. CCAS Client Workstation for administrative, programmer, alarm monitoring, CCTV review and badging.
- 1. The CCAS Client Workstation(s) shall be 100% Windows / Intel Standard compatible, approved for use with Microsoft Windows latest version, and scaled according to the following system application requirements:
    - a. CCAS Client Workstation minimum requirements shall consist of a Dell PowerEdge 2950 or equivalent business class computer.
      - 1) See Plans.
- D. Badging System Peripherals
- 1. Video Camera.
    - a. The video camera to capture cardholders' photos shall be highly durable with a built-in auto-focus feature. It shall have an auto iris, an optical power zoom lens and be capable of USB connectivity.
    - b. CCTV Camera shall be Canon Powershot sx110 or equal.
  - 2. Card Printer.
    - a. The high definition printer shall be Fargo HDP 5000 or approved equal. Contractor shall develop the card design with the Owner and A/E and provide three different design samples to review prior to implementation and issuance of the cards.
    - b. Specifications:
      - 1) The printer(s) shall be capable of printing full-color images and text on the following card types: ABS, PVC, PET, PETG, matte-finish (clean) and rough finish (clean). The cards may include proximity, contact smart, contactless smart, magnetic stripe, and optical memory technology. The printer must meet the following requirements:
      - 2) Print Method - High Definition Printing Dye-Sublimation / Resin Thermal Transfer.
      - 3) Resolution - 300 dpi (11.8 dots/mm).
      - 4) Colors - Up to 16.7 million / 256 shades per pixel.
      - 5) Print Ribbon Options:
        - a) Provide to print on the specified contactless smart cards.
        - b) Full-color with two resin black panels, Yellow, Magenta, Cyan, 500 prints.
      - 6) High Definition Print Film Options:
        - a) Standard Holographic (500 prints).
      - 7) Overlamine Options:
        - a) PolyGuard Overlamine, .6 mil thick (250 prints).
        - b) All overlaminates, standard holographic design.
      - 8) Print Speed:
        - a) 38 seconds per card / 95 cards per hour in batch mode (YMC with transfer).

- b) 46 seconds per card / 78 cards per hour in batch mode (YMCK with transfer).
  - c) 70 seconds per card / 51 cards per hour in batch mode (YMCKK with transfer).
  - d) 50 seconds per card / 72 cards per hour in batch mode (YMCK/lamination).
  - e) 75 seconds per card / 48 cards per hour in batch mode (YMCKK/lamination).
- 9) Accepted Standard Card Sizes - CR-80 (3.370"L x 2.125"W / 85.6mmL x 54mmW).
- 10) Print Area - Over-the-edge on CR-80 cards.
- 11) Accepted Card Thickness.
  - a) Print only: .030" (30mil) to .070" (50mil) / .762mm to 1.778mm.
  - b) Print / Lamination: .030" (30mil) to .070" (50mil) / .762mm to 1.778mm.
- 12) Accepted Card Types - ABS, PVC, PET, PETG, proximity, smart and mag stripe cards, optical memory cards.
- 13) Input Hopper Card Capacity - 100 cards (.030" / .762mm).
- 14) Output Hopper Card Capacity - 200 cards (.030" / .762mm).
- 15) Card Cleaning - Replaceable cleaning roller.
- 16) Memory - 16MB RAM.
- 17) Display - User-friendly, SmartScreen LCD Control Panel.
- 18) Software Drivers - Windows® 2000/XP, Windows 2003 or Windows Vista.
- 19) Interface - USB 2.0 (High Speed) and Ethernet with internal print server.
- 20) Operating Temperature - 65° to 90° F / 18° to 32° C.
- 21) Humidity - 20-80% non-condensing.
- 22) Agency Listings:
  - a) Safety: UL 60950, CSA C2.2 No. 60950, CB report (EN 60950), CE mark.
  - b) EMC: FCC Part 15 Class A, EN 55022; 1998 Class A, CRC c1374, EN 61000-3-2: 2000, EN 61000-3-2: 1995, EN 55024; 1998, CE mark, and CCC mark.
- 23) Supply Voltage - 100-240 VAC at 50 Hz / 60 Hz, 3.8A.
- 24) Warranty:
  - a) Printer – 2 year; including 1 year On-Call Express.
  - b) Print head – Lifetime; unlimited pass with Fargo Certified Cards.
- 25) Certified Supplies - Card Printer / Encoders require highly specialized media to function properly. To maximize printed card quality and durability, print head life and printer / encoder reliability, use only Certified Supplies. Warranties are void, where not prohibited by law, when non-Certified Supplies are used.
- 26) Required Options:
  - a) Printer Cleaning Kit.
  - b) Door and cartridge locks.
  - c) Card Lamination Module - dual-sided (simultaneous).
  - d) Dual-sided printing.
  - e) Contactless Smart Card Encoder (HID iCLASS and MIFARE).

## E. Report printer

1. The report printer shall be a Laser network printer of latest design.
2. Specifications:
  - a. Memory: 16 MB of RAM.
  - b. Print Specs:
    - 1) Speed (pages per minute): 19.
    - 2) Resolution: 1200 x 1200 dpi.
    - 3) Language: HP PCL 5e and 6; printer language (emulates Adobe PostScript<sup>7</sup> level 2).
    - 4) Fonts: 45 scalable fonts plus 35 postscript fonts built-in.
  - c. Paper Handling:
    - 1) Main input tray capacity: 250-sheet regular weight 20 lb (75 g/m<sup>2</sup>) paper or up to 30 envelopes.
    - 2) Priority input tray capacity: 10-sheet 20 lb (75 g/m<sup>2</sup>) paper or 1 envelope.
    - 3) Output bin capacity: 125-sheet 20 lb (75 g/m<sup>2</sup>) paper or cardstock 16 to 28 lb (60 to 105 g/m<sup>2</sup>) Straight through paper path handles media 16 to 43 lb (60 to 163 g/m<sup>2</sup>).
  - d. Paper size:
    - 1) Letter 8.5 x 11 and Legal 8.5 x 14 in (215 x 356 mm).
  - e. Connectivity: IEEE-1284 compliant bi-directional parallel port and 2.0 compliant USB port; HP Jetdirect 175x print server/ Internet connector; 10/100Base-T Ethernet, Microsoft TCP/IP & IPX/SPX, and LocalTalk protocols.
  - f. Environmental Ranges:
    - 1) Operating temperature: 50 to 90.5° F (10 to 32.5° C).
    - 2) Operating humidity: 20 to 80% RH non-condensing.
    - 3) Storage temperature: 32 to 104° F (0 to 40° C).
    - 4) Storage humidity: 10 to 80% RH non-condensing.
  - g. Supported OS: Microsoft Windows latest version, Apple Macintosh latest version.
  - h. Acoustics:
    - 1) Sound power: LwAd = 6.1 Bels (A) printing, LwAd = 6.5 Bels (A) copying (HP LaserJet 1220).
    - 2) Acoustics are inaudible during powersave mode.
    - 3) Tests per ISO 9296.
  - i. Power Requirements:
    - 1) Source: 110 to 120 v (∇ 10%)/127v (∇ 10%)/220 to 240 v (∇ 10%).
    - 2) Frequency: 50 to 60 Hz (∇ 2Hz)/60 Hz NOM/50 to 60 Hz (∇ 3Hz).
  - j. Dimensions: (w x d x h) 16.3 x 19.2 x 10.0 in (415 x 487 x 252 mm).
  - k. Weight (with cartridge): 18.3 lb (8.3 kg).
  - l. Printer shall be HP LaserJet 1035n or approved equal.

## F. Modem

1. The CCAS modem shall be available for remote diagnostics, downloading of upgrades, dial-in capabilities, and remote communications. The modem shall be plug and play and support the Windows 2000 Operating System. All system servers must include a modem.
2. The modem shall have the minimum specifications:
  - a. Data Transmission: 56 Kbps.

- b. Universal Compatibility: Yes.
- c. Error Control: V.42/MNP 2-4 error control.
- d. Data Compression: V.42 bis/MNP5 data compression.
- e. Approvals: FCC Approved (Part 15 Class B/Part 68), IC (Formerly DOC) Approved, UL Listed and CSA Approved.
- f. Warranty: five (5) year manufacturer's standard warranty.

G. Backup System

- 1. The system server shall utilize a network backup system for system backups and archiving capabilities. The network backup system must support the Windows 2000/2003 Operating System.
- 2. Scheduled / Unattended Backups: Allows System Administrators to perform backups at pre-determined times. Intervals shall be in hourly, daily, weekly, and monthly intervals.
- 3. Network Backup Storage shall be at minimum same size as CCAS server array.
- 4. Storage shall be connected to network in different location than CCAS servers.

## 2.5 ACCESS CONTROL FIELD HARDWARE DEVICES

A. General

- 1. The system shall be equipped with the access control field hardware required to receive alarms and administer all access granted / denied decisions. All field hardware must be designed to meet UL 294 and ULC requirements. Depending upon the configuration, the system field hardware must be able to include any or all of the following components:
  - a. Intelligent Field Panels (IFP).
  - b. Input Control Module (ICM).
  - c. Output Control Module (OCM).
  - d. Dual Reader Interface Module (DRI).
  - e. Proximity Card Readers.
  - f. Panel Power Supplies.

B. Intelligent Field Panel (IFP)

- 1. The Intelligent Field Panel (IFP) shall link the CCAS Software to all downstream field hardware components (RIMs, ICMs and IOMs). The IFP shall provide full distributed processing of access control / Alarm Monitoring rules and operations. A fully loaded and configured IFP with shall respond in less than one-half (0.5) second to grant or deny access to cardholder.
- 2. The IFP shall continue to function normally (stand-alone) in the event that it loses communication with the CCAS software. While in this off-line state, the IFP shall make access granted / denied decisions and maintain a log of the events that have occurred. Events shall be stored in local memory, and then uploaded automatically to the CCAS database after communication has been restored.
- 3. In addition, the IFP shall incorporate the following features:
  - a. UL 294, ULC, and CE Certified.
  - b. Support for Host Communications Speed of 38,400 bps.
  - c. Support for Direct Connect, Remote Dial Up, or Local Area Network (LAN) Connection.



- d. Support for Dual Path Host Communications - Secondary Path shall be Local Area Network (LAN) Connection, or Remote Dial Up Connection via Lantronix Ethernet controller.
- e. Support for up to 32 MB of On-Board Memory, min 6MB.
- f. LAN Support shall utilize RJ45 (10/100baseT) Ethernet Interface.
- g. Flash Memory for real time program updates and overall host communications.
- h. Support for four 2 wire downstream ports, two 4 wire downstream ports, or combination one 4 wire downstream port and two 2 wire downstream ports. Downstream ports shall be for connecting card readers and data gathering and output control panels via RS-485 multi-drop wiring configuration.
- i. Memory storage of up to 250,000 card holders and 65,000 transactions.
- j. Initial base memory download between IFP with standard memory from the CCAS shall require no more than ten (10) seconds.
- k. Support for up to 32 devices consisting of RIMs, ICMs, and OCMs in any combination desired with a maximum of 16 I/OCM devices.
- l. Support of multiple card technologies.
- m. Supervised Communications between IFP and CCAS Software.
- n. AES 128 bit Symmetrical Block Encryption conforming to the FIPS-197 standard between IFP and CCAS Software communications driver.
- o. Multi drop support for up to eight IFPs per CCAS communications port.
- p. Support of up to eight card formats and facility codes.
- q. Support for SEIWG card formats.
- r. RS-485 Full Duplex, UL 1076 Grade AA communication channel to the CCAS head-end.
- s. Integration to other manufacturer's card readers.
- t. Uninterruptible Power Supply (UPS) with battery backup.
- u. 32-bit Microprocessor.
- v. Biometric Interface Support.
- w. An IFP downstream serial port shall multi-drop 16 access control field hardware devices using an RS-485 UL 1076 Grade A communication format allowing a distance of 4,000 feet using Belden 9842 cable or equivalent.
- x. 12 VDC input power.
- y. Issue Code Support for both Magnetic and Wiegand Card Formats.
- z. Individual Shunt Times (ADA Requirement).
- aa. Up to four Digit PIN Codes.
- bb. Downstream serial RS-232 device support.
- cc. Status LEDs for normal component and communication status.
- dd. RoHS Compliance.

C. Input Control Module (ICM)

- 1. The Input Control Module shall provide 16 UL 1076 Grade A or AA alarm input zones and monitor / report line fault conditions, alarm conditions, power faults and tampers. Status LEDs shall provide information about the sixteen alarm zone inputs, cabinet tamper, and power fault.
- 2. In addition, the ICM shall incorporate the following features:
  - a. UL 294, ULC, and CE Certified.

- b. Alarm contact status scanning at up to 180 times per second for each zone.
  - c. Eight configuration DIP switches to assign unit addresses and communications speed.
  - d. Elevator control support for 64 floors.
  - e. Variable resistor values for line supervision.
  - f. A low power CMOS microprocessor.
  - g. Filtered data for noise rejection to prevent false alarms.
  - h. Up to 16 Grade A, or AA Supervised Inputs in any combination.
  - i. 12 VDC Input Power.
  - j. 2 Form C 2A, 30 VDC Contacts for load switching.
  - k. 2 dedicated inputs for tamper and power status.
  - l. RoHS Compliance.
- D. Output Control Module (OCM)
- 1. The Output Control Modules shall provide 12 Form-C 2A 30 VDC relay contacts for load switching. The relays shall be configurable for fail-safe or fail-secure operation. Each relay shall support "On" "Off" and "Pulse"
    - a. 12 VDC input power.
    - b. Two dedicated digital inputs for tamper and power failure status.
    - c. RS-485 communications, multi-dropped (2-wire or 4-wire RS-485).
    - d. Up to 16 OCMs per Intelligent System Controller.
    - e. Onboard termination jumpers.
    - f. DIP switch selectable addressing.
    - g. Status LEDs for communication to the host, heartbeat and relay status.
    - h. Elevator control, support for 64 floors.
    - i. RoHS Compliance.
- E. Dual Reader Interface Module (DRI)
- 1. The DRI shall provide a dual interface between the IFP and authentication devices. The DRI must operate with any authentication device that produces a standard Wiegand (Data 1 / Data 0 or Clock and Data) communication output.
  - 2. In addition the DRI shall incorporate the following features:
    - a. 12 VDC power supply.
    - b. Reader communications (Clock / Data or Wiegand Data1 / Data0) - more than 150 different readers approved for use.
    - c. 4 Form-C 2A at 30 VDC relay outputs.
    - d. Up to 16 different formats (8 card and 8 asset).
    - e. Issue code support for Magnetic and Wiegand formats.
    - f. Door contact supervision (Open / Closed).
    - g. REX push-button monitor.
    - h. Strike Control output.
    - i. Bi-color status LED support and 2-wire LED support.
    - j. Beeper control.
    - k. Dedicated tamper and power failure circuits.
    - l. Support for offline reader access mode.
    - m. Onboard jumpers for termination.
    - n. Elevator control, native support for 6 floors.
    - o. DIP switch selectable addressing.
    - p. UL 294 listed and CE approved.
    - q. RoHS Compliance.

F. Card Readers

1. All readers shall be configured with the card reader and reader interface module mounted separately. The reader interface module shall be mounted in the EIB located on the secure side of the door.
2. Smart Access Control Reader with Keypad: Provide *iCLASS*, contactless smart card reader or equivalent where shown on the drawings. Card reader shall be "single-package" type, combining controller, electronics and antenna in 1 package, in the following configurations:
  - a. RK40 - Card Reader, Wall Mounting (Single-Gang Mounting Applications):
    - 1) Provide "single-gang" mounting style contactless smart card reader for wall mounting, Vehicle Stanchions and Pedestals, and where shown on plans.
    - 2) The reader shall be of potted, polycarbonate material, sealed to a NEMA rating of 4X (IP65).
    - 3) The reader shall contain an integral magnet for use with an external magnetic reed switch to provide tamper protection when connected to an external alarm system. Provide external magnet reed switch and tamper indication.
    - 4) The reader shall be UL/C 294 listed, and shall be FCC and CE certified, and shall conform to the following ISO Standards: 15693, 14443A (CSN read-only), 14443B1 (read-only), and 14443B2.
    - 5) Transmit Frequency: 13.56 MHz6) The reader shall have an approximate read range of 1 inch to 4.5 inches when used with the compatible access card.
    - 7) The reader shall require that a card, once read, must be removed from the RF field for 1 second before it will be read again, to prevent multiple reads from a single card presentation and anti-passback errors.
    - 8) The reader shall be capable of reading access control data from any *iCLASS* contactless smart card or equivalent, and transmitting that data in SIA standard Wiegand format.
    - 9) The reader shall be capable of reading the CSN (card serial number B a permanent, unique identification number) from any MIFARE<sup>®</sup> card using the S50 chip or equivalent, and transmitting that data in SIA standard Wiegand format.
    - 10) The reader shall be capable of writing to the compatible access card in compliance with ISO 15693 or 14443B2.
    - 11) The reader shall provide 1 Wiegand port, for connection to standard access control panels.
    - 12) The reader shall provide Internal Control for Read-only Access Control applications, transmitting Wiegand Data.
    - 13) The reader shall have separate terminal control points for the green and red LEDs, and for the audible indicator.
    - 14) The reader shall have multiple LEDs for increased visibility
    - 15) The reader shall have a 12-position keypad, with metal keycaps, and backlit numbers located above each key.
    - 16) The reader keypad shall be rugged, waterproof and backlit, and impervious to liquid spills, dirt, and water spray from any direction.
    - 17) The reader shall be configurable so that keypad data may be

- sent as individual keystrokes or buffered and formatted in a card data format, as required by the Host System.
- 18) The reader shall allow users to enter a PIN code as a primary, secondary or alternate means of identification, based on configuration of the Host System.
  - 19) The reader shall optionally be configurable to verify the user's PIN entry locally, based on a comparison with PIN data stored on the user's card, transmitting Wiegand data to the host only if the PIN code is valid.
  - 20) The reader keypad shall have keys of sufficient size and with sufficient separation such that users wearing gloves can easily press the individual keys.
  - 21) The reader keypad shall work in conjunction with the audio transducer, such that each keypress shall produce a click or beep signifying that the keypress was received by the microprocessor.
  - 22) The reader keypad should have definite tactile "snap" when depressed, giving the user confirmation that the key was pressed correctly.
  - 23) The reader shall have an audio transducer capable of producing unique tone sequences for various status conditions.
  - 24) The reader shall have a configurable hold input, which when asserted shall either buffer a single card read or disable the reader, until the line is released. This input may be used for special applications or with loop detectors.
  - 25) Access control data shall be protected using 64-bit diversified security keys, encrypted RF data transmission, and mutual authentication using a proprietary symmetrical key-based algorithm.
  - 26) Security keys in the cards and readers shall be required to match, and may be customized for individual sites by using the *iCLASS* Card Programmer (or equivalent) or by special order from the factory.
  - 27) The reader shall have flash memory to allow future feature enhancements to be added in the field.
  - 28) The reader shall have a lifetime warranty against defects in materials and workmanship.
  - 29) Color shall be selected by the Architect: gray, black or white
  - 30) HID Model RK40, or equivalent, compatible with selected card media.
- b. Biometric Card Reader.
- 1) Reader shall use the combination of the fingerprint and *iCLASS* contactless smart card technology from HID. Both the fingerprint and *iCLASS* technology shall be designed to meet the needs of access control. The card reader shall be as manufactured by Bioscript or HID.
  - 2) Reader shall offer a RS-232, RS-485 and Weigand connection.
  - 3) Using the ISO 7816 protocol, the standard for contact smart card applications, the RWKLB575 allow connection to a PC or microcontroller to support read/write applications. Provide RS-232 to USB converter.
  - 4) Keypad: Offers twelve discrete switches with metal keycaps. Raised

tactile mark on "5" key for visually impaired users. Configurable audio feedback. Backlit numbers in bezel overlay, above each key. Lighting is configurable: "Always On", "Always Off", "Triggered by Card Read", or "Triggered by Key Press".

- 5) User Function Keys: Four programmable user function keys with metal keycaps. User function keys are available with factory default settings or can be customized. In either case, user function keys are easily defined in the graphical LCD display.
- 6) Security: 64 bit authentication keys are extremely secure. Readers and cards require matching keys to function. All RF data transmission between the card and keypad reader is encrypted, using a secure algorithm. The key management system reduces the risk of compromised or duplicated cards.
- 7) Cards and keypad readers with site-specific keys shall be provided from the factory.
- 8) Audiovisual Indication: Audio transducer provides configurable tone sequences to signify access granted, access denied, power up, and configuration card read. A light bar provides a clear visual status indication in red, green, or amber. All units contain an LED to light the sensor area if the biometric option is included.
- 9) Graphical Display: The backlit graphical LCD display offers a 60 x 18 mm viewing area, 120 x 32 resolution. It is factory preset to provide written instructions to the user. Fully customizable, the display also describes the function of the user function keys.
- 10) Indoor Design: Rugged, weatherized polycarbonate enclosure provides reliable performance and resistance to vandalism. Permanent magnet built into housing facilitates tamper alarm when used with a magnetic reed switch.
- 11) Enrollment: Enrollment software and a reader unit shall be provided to write the biometric template to the cards. The template never enters the PC – it is collected by the reader and written to the *iCLASS* card all in one simple process. To alleviate privacy and database management concerns, the biometric template is stored on the *iCLASS* card rather than in the unit.
- 12) *iCLASS* Credential Compatibility: The reader shall be compatible with all *iCLASS* credentials. The units shall read or read/write to credentials compatible with several ISO standards including:
  - a) 15693 - read/write; 2kbits (256Bytes) and 16kbits (2kBytes) *iCLASS* credentials.
  - b) 14443A - read only; MIFARE® Standard (serial number), Ultralight, or DESFire™.
  - c) 14443B2 – read / write; 16kbits (2kBytes) *iCLASS* credentials.
- 13) Reader shall be HID Model RWKLB575 with high security key management and programmable LED / Beeper / LCD key operation or approved equal.

- G. Field Hardware Power Supplies: Power Supplies for field hardware shall be designed specifically for the equipment installed. These power supplies shall be regulated, isolated versions for the IFP, ICM, Card Readers and other equipment. Each shall be available in UPS with battery back-up. All power supplies shall be housed in locked enclosures that also allow mounting space for the IFP, ICM, DRI or other device / panel required.

- H. Audible Annunciators
  - 1. The audible annunciators and associated volume and reset controls shall be rack-mounted.
  - 2. The audible annunciators shall not conflict with other audible signals at the SCC.
  - 3. Each audible annunciator shall provide a maximum sound output of at least 60 dbA at 1 foot.
- I. Local Audible Annunciators
  - 1. Local audible annunciators shall be self-contained units of rugged, vandal-resistant construction.
  - 2. Each annunciator shall incorporate the following features, as a minimum:
    - a. Audible alarm.
    - b. Visual indicator with a solid-state flasher.
    - c. Solid-state power supply.
    - d. Contacts for remote reset.
    - e. Operates on low voltage dc.
  - 3. The audible alarm shall provide a sound output of at least 60 dbA at 1 foot.

## 2.6 SURVEILLANCE AND ASSESSMENT SUBSYSTEM (SAS)

- A. System Description: Video
  - 1. Provide a complete and operational IP-based Digital Video Management System (IPDVMS) as specified here and shown on the drawings.
  - 2. IPDVMS shall provide the following functions:
    - a. IPDVMS shall store video from video cameras. Provide access to video in real-time ("live"), and stored on computer-based storage devices for review at a later time.
    - b. Recorders and servers will consist of rack-mountable PCs connected to a LAN.
    - c. Video and other data managed by the IPDVMS accessible from workstation PCs connected directly to the LAN, WAN or modem connections.
    - d. Includes GUI software designed to run on PCs equipped with the Microsoft Windows latest operating system.
    - e. GUI application software functions include system setup, administration and monitoring; live video viewing and PTZ camera control; video playback; video export; alarm monitoring; and other capabilities as detailed in the following paragraphs.
    - f. Provide access and control cameras via wireless handheld devices.
  - 3. Compatibility with Digital Video Equipment: The IPDVMS shall be designed to work with a wide variety of IP Cameras. The recorders shall utilize a standard Ethernet connection for video input via TCP/IP.
  - 4. Scalability and Expandability:
    - a. Cameras: The IPDVMS family of products to include cost-effective solutions for any number of cameras including large sites with 1000 or more cameras in a single system.
    - b. Storage: The IPDVMS to support a wide range of automated storage options ranging from as little as a few hours of online storage capacity to months of long-term storage using digital tape or other cost-effective long-term storage media.

- c. Workstations: The IPDVMS shall be a distributed, multiuser, multitasking system capable of supporting simultaneous requests from multiple workstations.
- d. Sites: The IPDVMS shall be capable of supporting large organizations with systems at multiple sites connected via LAN, WAN or dial-up modem connections.

## 2.7 CONTROLLED ACCESS SUBSYSTEM (CAS)

- A. Card Reader Electronics Interface Box (EIB)
  - 1. Each card reader EIB shall consist of a tamper-resistant enclosure equipped with a tamper switch and a UL-approved cylinder lock (per UL 437, "Key Locks"). The card reader EIB shall normally be mounted on the secure side of each card reader-controlled access point. Mounting screws for surface mounting shall be provided inside the enclosure or, if exposed, shall be tamper-resistant requiring a special tool for removal. All EIB boxes shall be keyed alike.
  - 2. Card reader EIBs shall incorporate the required local power supply and battery backup unit equipment for operating the card reader(s), and the associated electrical locking device(s) at card reader controlled access points. A trouble signal shall be provided to indicate failure of any portion of this power supply equipment.
  - 3. Each card reader EIB shall be capable of supplying power to a minimum of 2 card reader controlled access points. Power cabling from the card reader EIB to the card reader shall be a maximum of 50 feet.
- B. Exit Pushbutton
  - 1. Each exit pushbutton shall consist of a momentary switch within an enclosure. Mounting screws for surface mounting shall be provided inside the enclosure or, if exposed, shall be tamper-resistant requiring a special tool for removal.
  - 2. Each switch shall provide 1 set of normally open and normally closed contacts. The switches shall be rated for a minimum of 1,000,000 activations without malfunction.
  - 3. The exit pushbuttons shall be provided with a 1-1/2 inch mushroom button.
- C. Panic Hardware (Push Bars) - Refer to access point schedule for scope of work in the terminal contract.
  - 1. Push bars shall be external surface-mounted rim devices, UL-listed for accident hazard installations.
  - 2. Each push bar shall incorporate the following features, as a minimum:
    - a. Nonhanded.
    - b. Field sizeable.
    - c. Both time delay exit and lock/unlock operation
  - 3. Each push bar shall be provided with a surface-mounted rim strike with a signal switch. The signal switch shall be a normally open momentary switch rated for a minimum of 1,000,000 activations without malfunction.
  - 4. The device finish shall match existing door hardware.
- D. Signage - Refer to access point schedule for scope of work in the terminal contract.
  - 1. Signage shall be provided as indicated on the drawings at selected access points to provide information for the users.

2. Signs shall be black acrylic plastic with graphics silk-screen applied to the back side of the sign. Lettering shall be white Helvetica medium. Signs shall be square, with rounded corners and white border line. Provide samples of the signs for approval.
3. The signs shall be applied with adhesive tape to the door or to metal plates which are mechanically attached on the wall adjacent to the door at a height of 5 feet, 7 inches as follows:
  - a. Wood screws for anchoring to wood.
  - b. Toggle bolts for anchoring to hollow masonry or gypsum board.
  - c. Expansion shields and lag bolts for anchoring to concrete or solid masonry.

E. Gate Control Panels

1. Each gate control panel shall consist of a tamper-resistant weatherproof NEMA 4X (stainless steel) enclosure equipped with a tamper switch and a UL-approved cylinder lock (per UL 4379 "Key Locks") or padlock. The gate control panel shall normally be mounted on the secure side of the card reader-controlled vehicle gate. Mounting screws for surface mounting shall be provided inside the enclosure or, if exposed, shall be tamper-resistant requiring a special tool for removal.
2. The gate control panel shall incorporate the required local power supply and battery backup equipment for operating the card reader(s), PINpad(s), and gate operator at card reader-controlled vehicle gates. A trouble signal shall be provided to indicate failure of any portion of this power supply equipment.
3. The gate control panel shall be provided with a heating element to assure continued gate operation during severe cold temperatures.
4. A concrete foundation shall be provided for the gate control panel.

## 2.8 INTRUSION DETECTION SUBSYSTEM (IDS)

A. Balanced Magnetic Switches

1. Balanced magnetic switches will be designed for intrusion detection in security applications.
2. Each balanced magnetic switch will consist of two (2) cast nonferrous metal enclosures. Mounting screws for surface mounting will be provided inside the enclosure or, if exposed, will be tamper resistant requiring a special tool for removal. Each magnet will be 778ALNICO V or better.
  - a. The switch enclosure will be mounted on the door frame or other non-movable surface. Each switch enclosure will contain a reed switch, an adjustable bias magnet, a tamper switch, and one (1) set of normally open and normally closed contacts. (Note: In lieu of a tamper switch, the enclosure may be encased in epoxy.) Arc protection will be provided to prevent the reed switch from being fused together by transient current conditions. Each switch will be rated for a minimum of 1,000,000 activations without malfunction. The switch enclosure will be provided with a 1/2-inch threaded conduit connector at one end.
  - b. The magnet enclosure will be mounted on the door or other movable surface, so that when the door is closed, the magnet will be within 1 inch of the reed switch.
3. Balanced magnetic switches will comply with the applicable requirements of UL 634, Connectors and Switches for Use with Burglar-Alarm Systems and UL 639, Intrusion Detection Units.



B. Gate Position Switches

1. Gate position switches shall be designed for wide gap (up to 3 inches) applications.
2. Each gate position switch shall consist of 2 cast nonferrous metal enclosures. Mounting screws for surface mounting will be provided inside the enclosure or, if exposed, shall be tamper resistant requiring a special tool for removal. Each magnet shall be ALNICO V or better.
  - a. The switch enclosure shall be mounted on the fence post or other non-movable surface. Each switch enclosure shall contain a reed switch, an adjustable bias magnet, a tamper switch, and 1 set of normally open and normally closed contacts. (Note: In lieu of a tamper switch, the enclosure may be encased in epoxy.) Arc protection shall be provided to prevent the reed switch from being fused together by transient current conditions. Each switch shall be rated for a minimum of 1,000,000 activations without malfunction. The switch enclosure shall be provided with a 1/2-inch threaded conduit connector at one end.
  - b. The magnet enclosure shall be mounted on the gate post or other movable surface, so that when the door is closed, the magnet shall be within 1 inch of the reed switch.
3. Gate position switches shall comply with the applicable requirements of UL 634, Connectors and Switches for Use with Burglar-Alarm Systems and UL 639, Intrusion Detection Units.

C. Tamper Switches

1. Each tamper switch shall consist of a single-pole, double-throw momentary switch rated for 5 amps at 120 volts. Each switch shall be rated for a minimum of 1,000,000 activations without malfunction.
2. Tamper switches shall comply with the applicable requirements of UL 634, Connectors and Switches for Use with Burglar-Alarm Systems and UL 639, Intrusion Detection Units.

D. End-of-line Termination Networks

1. End-of-line termination networks required to provide the proper impedance for supervision specified in Paragraph 1.09G.5 shall be provided on printed circuit cards. A terminal block shall be provided on each card for connection to the individual devices.

E. Duress Alarm Devices

1. Each duress alarm device shall consist of a momentary switch and a tamper-resistant enclosure.
2. The momentary switch shall be rated for 1,000,000 activations. The switch shall be provided with a latched output.
3. Mounting screws for surface mounting shall be provided inside the enclosure or, if exposed, shall be tamper-resistant requiring a special tool for removal.
4. The duress alarm devices shall be hand-actuated.

## 2.9 UNINTERRUPTIBLE POWER SUBSYSTEM (UPS)

A. Battery Backup Units for IFP, EIB and Gate Control Panels.

1. Each battery backup unit shall incorporate an inverter, battery charger, batteries and a sensing and transfer relay housed in a cabinet.

2. The battery backup unit inverters shall be the filtered rectangular waveform type with an efficiency of not less than 80 percent at 0.9 power factor, full load and rated output.
3. The battery chargers shall be solid-state and designed for taper charge operation.
4. Batteries shall be completely sealed and ready for service. The batteries shall be capable of accommodating a minimum of 500 full discharges / recharges.
5. The sensing and transfer relays shall monitor the ac input and initiate a transfer to the battery supply upon failure or low voltage. Transfer shall be automatic and shall be completed within 20 milliseconds. The sensing and transfer relays shall continue to monitor battery voltage and shall disconnect the load if the voltage drops below 85 percent of its rated output.
6. Front panel indication of critical status information shall be provided with contacts for remote monitoring via the DPS. A local audible signal shall be provided for off-normal conditions.

## 2.10 ID BADGE / KEYCARDS

- A. ID badge / keycards shall have provisions to incorporate a badge insert on the front side and the following information on the back side (preprinted):
  1. Guaranteed postage and mailing address for lost devices.
  2. Arrow or similar marking to indicate the proper orientation for presentation at a card reader.
  3. Notice: "THIS BADGE MUST BE WORN ON OUTER GARMENT WHEN IN AOA AND MUST BE RETURNED TO AIRPORT OPS WHEN EMPLOYMENT IS TERMINATED."
- B. ID badge / keycards shall be provided with removable pocket clips.
- C. ID badge / keycards shall be capable of incorporating a printed photograph of the user-without interfering with its operation.
- D. ID badge / keycards shall be resistant to wear and environmental deterioration to include breakage, cracking, delaminating or coding changes or losses from any of the following conditions.
  1. Minor impact.
  2. Temperature changes.
  3. Radial-type bend up to 90 degrees in either direction (end to end along the longest dimension of the card) for at least 50 bends.
- E. Access Cards (Credentials): Provide a quantity of 2000 *iCLASS* Contactless Smart Card Credentials (or equivalent) in the following form factor:
  1. Access Card:
    - a. Access cards shall be used with access readers to gain entry to access controlled portals (e.g.; doors, gates, turnstiles) and to hold information specific to the user.
    - b. The card shall be available in single technology or multiple technology configurations. Double technology cards shall meet the following criteria:
      - 1) The card shall meet the following standards for contactless smart cards: ISO 15693 and ISO 14443B2.

- 2) The card shall meet ISO 7810 specifications for length, width thickness, flatness, card construction and durability, and shall be in a form suitable for direct two sided dye-sublimation or thermal transfer printing on the specified badge printer.
- 3) Presentation to the access control reader at any angle within a minimum of one (1) inch shall result in an accurate reading of the card.
- 4) Unique 64-bit, fixed card serial number, used for anti-collision and key diversification.
- 5) The card shall support read / write capability, with a minimum of 16 Kbits [2048 bytes] of EEPROM memory. The 2 Kbit card shall have a minimum of 2 Application Areas, and the 16Kbit shall have either (specify) 2 or 16 Application Areas to support future applications. Data retention shall be ten (10) years, nominal. Wiegand card data up to 84 bits in length shall be factory programmed in Application Area 1 for use with access control systems.
- 6) Each Application Area on the card shall be secured with a 64-bit unique, diversified security key, such that data stored in that area cannot be accessed or modified until the card and reader have completed a mutual authentication process.
- 7) The card shall be capable of completing any write operation, even if the card is removed from the RF field during that operation.
- 8) The card shall be warranted against defects in materials and workmanship for two (2) years, or if multiple technologies are used: with a magnetic stripe the card shall have a fifteen (15) month warranty.
- 9) The card shall not carry any identification showing the location of the property unless otherwise specified herein.
- 10) The card shall be capable of accepting a slot punch on one end, allowing it to be hung from a strap / clip in a vertical orientation.
- 11) The card shall be PET/PVC composite.
- 12) The card shall support 13.56 MHz *iCLASS* contactless smart chip and antenna plus any or all of the following technologies, simultaneously:
  - a) 125 kHz HID Proximity chip and antenna.

F. Corporate 1000 Program

1. Cards shall be uniquely identified for the location using HID Corporate 1000 Program.

## 2.11 MISCELLANEOUS PROVISIONS

A. Physical Barriers

1. Wherever mechanical locks and keys (mortise locks, key-in-knob, etc.) and padlocks are required to provide access controls, the proposed locks may become part of the PIA Master-Keyed-System.
  - a. This system will employ high security locks, with keyblanks, key codes and keyways restricted by the manufacturer. Locks will be of the seven-pin tumbler type, combined for six pins. Locks will be furnished with interchangeable cores and pinned to the specifications

furnished by the PIA Administration. Each lock will be supplied with at least one spare (uncombined) interchangeable core. Keyblanks will be released by the manufacturer only upon written authorization of a predesignated PIA official. Keyblanks will be stamped "DO NOT DUPLICATE". No other markings will be acceptable.

- b. Each padlock will be furnished with one padlock chain, preattached to the lock shackle. The padlock chain will be no less than 2 feet in length, and no more than 4 feet in length. The unattached chain end will be equipped with a device to allow rapid attachment of padlock chain to chainlink fencing or other mounting surface as required. The padlock chain will be vinyl coated preformed aircraft cable.
- 2. Bollards shall be provided around field-installed equipment at Type 11 and Type 12 access points to preclude accidental damage from vehicles. These bollards shall consist of concrete-filled pipes appropriately anchored.

## 2.12 MAINTENANCE AIDS AND SPARE PARTS

### A. Nonstandard Test Equipment, Tools, Adaptors and Fittings

- 1. One set of all special or nonstandard test equipment, tools, adaptors and fittings required to install, maintain and service the CCAS shall be provided to include card extenders for each different type of printed circuit card in the system, tools for removing tamper resistant screws and a portable IFP analyzer.
- 2. The portable analyzer unit shall be able to test the IFPs in either an on-line or off-line mode. This unit shall be capable of exercising all devices connected to the IFP and all functions of the IFP itself.
- 3. All test equipment and tools provided shall be new, unused, of first-class quality and of suitable material.
- 4. All test equipment and special tools furnished shall be provided with complete operating instructions.

### B. Spare Parts

- 1. Provide spare parts in the amount of 10% of all hardware furnished on the project. The spare parts shall include, but not be limited to, mag locks, card readers, power supplies, balance magnetic contacts, REX switches, tamper switches and other similar components.
- 2. Provide at least one quantity when 10% results in a quantity of less than one.
- 3. Provide two IFP panels completely equipped to support six card readers.
- 4. Provide two IFP hardware components located in the gate control terminal cabinets.
- 5. Provide two network switches located in GCTC cabinet.

## 2.13 SOFTWARE REQUIREMENTS

### A. General

- 1. The CCAS software shall perform all processor-related functions at PIA necessary to satisfy the security requirements defined in FAR 1542. This software shall support all functions required for system operations, system software debugging and I/O handling.
- 2. Source code for application programs shall be in a high level language.
- 3. The CCAS shall be supplied with 2 complete sets of software and firmware (running and backup), compiled after the completion of the Field Verification Test, to include, as a minimum:

- a. Executive programs and operating system.
  - b. Utility programs.
  - c. Software debugging and on-line / off-line diagnostic and test routines.
  - d. On-line / off-line hardware diagnostics.
  - e. I/O drivers.
  - f. Application programs.
  - g. Software spooling to I/O devices.
  - h. Macro-assembler.
  - i. On-line high level language compiler.
  - j. Run-time library for the high level language supplied.
  - k. Relocatable loader.
  - l. Full-screen text editor.
  - m. Database manager with report generator.
- 4. The Contractor shall be responsible for all required software licenses.
  - 5. The Contractor shall not make any modifications to the standard software package provided by the central processor supplier that would in any way preclude the purchase of a standard maintenance and service contract directly from the supplier.
  - 6. Provisions for system regeneration, reprogramming and background processing using either central processor and other supplied equipment shall be provided. These activities shall not interfere with the real-time functions of the CCAS or the automatic switchover provision. The program development provisions supplied shall allow operators to utilize a high level language that has efficient access to all information included in the system databases. High level reprogramming capability shall include provisions to modify existing display / printout / log formats and to generate new displays / printouts / logs.
  - 7. All utilities and command files required to compile, link and execute the application programs shall be provided. Application program source code shall be loaded, compiled and linked at the job site at the start of the Field Verification Test.
  - 8. All firmware changes to E-PROMS resulting from the Field Verification Test shall be incorporated into all like devices and fully documented.
- B. CCAS Software Capabilities
- 1. The CCAS Software shall support an unlimited number of card readers, input points, video cameras, intrusion detection points, and relay outputs. The CCAS database server shall support an unlimited number of cardholders, visitors, and assets limited only by the available memory on the IFP. The database server shall also support an unlimited number of system events and System Operator transactions in the history file limited only by available hard disk space. Client Workstations shall be limited only by the limitations of the operating system server software.
- C. CCAS Software Functionality
- 1. Time Zones.
    - a. The CCAS shall be capable of creating and storing up to two hundred fifty four (254) time zones. Each time zone shall have a minimum of six (6) intervals. Each interval shall be assignable to any day of the week.
    - b. Each time zone shall be assignable to an alphanumeric name of up to 40 characters. Time zones shall be applied to access levels, card reader modes, alarm inputs, alarm outputs, and alarm masking and

logging functions. Time zones shall be allowed to belong to any or all access levels so that the time zone only has to be defined once.

2. Access Levels.
  - a. The CCAS shall be capable of defining a minimum of 32,000 access levels with a minimum of 32 access levels per cardholder per database segment (see Section 2.04.8 Database Segmentation). Access Levels shall consist of a combination of card readers and time zones.
  - b. Each Access Level shall be assignable to an alphanumeric name using up to 40 characters.
  - c. Card readers shall have the ability to be assigned to any or all access levels defined in the CCAS. Individual card readers shall be capable of having a distinct time zone assigned to it.
  - d. The CCAS shall allow an "Allow User Commands" option to be assigned on a per access level basis where keypad readers are in use.
3. Temporary Access Levels.
  - a. The CCAS shall be capable of assigning Temporary Access Levels inclusive of the 32,000 assignable Access Levels.
  - b. Each Temporary Access Level shall be assignable to an alphanumeric name using up to 40 characters.
  - c. Each Temporary Access Level shall be definable with a start and end date.
  - d. Temporary Access Levels shall be stored in the IFP and functionality shall be maintained in the event of disconnection with the IFP.
4. Access Groups.
  - a. The CCAS shall be capable of assigning Access Groups with a maximum of 32 Access Levels per Access Group.
  - b. Each Access Group shall be assignable to an alphanumeric name using up to 40 characters.
5. Precision Access Levels.
  - a. The CCAS shall be capable of assigning Precision Access Levels in addition to the 32,000 Access Levels with the ability to assign unlimited card reader and time zone combinations.
  - b. Each Precision Access Level shall be assignable to an alphanumeric name using up to 64 characters.
6. Holidays.
  - a. The CCAS shall provide a minimum of 255 Holiday assignments using an embedded calendar. Holidays shall be assigned an alphanumeric name using up to 40 characters and shall be grouped into eight (8) types of holidays, and shall be assignable to individual time zones. Access rights, card reader modes, and alarm masking schedules must be able to be altered when the current date is designated a Holiday.
  - b. Dates for Daylight Savings Time changes shall be definable and shall take effect automatically.
  - c. The CCAS shall support Holiday Ranges that allow a single holiday to span across multiple calendar days.
7. Database Segmentation.
  - a. The CCAS shall be required to support data segmentation whereby each segment shall have its own set of cardholders, field hardware and system parameters (time zones, access levels etc.). This segmentation shall expand the limitations of the CCAS parameters

(i.e. access levels and time zones) to the maximum capacity of each parameter multiplied by the number of segments. The following list shall be made available for segmentation:

- 1) Access Group.
  - 2) Access Levels.
  - 3) Actions.
  - 4) Action Groups.
  - 5) Alarm Inputs.
  - 6) Alarm Mask Groups.
  - 7) Alarm Outputs.
  - 8) Areas.
  - 9) Badge Types.
  - 10) Card Formats.
  - 11) Cardholders.
  - 12) Card Readers.
  - 13) Central Station Receivers.
  - 14) Device Groups.
  - 15) Digital Video Archive Servers.
  - 16) Fire Alarm Panels.
  - 17) Guard Tours.
  - 18) Global I/O Function Lists.
  - 19) Global I/O Links.
  - 20) Holidays.
  - 21) Intercom Panels.
  - 22) Intercom Stations.
  - 23) Intrusion Detection Panels.
  - 24) IFPs.
  - 25) Maps.
  - 26) Monitor Zones.
  - 27) Precision Access Groups.
  - 28) Receiver Accounts.
  - 29) System Operators.
  - 30) Time Zones.
  - 31) Tour Groups.
  - 32) Visitors.
  - 33) User Permission Groups.
9. Field Hardware Communications.
- a. The CCAS shall communicate with the IFPs by the following protocols:
    - 1) RS-232.
    - 2) RS-485.
    - 3) TCP/IP.
    - 4) Dial-up via Modem.
  - b. Communication baud rate shall be system selectable with a range between 9,600 to 38,400 bits per second.
  - c. Download communication between the CCAS and the IFP shall be fully multi-tasking and shall not interfere with operational functions.
  - d. Upon loss of communications between the CCAS Server and the IFP an alarm shall be created with a time stamp. Upon re-established communication the CCAS and the IFP shall automatically re-synchronize from the point of communication loss without operator intervention.
10. Dual Path Field Hardware Communication.

- a. The CCAS shall support Dual Path communications between the CCAS Server and the IFPs. This shall allow for a redundant communication path in the event the primary path fails. The secondary path shall support all primary path protocols.
  - b. In the event of a communication failure of the primary path the IFP shall initiate a switch over to the secondary path. During this fail over period the IFP shall periodically check to see if the primary path has been re-established and will automatically switch back upon a successful connection. Alarms shall be generated upon loss or restoration of communications.
- 11. Area Control.
  - a. The CCAS shall provide five (5) area control features: Global Hard Anti-passback, Global Soft Anti-passback, Timed Anti-passback, Two Person Control, and Occupancy Limit. Area control shall be a security method of preventing a person from passing their badge to another person for dual entry into a single location utilizing one card.
    - 1) Global Hard Anti-passback.
      - a) The Global Hard Anti-passback feature shall require that a badge always be used to enter and exit an area. The controlled areas shall have both entry and exit card readers at all portals. Entry and Exit Readers shall be able to span across multiple Ifps. Areas shall be logically defined under the CCAS, and area control shall not be required at all areas of CUSTOMER facility to be utilized. Global Hard Anti-passback shall work in the following manner. A cardholder must present his / her badge at the entry card reader of the area that the person wishes to enter. Once access has been granted into the area, the cardholder cannot present the badge to another entry card reader within the same area without first presenting his / her badge to the respective exit card reader of that area. Should a cardholder attempt to use any other card reader in the same area besides the occupied area=s exit card reader once access has been granted to that area, the cardholder shall be denied access and an alarm shall be reported to the Alarm Monitoring client workstation. Nested control areas (areas inside areas) shall be definable with a minimum of 64 entry and exit card readers. It shall be possible to have an area within an area and / or multiple areas that are independent of each other in which Global Hard Anti-passback rules shall apply.
    - 2) Global Soft Anti-passback.
      - a) The Global Soft Anti-passback feature shall require that a badge be used to enter and exit an area. The controlled areas shall have both entry and exit card readers at all portals. Entry and Exit Readers shall be able to span across multiple IFPs. Areas shall be logically defined under the CCAS, and area control shall not be required at all areas of CUSTOMER facility to be utilized. Global Soft Anti-passback shall work in the following manner. A cardholder must



present his / her badge at the entry card reader of the area that the person wishes to enter. Once access has been granted into the area, the cardholder cannot present the badge to another entry card reader within the same area without first presenting his / her badge to the respective exit card reader of that area. Should a cardholder attempt to use any other card reader in the same area besides the occupied area's exit card reader once access has been granted to that area, the cardholder shall be allowed access (if that cardholder has the appropriate access level to access the new area), and an alarm shall be reported to the Alarm Monitoring client workstation. It shall be possible to have an area within an area and / or multiple areas that are independent of each other.

- 3) The following summary criteria shall apply under Global Hard or Soft Anti-passback:
  - a) Initially (Time 0) all card holders are reset to Area 0.
  - b) Any cardholder shall enter a controlled area anytime after Time 0 by presenting a badge to a CCAS entry card reader.
  - c) A cardholder shall not exit the controlled area unless he has entered the area presenting a badge to the CCAS entry card reader.
  - d) A cardholder shall not enter the controlled area a second time unless the cardholder has exited that area previously.
  - e) A cardholder shall be able to enter through any entry card reader and exit through any exit card reader of a single controlled area.
  - f) These options shall include a "forgiveness" feature that will allow the System Administrator to reset the anti-passback of all cardholders to Time 0 Area 0, either through a manual override or a time zone command.
  - g) The CCAS shall provide an anti-passback exempt option for privileged or VIP cardholders. Cardholders with this option will not have anti-passback rules applied to them.
  - h) The CCAS shall also have a "forgiveness" feature that will allow the System Administrator to assign "one free pass" to an individual cardholder. This shall allow the System Administrator to reset the anti-passback of an individual cardholder to Time 0 Area 0.
- 4) Timed Anti-passback.
  - a) Timed Anti-Passback shall allow the System Administrator to decide how long after a cardholder has swiped their badge that they will have to wait before the same badge will be accepted again at the same card reader. This helps prevent multiple swipes by an individual to allow access to others through turnstile doors.
- 5) Two Person Control.

- a) Two Person Rule shall be provided to restrict access to certain areas unless there are two (2) cardholders present. This restricts individuals from being alone in restricted or highly secure areas. When an area is configured for Two Person Rule, the following criteria shall prevail:
  - b) The card reader shall grant access only if two valid cardholders (with authorized access levels) swipe their badges one (1) after the other. In the event that a second authorized card is not presented within ten (10) seconds of the first authorized badge, the card reader shall reset and the first card will have to be swiped again.
  - c) Once two (2) people occupy an area, individual access shall be granted.
  - d) Individual exit shall be permitted until an area is occupied by only two (2) cardholders at which point the Two Person Rule applies for exit.
- 12. Mustering.
  - a. The CCAS shall support advanced Mustering functionality. The Mustering function shall provide an automatic capability for registering cardholders that are on site during an incident. Designated exit and entry card readers shall be used to enter and leave hazardous locations and safe locations. When an incident occurs, a Muster Report shall be generated that consists of a listing of all personnel that are within the hazardous locations as well as all personnel that have registered in a safe location.
- 13. Global Input / Output / Event Linkage.
  - a. The CCAS shall support a global linkage feature whereby any input / output / event shall be linked to any other input / output / event in the CCAS. Input / Output Linkages shall be able to span across Intelligent System Controllers.
  - b. System Administrators shall be able to create global I/O function lists, each consisting of a sequence of actions to be performed, such as changing card reader modes, activating outputs, and opening or closing anti-passback areas. Each function list may include up to six actions.
- 14. Cardholder Escort Control.
  - a. The CCAS shall support comprehensive Escort functionality based upon Access Levels. Access Levels shall include options for "Escort Required," "An Escort" and "Not an Escort" and "does not require an Escort"
  - b. The Escort feature shall be capable of one-to-one and one-to-many Escort to Escorted functionality.
- 15. Cardholder Use Limits.
  - a. The CCAS shall support a Cardholder Use Limit feature that shall allow System Administrators to specify the maximum number of times that a cardholder may use their credential at card readers in the CCAS.
- 16. Extended Individual Strike Times.
  - a. The CCAS shall support Extended Individual Strike Times that allows a card reader's strike to be active for an extended period of time beyond the pre-determined standard strike time on a per cardholder

- basis. The extended strike time shall be user definable up to 255 seconds. Extended strike times shall be set on a card reader by card reader basis.
17. Extended Individual Door Held Open Times.
    - a. The CCAS shall support Extended Individual Door Held Open Times that allows a card reader's door to be held open for an extended period of time beyond the predetermined standard held open time on a per cardholder basis. The extended held open time shall be user definable up to 131,070 seconds. Extended held open times shall be set on a card reader by card reader basis.
  18. Extended, on Demand, Door Held Open Times.
    - a. The CCAS shall support extended, on demand, door held times via a command keypad. The Extended Held Open command configuration shall consist of a command key sequence that shall be from 3 to 6 keys used to enter the number of minutes to extend the door held open time (up to 999 minutes) and a pre alarm time (from 0 to 30 minutes).
    - b. Only those cardholders having Command Authority at a given card reader configured for >Allow User Commands= shall have the ability to execute the Extended Held Open command at that card reader. The Extended Held Open command shall be available after a valid cardholder has received an Access Grant at the card reader. The cardholder shall have a period of fifteen seconds after the Access Grant to enter the extended held open command sequence.
  19. Elevator Control.
    - a. The CCAS shall provide elevator control using standard access control field hardware that will permit the restriction of cardholder access to certain floors while also allowing general access to other floors. The elevator control feature shall allow, at the elevator, the use of any card reader and all card reader modes used on any other card reader in the SMS. Each elevator card reader shall control access for a minimum of 64 floors.
    - b. The CCAS shall be able to track which floor was selected by an individual cardholder for auditing and reporting purposes.
  20. Graphical System Overview Tree.
    - a. A graphical system overview tree shall display a graphical representation of all field hardware (including IFPs, fire panels, intrusion detection devices, personal safety devices, intercom systems, central station alarm receivers), digital video hardware, access levels, time zones, access groups, holidays, and card formats that have been configured in the CCAS. System Administrators shall be able to modify a device that is depicted on the graphical system overview tree or see it's properties by double clicking on the icon and the CCAS shall bring them to the appropriate form.
  21. Pre-Alarm.
    - a. The CCAS shall support a pre-alarm feature at the card reader. The pre-alarm will sound a tone at the card reader prior to the door held open alarm. The pre-alarm setting shall be configurable for up to a maximum of 5,940 seconds (99 minutes).
  22. Alarm / Event Logging.
    - a. All alarms and events in the CCAS shall by default, always be recorded in the database. The CCAS shall give System

- Administrators the ability to select on a time zone basis, the times that they require the CCAS to log specific events to the database.
- b. System Administrators shall have the option for Alarm / Events to be set to log or not to log particular alarms / events on any individual reader and or input.
23. Scheduling Utility.
- a. The CCAS shall provide an integral Scheduling Utility. The Scheduling Utility shall allow System Administrators to schedule actions to occur on a one-time or a recurring basis. Recurring schedules shall be configured to begin immediately, last indefinitely, or have optional start and end dates.
  - b. The Scheduling Utility shall be available from both the System Administration and Alarm Monitoring modules.
  - c. The types of actions that shall be schedulable include but are not limited to:
    - 1) Action Group.
    - 2) Event Archiving / Purging.
    - 3) Arm / Disarm Area.
    - 4) Start of Guard Tour.
    - 5) Execution of Data Exchange Scripts.
    - 6) Activate, Deactivate, Pulse Device Output and Device Output Groups.
    - 7) Global Anti-Passback Reset.
    - 8) Download Database to IFPs.
    - 9) Execute Function List.
    - 10) Mask / Unmask Inputs, Input Groups, Alarm Mask Groups, Door Forced Open or Held Open.
    - 11) Open Door, Open Door Group.
    - 12) Change Reader Mode.
    - 13) Automatic Reports.
    - 14) Reset Use Limit.
    - 15) Move Bulk Badges from an Area.
    - 16) Deactivate Badges.
    - 17) Logout Visitors.
    - 18) Schedule PTZ Presets.
  - d. The Scheduling Utility shall maintain a history log in the database for actions that it executes.
24. Multiple Card Formats.
- a. The CCAS shall support an unlimited number of card formats. Magnetic stripe and Wiegand card formats shall be supported. Each IFP shall support a minimum of eight (8) access control card formats and if applicable, eight (8) asset formats. As such, each card reader shall also be able to support a minimum of eight (8) access control card formats. If applicable, asset readers shall be able to support a minimum of eight (8) access control card formats and eight (8) asset management card formats. The CCAS shall support any magnetic stripe format that uses card number, facility code, and issue code combinations with a maximum of a nine digit card number and two digit issue code. The CCAS shall support any industry standard Wiegand card format.
25. Denied Access Attempts Counter.
- a. The CCAS shall support a denied access attempts count on a per card reader basis. The "Denied Attempts Count" value shall be

configurable from 0 to 255. The following access denial types shall cause the current denied count to be incremented:

- 1) Unknown PIN entry at a card reader configured as "PIN or Card" mode.
- 2) Invalid cipher entry at a card reader in Cipher Mode.
- 3) Invalid PIN entered for a given card at a card reader configured as "Card and PIN" mode.
- 4) Non-matching biometric presented for a given card at a card reader in biometric verify mode.

26. Card Reader Time Zone Overrides.

- a. The CCAS shall allow for the pre-defined default card reader settings to be overridden or temporarily changed on a time zone basis. At the beginning of the a selected time zone, the selected card reader=s operational mode shall be modified from it=s default mode to any one of the following modes: locked, unlocked, facility code, card only, card or PIN, card and PIN, card and Biometric, card or PIN and biometric, and / or card and PIN and biometric. The aforementioned options shall be available depending on the type of card reader utilized.
- b. Each card reader shall have the ability to have multiple time zone setting overrides assigned to them as required by the System Administrator.

27. On-Line Context Sensitive Help.

- a. The CCAS shall provide on-line context sensitive help files to guide System Administrators and System Operators in the configuration and operation of the CCAS. The help menu shall be available from any window in the CCAS by pressing the F1 function key or clicking on the Help icon in the toolbar. Help windows shall be context sensitive so System Administrators can move from form to form without leaving the help window. The CCAS shall also come with complete on-line documentation on CD.

28. Monitor Zones.

- a. The CCAS shall provide System Administrators the ability to segment their access control CCAS field hardware devices into various zones or areas where Alarm Monitoring client workstations will monitor. These zones shall be assigned an alphanumeric name using up to 128 characters.
- b. The CCAS shall allow subset relationship devices (such as card readers or ICMs to Intelligent System Controllers) to be automatically part of the monitoring zone when an IFP is selected AND it shall allow the System Administrator to define which subset devices (card readers, ICMs, etc.) belong to that monitor zone.
- c. Updating of monitor zones shall take place in real time and without requiring operators to re-login.

29. Alarm / Event Routing.

- a. The CCAS shall be capable of allowing System Administrators to route alarms and events to various Alarm Monitoring client workstations on the network. The CCAS shall allow any alarm or event to be routed to one or multiple client workstations on the network regardless of where the alarm is generated in the field. Alarms shall be routed to client workstations on a device by device level.

- b. The CCAS shall be capable of automatic re-routing of an alarm from workstation X to workstation Y if the alarm is not responded to within a user definable time period.
  - c. The CCAS shall implement network synchronization that in the event alarm / event is routed to multiple client workstations, once the first client workstation >grabs= the alarm, the alarm / event shall be cleared from all other client workstations. As such, alarms that are routed to an Alarm Monitoring client workstation which does not have a System Operator logged in shall be queued so that all unacknowledged alarms will report to that client workstation once a System Operator has logged into the CCAS. Alarms / Events shall be routed based on default settings or time zone control.
- 30. Text Instructions.
  - a. The CCAS shall allow for a set of text instructions to be associated with each alarm that arrives into the CCAS. The text instruction function shall allow the System Administrator to enter a minimum of 32,000 characters of text for procedures to follow for each alarm that arrives at the Alarm Monitoring client workstations. Each alarm or event in the CCAS shall have it=s own unique set of text instructions should the System Administrator desire.
- 31. Customizable Voice Instructions.
  - a. The CCAS shall allow for a customizable voice instruction to be associated with CCAS alarms. The customizable voice instruction feature shall allow the System Administrator to record a voice instruction of unlimited length.
- 32. Customizable Voice Annunciation.
  - a. The CCAS shall allow for a customizable voice annunciation to be associated CCAS alarms. The customizable voice annunciation shall allow the System Administrator to record a voice annunciation of unlimited length.
- 33. Alarm Attributes.
  - a. The System Administrator shall have the ability to configure how the CCAS handles the annunciation of alarms on an individual basis. Each alarm and / or event shall have the option(s) to:
    - 1) Display at one or more Alarm Monitoring client workstation.
    - 2) Allow higher priority alarms to be displayed on the Alarm Monitoring client workstation ahead of lower priority alarms.
    - 3) Require the field device, which generated the alarm to be restored to its normal state before the alarm is cleared.
    - 4) Print the alarm to the local event printer.
    - 5) Have a customized voice message annunciate at the client workstation.
    - 6) Have the alarm breakthrough to the Alarm Monitoring window should the System Operator be working in another application
    - 7) Allow System Operators to amend the journal entry once the alarm has been acknowledged.
    - 8) Insure that the alarm will not be able to be deleted from the Alarm Monitoring window upon acknowledgment.
    - 9) Display text and audio instructions outlining the procedures to follow when responding to the alarm.
    - 10) Automatically call-up associated maps.
    - 11) Automatically call up the associated cardholder record.

- 12) Automatically call up the associated cardholder photo using the video verification function.
  - 13) Require a password to view the alarm.
  - 14) Require a password to acknowledge the alarm.
  - 15) Require acknowledgment to clear.
  - 16) Allow mandatory journal entry upon acknowledgment.
  - 17) Use pre-defined journal entries for alarms.
  - 18) Select the option for journal entry based upon the specific alarm.
  - 19) Bring up video on defined monitors.
  - 20) Automatically send an e-mail message.
  - 21) Automatically send an alphanumeric page.
  - 22) Have the alarm appear on the Alarm Monitoring window with a flashing colored coded bar across the alarm for high priority alarms.
  - 23) Have the alarm, when acknowledged, display an alternative flashing color coded bar across the alarm than for the original alarm color.
  - 25) Require User Logon for Acknowledgment.
  - 26) Have the ability to mark an alarm as Aln Progress® where the system shall silence any repeating audio notifications on the Workstation where the alarm was routed and remove the alarm sprite notification on the graphical map. Additional operators monitoring alarms shall be notified that the alarm has been marked Aln Progress.®
34. Alarm-Event Mappings.
- a. The CCAS attributes in Alarm Attributes shall be assignable on a >global= basis to all devices that share an alarm description. Thus, the >door forced open= alarm attributes shall apply to any door with a card reader that is forced opened in the CCAS. The CCAS shall have the capability to assign a unique group of alarm attributes to specific device / alarm combinations to override the global settings for specific case settings.
35. System Downloads.
- a. The CCAS shall provide for the downloading of data to the IFPs. Downloads shall load CCAS information (time zones, access levels, alarm configurations, etc.) into the IFPs first, followed by cardholder information and card reader configurations.
  - b. All IFPs on the CCAS shall be capable of either full or selective downloads to individual Intelligent System Controllers, and bi-directionally so that alarms will still report to their respective Alarm Monitoring client workstations as cardholder information is being downloaded.
  - c. A complete database download of 10,000 cardholder records to all IFPs (regardless of the number of IFPs) must be complete within ten (10) minutes.
  - d. Information on cardholder status, badge status, time zones or access levels shall download in real time as they are added, modified, or deleted from the CCAS.
36. Card Reader Options.
- a. The CCAS shall include the following options for each reader on the system:
    - 1) Allow User Commands.

- 2) Rename Auxiliary Inputs.
- 3) Rename Auxiliary Outputs.
- 4) Independently Supervise REX and DPS.
- 5) Configure REX and DPS as Normally Open or Normally Closed.
- 6) Deny if Duress.
- 7) Alarm Masking.
- 8) Activate Outputs.
- 9) Two Card Control.
- 10) Checkpoint.
- 11) Do Not Activate Strike on REX.
- 12) The ability to allow System Administrators to determine on a time zone basis to log or not to log on a card reader by card reader basis:
  - a) Access Grants.
  - b) Access Denied.
  - c) Card Reader Status Alarms.
  - d) The CCAS shall allow for user definable door strike functionality for each card reader in the CCAS.
  - e) The CCAS shall allow for each card reader to be selected as either an "in" reader, "out" reader, or "none" to allow for ease of reporting time and attendance basic "time in" and "time out" data.
  - f) Enforce Use Limit - This option shall enable Card Use Limits at the card reader limiting the number of times that cardholders may use their credential to gain access at the card reader.
  - g) Supervise Door - Sets the CCAS so that the card reader door contact is wired as a supervised input.
  - h) The CCAS shall allow for one or more access points in a specified area to be armed and disarmed directly from the Command Control Keypad.

37. Input Control Module (ICM) Options.

- a. The CCAS shall provide the following options for the Input Control Modules:
  - 1) Alarm Masking B The ability to mask the alarm input on a time zone basis.
  - 2) Local Linkage B The ability to locally link outputs with inputs that are attached to the same ICM/Output Control Module (OCM).
  - 3) Activate Output - The ability to activate an output tied to the ICM/OCM on a time zone basis.
  - 4) Activate Output Always- The ability to activate an output always.
  - 5) Configuration of Debounce Times B The ability to control the amount of time that an input state change must remain consistent in order for it to be considered a real change of state.
  - 6) Configuration of Hold Times - When configuring an Alarm Input, a hold time setting shall be settable from 0-15 seconds.
  - 7) Checkpoint B The ability to configure an input as a designated stop on one or more guard tours.



- 8) Supervised Input B The ability to specify if a specific alarm contact on the ICM is a supervised or unsupervised contact.
- 9) Entry / exit Delay B The ability to set up entry / exit delays for inputs that are attached to any ICM, SRI, or DRI. This shall include Non-Latched Entry: When an input activates, the alarm will not be reported until the Entry delay expires. If the input is still active when the entry delay expires, the alarm will be reported. If the input is not active when the entry delay expires, then the alarm will not report; Latched Entry: When an input activates, the alarm will not be reported until the Entry delay expires. If the input is still active when the entry delay expires AND the alarm has NOT BEEN MASKED, the alarm will be reported. If the input has been masked when the entry delay expires, then the alarm will not report; Exit Delay: When an input activates, the alarm will not be reported (operates as if masked) until the Exit delay expires. If the input is still active when the exit delay expires, the alarm will be reported. If the input is not active when the exit delay expires, the alarm will not be reported.
- 38. Alarm Monitoring.
  - a. Alarm Annunciation Configuration - The CCAS shall offer the same functionality as ICM of this document.
- 39. Current Status Indication.
  - a. The Alarm Monitoring window shall provide a visual status that displays the current status of all devices in the device tree including child devices downstream from the primary device. Additionally there shall be a numeric display of card readers, IFPs and ICMs that are off line.
- 40. Device Group Support.
  - a. The CCAS shall support device grouping for uniform command and control of groups of devices within the system. Four types of homogeneous device groups shall be supported:
    - 1) Card Reader Groups.
    - 2) Input Groups.
    - 3) Relay Output Groups.
    - 4) Video Camera Groups.
- 41. Color Coding for Alarm Priorities.
  - a. The CCAS shall display alarms in the active Alarm Monitoring window with a flashing colored bar across the alarm based upon priority. Acknowledged alarms may be set with alternate color-coding. A minimum of 255 colors must be available for assignment to a minimum of 255 priority levels.
- 42. Highlighting of Unacknowledged Alarms.
  - a. The CCAS shall provide an Unacknowledged Alarm pop-up window that displays alarms that have been unacknowledged after a user defined period of time.
- 43. Pre-Defined Canned Alarm Acknowledgment Responses a. The CCAS shall have the capability for pre-defined alarm acknowledgment responses for alarms in the CCAS. An unlimited number of pre-defined responses shall be able to be configured for each alarm in the CCAS.
- 44. Lost Card Alarm.

- a. The CCAS shall provide an optional setting to designate a Lost Card Alarm when a badge that is not active. The normal settings would be Terminated or Lost.
- 45. Request to Exit Event.
  - a. The CCAS shall provide an optional setting to annunciate an event when a REX device is used. Normally a REX event is not annunciated.
- 46. Real-Time, Live Video User Verification.
  - a. The CCAS shall have the capability of interfacing to a CCTV system and displaying a live video image next to a stored cardholder image record. This feature shall be system configurable.
- 47. Traces.
  - a. The CCAS shall allow for a live or historical trace on any IFP, ICM, Alarm Input, Credential (Cardholder), Intrusion Detection Device, Monitor Zone, or card reader. If applicable, the CCAS shall allow for a trace on any asset, intercom, or camera. Multiple traces may be run simultaneously. The CCAS shall allow System Operators to filter alarm types from the history trace window. Alarms that shall be filtered from the trace window are access granted alarms, access denied alarms, system alarms, duress alarms, and area control alarms.
- 48. "On the Fly" New Login of System Operators.
  - a. The CCAS shall allow a System Operator to login over another System Operator who is already logged into the same client workstation. This process shall log the first System Operator off of Alarm Monitoring and log the new System Operator on, changing any permissions necessary for that System Operator.
- 49. Auto Exit to Windows 2000 / 2003/ XP Login Window.
  - a. The CCAS shall be configurable to automatically exit the Alarm Monitoring application and log the System Operator out of the Windows 2000 / 2003 / XP Operating System when a System Operator logs off an Alarm Monitoring client workstation. The CCAS shall then bring the System Operator to the Windows / XP Login Window for the next System Operator to log on.
- 50. Alarm Monitoring - Column Display & Configuration.
- 51. Test Mode.
  - a. The CCAS shall support a Test Mode for Alarm Inputs, Door Forced Open, and Access Grants. Tests on Input Device Groups shall be available to verify that all inputs within the group are operational. Upon entering into Test Mode and for the duration of the test, alarms from members of the group shall either be displayed in a separate window/view on test Alarm Monitoring client workstations or on all Alarm Monitoring client workstations in which the alarms are usually routed. During the test (the duration of the test shall be set by the System Operator), all inputs within the group are manually activated in the field. At the end of the time duration, a report shall be generated flagging any inputs for alarms that were not received. During the Test Mode, all alarm operations carry on as programmed (i.e. Global I/O functions, CCTV commands, printer activity, etc.) so that all functions are tested.
- 52. Manual Control.
  - a. The CCAS shall provide the System Operator the option to manually control over all output points or input points connected to the CCAS.

Control points are defined as any door strike, auxiliary card reader output, or any other relay output point of an Output Control Module (OCM).

53. Real-Time, Dynamic Graphical Maps.
  - a. The CCAS shall support graphical maps that display device / group status, function lists and video cameras dynamically in real-time. The maps may be configured to appear on command or when specified alarms are selected for acknowledgment. Map device icons shall have the ability to dynamically change shape and / or color to reflect the current state of the device. The CCAS shall indicate if the field hardware is not operating with the most current version of firmware.
  - b. The CCAS shall support all commands available and used map formats listed below:
  - c. The CCAS shall support user defined icons for field hardware devices. The CCAS shall also give System Operators the ability to affect the mode of card readers, open doors, start a trace on a device, mask / unmask alarm inputs, and activate / deactivate / pulse an output from the map icons.
  - d. The graphical maps shall have the ability to be printed to a local printer.
54. Automatic Credential Deactivation by Lack of Use.
  - a. The CCAS shall have an automatic credential deactivation function where a cardholder's credential will automatically deactivate after an extended period of inactivity based upon a predetermined time period. The credential status may be reset by authorized System Operators.
55. Automatic Credential Deactivation based upon an Event.
  - a. The CCAS shall have a programmable ability to deactivate an active badge based upon a pre-determined event.
56. Alarm Filtering.
  - a. The CCAS shall have the capability for filtering out alarm types from the Alarm Monitoring window. Alarms that may be filtered are access granted alarms, access denied alarms, system alarms, duress alarms, and area control alarms. If applicable, fire alarms, asset alarms, intercom alarms, central station receiver alarms, intrusion detection alarms, video event alarms, and transmitter alarms may also be filtered.
57. Manual Override of Card Readers.
  - a. The CCAS shall support System Operator overrides of card readers from the Alarm Monitoring window, graphical maps or the real-time system status tree. The CCAS shall also support the ability to manually set a reader back to default mode.
58. Alarm Masking.
  - a. The CCAS shall support the masking of alarms to be controlled on a time zone basis or by manual control.
  - b. The CCAS shall support the ability to configure inputs to be "Unable to Mask."
59. On-Line Context Sensitive Help,
  - a. The CCAS shall provide on-line context sensitive help. The help menus shall be available from any window in the CCAS by pressing the F1 function key or clicking on the help icon in the toolbar.
60. Sorting Capabilities,

- a. The CCAS shall allow System Operators to arrange the way that alarms and / or events in the Alarm Monitoring window are listed by sorting the alarms and events. Sort criteria shall be based on priority, time / date, IFP, Card Reader, ICM, Input Device, or Cardholder. Additionally alarms and events can be sorted based on asset scan ID, asset name, intercom station, intrusion panel, transmitter, or transmitter input.
- 61. Paging Interface,
  - a. The CCAS shall support a paging interface seamlessly integrated within the CCAS Alarm Monitoring module. System Operators shall have the ability to manually or automatically send numeric or alphanumeric paging messages on demand regarding any alarm currently displayed in the Main Alarm Monitoring window. Pages shall have to ability to be sent to multiple pagers if desired. The CCAS shall allow any pager to be accessed through a paging terminal that communicates through the TAP (Telocator Alphanumeric Paging) protocol.
- 62. E-mail Interface,
  - a. The CCAS shall provide an e-mail interface seamlessly integrated within the CCAS Alarm Monitoring module. System Operators shall have the ability to manually or automatically send ASCII text e-mail messages from the Alarm Monitoring module on demand regarding any alarm currently displayed in the Main Alarm Monitoring window. E-mails shall have to ability to be sent to multiple e-mail accounts if desired. The CCAS shall integrate with Microsoft Exchange Server.
- 63. Credential Management,
  - a. The CCAS shall incorporate a Credential Management (PIDS) and Enrollment module that is integral to the CCAS source code with the ability to create and maintain the Cardholder database. Features shall include the ability to:
    - 1) Add, Modify and Delete records based upon permissions.
    - 2) Capture photo images, biometric information and signatures.
    - 3) Print Credentials.
    - 4) Boolean Search on any single or multiple fields.
    - 5) Determine single or multiple active badges.
    - 6) Assign Access Levels and Access Groups.
    - 7) Bulk Assignment / Modification / Deletion of Access Levels.
    - 8) Bulk Deletion of Cardholder Records.
    - 9) Native support for U.S. Government CHUID standard.
    - 10) Limit the number of times the credential can be printed.
    - 11) Limit the access for searching the database based upon user defined criteria.
- 64. Mobile Badging Operations.
  - a. The CCAS shall support seamlessly integrated Mobile Badging Operations that allow the CCAS cardholder database to be replicated onto an off the shelf laptop computer. The laptop computer shall then have the ability to go to remote sites to enroll cardholders into the CCAS and later synchronize the data.
- 65. Credentials.
  - a. The CCAS shall support the following credential types and allow for direct Thermal Dye Sublimation printing onto the credential surface.
    - 1) Composite Credentials - 3.375" x 2.125", UPVC Composite credentials with an ISO standard 30 mil thickness.

- 2) Proximity credentials.
- 3) Smart Cards B Contact-less.
- b. The CCAS shall support HID ICLASS contact-less smart card technology. Security for ICLASS cards shall be handled via challenge and response authentication techniques, data ciphering, message authentication checking and unique unalterable serial numbers. The system shall support HID OEM- 100/150 encoders and allow for 2K and 16K ICLASS encoding.
- 66. Credential Management Enrollment Features.
  - a. The CCAS shall allow for automation of enrollment procedures with the following attributes based upon badge type:
    - 1) Default Deactivation Date.
    - 2) Default Access Levels.
    - 3) Badge Design Layout.
    - 4) Badge Printer Selection.
    - 5) Encoding Format (if required).
    - 6) Badge ID if set to automatic generation.
  - b. The CCAS Credential Management module shall incorporate a seamless interface to IDScan models CSS-800 and CSS- 1000 series scanners that scan, import text and / or photo data and automatically populates the associated CCAS database fields from drivers licenses, passports, government issued and DOD issued credentials.
- 67. Cardholder Image Capture.
  - a. The CCAS must be compatible with flash lighting, USB sources and digital cameras and allow the capturing of the cardholder image at a minimum resolution of 640 x 480.
  - b. CCAS image capture, storage, and hardware compression techniques must be in compliance with the ANSI standard or JPEG (Joint Photographic Experts Group). Cardholder images must be stored as Binary Large Objects (BLOB) within the cardholder record.
  - c. The CCAS shall provide the ability to capture a cardholder=s image through the use of any industry standard scanner or digital camera that utilizes a TWAIN interface. Images shall be able to be scanned in at up to 16.7 million colors for a true color scanned image. When using a digital camera that supports multiple resolutions, the system shall allow the operator to select the desired resolution.
- 68. Image Import.
  - a. The CCAS shall allow for System Operators to have the ability to import a cardholder's image at the time of enrollment. The CCAS must support all standard and commonly used image formats:
- 69. Biometric Verification.
  - a. The CCAS shall allow for the viewing, capturing and deletion of biometric templates.
  - b. All biometric templates shall be stored within the CCAS database, and depending on the Biometric device and the CCAS configuration, in the IFP or on a smartcard chip.
  - c. The CCAS shall support Biometric Verification for the following platforms:
    - 1) RSI Handkey with template on IFP.
    - 2) Identix V20 with template on IFP.
    - 3) Biocentric with template on IFP.

- 4) Bioscrypt with template (one or two finger capture) on iClass, Mifare ISO 14443A and 1569 technologies or on IFP (model dependant).
  - 5) LG Iris Scan with template on iClass.
  - 6) Ultra-Scan with template on iClass.
  - 7) Cross Match ID-500 ten fingers for ID verification and use with access control authentication.
  - d. The CCAS shall be capable of a search of cardholder records to view biometric template images that are currently associated with that cardholder.
70. Digital Certificate Management.
- a. The CCAS shall support Digital Certificate Services to enable System Operators to securely obtain and manage digital certificates for smart card cardholders. The CCAS shall allow a System Operator to enroll and issue a smart card to each cardholder during enrollment process. This shall allow the issuing of a Smart Card Logon certificate (which provides authentication) or a Smart Card User certificate (which provides authentication plus the capability to secure e-mail) for the purpose of Smart Card Login to PCs.
  - b. The CCAS shall support any smart card reader(s) that have been tested by the Microsoft Windows Hardware Quality Lab and have obtained the Windows-compatible logo and that are to be installed on Windows 2000/2003/XP computers.
71. Smart Card Encoding Support.
- a. The CCAS shall include the ability to support Off-line and In-Line SmartCard Encoding for the following readers and technologies
    - 1) Bioscrypt V-Smart (iClass & Mifare) Off-line and Inline.
    - 2) Integrated Engineering (Mifare) Off-line and Inline.
    - 3) Biometric Container (iClass and DESfire) In-line.
    - 4) Texas Instruments (15693 Vicinity) Off-line.
    - 5) GSC (iClass and DESFire) In-Line.
    - 6) LG Iris Access (iClass) In-line.
    - 7) Ultra Scan (iClass) In-Line.
    - 8) Badge Design.
  - b. The CCAS shall incorporate a Badge Design module that is integral to the CCAS source code with the ability to create and maintain badge designs. Features shall include the ability to support:
    - 1) Complete Badge design and Layout tools.
    - 2) Image Import.
    - 3) Signature Capture.
    - 4) Barcode.
    - 5) Smart chip Support.
72. ID Badge Printers.
- a. The CCAS shall support any printer with industry standard and Microsoft Certified Windows 2000/2003/XP drivers. The CCAS shall support.
    - 1) Double-sided full color printing.
    - 2) Edge to edge printing.
    - 3) High-speed printing.
    - 4) Holographic overlays.
    - 5) In-line Magnetic Stripe Encoding.
    - 6) In-line Smart Card Encoding (printer model specific).
73. Avery Dennison Badge Label Templates.

- a. The CCAS shall provide pre-defined badge layouts that are specific to match Avery Dennison=s US and International self adhesive ID labels.
- 74. Image Export.
  - a. The CCAS shall have the ability to export a captured and cropped cardholder image to an industry standard JPEG (.jpg) file format.
- 75. Intelli-Check ID Check Integration.
  - a. The CCAS shall integrate with the Intelli-Check ID Check 1400 product for the scanning of credentials including driver's licenses, military and government issued IDs. This integration will populate cardholder form during the enrollment process. Provide the specified or equivalent product to achieve the function.
- 76. Remote Access Level Management.
  - a. The CCAS shall provide a client / server based or N-Tier architecture browser based Remote Access Level management option. This optional shall allow users with the correct permission to administer and allocate access levels to specific pre determined devices.
- 77. IP Based Integrated Digital Video Management System (IPDVMS).
  - a. The CCAS shall support an integrated IP Based Digital Video Management recording solution that provides the following features and capabilities:
    - 1) Integration with the CCAS.
    - 2) Stand alone operation without connection to the CCAS.
    - 3) The IPDVMS shall be computer hardware independent and must meet or exceed the manufacturer's minimum specification for the computer and related devices.
    - 4) The IPDVMS shall incorporate a modular architecture and be able to support an unlimited number of cameras.
    - 5) The IPDVMS shall be able to simultaneously record and display live video and display recorded video.
    - 6) The IPDVMS shall support both event based and continuous recording.
    - 7) The IPDVMS shall mark all events and they shall be available for playback and or archiving at any time.
    - 8) Video events shall be linked to CCAS events in the CCAS database and only one database shall be acceptable for this interface.
    - 9) Up to 32 simultaneous users shall be able to access any video feed from any recorder on the network.
    - 10) User defined profiles shall be available for tailoring granular access to configuration and operation.
    - 11) Shall have the ability to enhance a frame of video with embedded features or off the shelf software while providing security for the original video image to preserve integrity.
    - 12) Shall be capable of independent camera setup for, compression rate, brightness, contrast and other factor setups.
    - 13) The IPDVMS shall support Ethernet 10BT, Ethernet 100BT and 1000BT. Network protocols shall be supported including TCP/IP, IPX, and UDP.
    - 14) The network interface shall allow remote access of the IPDVMS from anywhere on the end-users LAN/WAN.

- 15) Shall support limiting of frame rate transmission to individual clients.
  - 16) The IPDVMS shall support either Multicast or Unicast streaming technology.
  - 17) The IPDVMS shall be have the ability to playback stored video over the LAN / WAN for remote access of video clips.
  - 18) The IPDVMS shall support World Time Zone.
  - 19) Any alarm / event in the CCAS shall have the ability to be associated with a digital video clip in real time. The IPDVMS shall support user defined pre and post roll.
  - 20) Each camera shall be configurable for a 32 alphanumeric character name and shall allow for the setup and adjustment of brightness, contrast, archiving, motion detection, Pan / Tilt / Zoom, on a per camera basis.
  - 21) The IPDVMS shall support CCTV PTZ control via the CCAS video interface.
  - 22) The IPDVMS shall support Analog CCTV PTZ control via approved Video Encoding Devices.
  - 23) The IPDVMS shall support MJPEG, H.264 and MPEG4 formats for multiple IP Video Cameras and IP Video Encoders from approved sources.
  - 24) The IPDVMS shall support integral time stamping upon receipt of video from the camera.
- b. The IPDVMS shall support the following configuration and customization parameters:
- 1) Compression percentage.
  - 2) Pre and Post Roll in seconds.
  - 3) Motion Detection Alarms.
  - 4) Set Time Lapse Recording.
  - 5) Continuous Recording Mode.
  - 6) The ability to enforce user authentication to specify individuals or groups that have the ability to view live or recorded video or make modifications to the system.
  - 7) The ability to change any or all of the associated IP camera passwords manually or on schedule.
  - 8) User determination of Event Locking method.
  - 9) Dual Path Fail Over support.
  - 10) Blind Camera (Obstructed View) Alarm reporting.
  - 11) Presets on Alarm.
  - 12) Event Locking to protect specific video events from being overwritten.
  - 13) UNC path support for Network Attached Storage Devices.
  - 14) Configuration of Off-line cameras.
  - 15) Support for Intelligent Motion Video Searching.
  - 16) Advanced Video Analytics and Video Searching.
  - 17) Facial Detection.
  - 18) Object Direction.
- c. Device Linkages.
- 1) An unlimited number of access control hardware / device links shall be configurable.
  - 2) A camera viewing priority shall be given to each access control hardware device link.



- 3) Each alarm / event condition shall have the ability to mark the start of a video event or the end of a video event in real time.
- d. The IPDVMS shall support automatic firmware downloads to select IP cameras.
- e. The IPDVMS shall support both internal camera video storage and external camera video storage. Internal storage shall allow the camera to store video events and then download these events to the IPDVMS on a predetermined schedule or on demand.
- 78. Pan / Tilt / Zoom Control from Alarm Monitoring.
  - a. The IPDVMS shall support PTZ control from the Alarm Monitoring workstation. The PTZ control shall support approved IP PTZ cameras and Analog Cameras connected to approved IP Servers.
  - b. The IPDVMS shall support the following PTZ features:
    - 1) Priority Levels.
    - 2) Device Group Control.
    - 3) PTZ Override (Lockout).
    - 4) Proportional PTZ Control.
    - 5) Preset Lock via video screen.
    - 6) Preset Tour.
- 79. Video Archiving.
  - a. The Archive Server software shall be hardware independent, providing the ability to utilize commercial off-the-shelf mass storage devices, including SAN (Storage Area Network) solutions, Tape Libraries, and direct connect external storage drive arrays.
  - b. The Archive Server software shall provide the ability to manage and store video information from multiple video recorders to a central location, without operational degradation.
  - c. Each DVMS / IPDVMS shall have the ability to set its own unique archiving properties. Video shall automatically be archived based on user defined "percentage full" settings. When the IPDVMS (\*\* Select either DVMS or IPDVMS) reaches the designated capacity threshold, video shall be automatically copied to the archive storage media and space on the recorder is released for over-write by new video information.
  - d. Regardless of the storage location (local on the recorder or in archive) the system will automatically retrieve video associated with an event on demand. The actual storage location shall be transparent to the user.
- 80. Browser Based Video Viewer.
  - a. IPDVMS shall allow monitoring of real time video from an optional web browser based video viewer using N-Tier architecture and Microsoft Internet Explorer @ 1024x768 resolution. The browser based viewer shall have the ability to select multiple viewing templates. The browser based viewer shall provide the following functionality:
    - 1) Display live video.
    - 2) Digital zooming and panning.
    - 3) PTZ camera control.
      - a) Drag or double click to center.
      - b) Continuous click to center.
      - c) Click and hold to move.
    - 4) Ability to access video from multiple recording sources.
    - 5) PTZ locking.

- 6) Priority based camera control takeover.
- 81. Real Video Time Monitoring.
  - a. IPDVMS shall allow monitoring of real time video from any Alarm Monitoring client workstation. DVS and Camera status shall be displayed on a System HardwareTree.
- 82. Video Viewing Layouts.
  - a. IPDVMS shall support the ability to save the list of camera views currently being displayed along with the currently selected template with a user defined name to be loaded as needed by the system operator.
- 83. Video Player.
  - a. IPDVMS shall support an advanced matrix view of multiple On-line camera views. Up to a total of 128 fps @ CIF resolution and 72 fps @ 4CIF resolution shall be available for viewing in the Matrix View. The 128 frame rate limitation of video shall be any combination of Live or Recorded video. The number of open video windows shall be dependent on the frame rate and resolution of the cameras. The Video Player shall allow operator sizing of the video windows in the matrix view.
- 84. Video Camera Groups / Video Camera Tours.
  - a. IPDVMS shall support camera grouping to allow for video camera tours in the CCAS Alarm Monitoring Module.
  - b. An unlimited number of camera groups shall be supported in the CCAS and each camera group shall support an unlimited number of cameras. Cameras within a camera group shall span multiple digital video servers. Cameras shall have the ability to be placed into multiple camera groups.
  - c. The CCAS shall provide for video camera tours that rotate live video between each of the cameras defined in the video camera group at a user defined increment. The time increment shall be user definable in whole seconds.
- 85. Still Image Capture / Save.
  - a. During playback or monitoring of video, the System shall have the ability to create and save a still picture. This operation shall not affect any other operation and shall not alter the recorded video. The file format shall be an industry standard format allowing for file transfer via email, printing or file transfer to other media.
- 86. Export Video Clip to File.
  - a. The CCAS shall have to ability to save and export recorded video to a file for the purpose of sharing and reviewing video clips. The start and end times for each video segment shall be user defined. The exported video clip shall be viewable via a standard Windows media player.
- 87. Video Image Processing.
  - a. IPDVMS shall support video image processing of a single frame captured image through use of an integral image processing module which shall offer the following features:
    - 1) Intensity, Contrast and Saturation.
    - 2) Gamma Correct.
    - 3) Histo-Contrast and Histo-Equalize.
    - 4) Flip, Reverse, Invert and Rotate.
    - 5) Shear.

- 6) Add Noise, Average, Sharpen, Mosaic, Posterize and Median.
- 7) Halftone.
- 8) Emboss.
- 9) Gray Scale.
- b. IPDVMS shall allow the ability to save any combination of effects as a defined profile. Profiles shall have the ability to be added or deleted from the CCAS at any time.
- 88. Video Loss Detection.
  - a. The CCAS shall detect video loss from any or all cameras and activate an alarm.
- 89. Automated Motion Video Searching.
  - a. IPDVMS shall support advanced automated motion video searching against pre-recorded video. The automated motion video search shall analyze frames in a video segment to detect motion activity from image to image. It shall display thumbnail images of the frames with activity, complete with a histogram depicting the relative amount of activity within each frame.
  - b. The search shall be defined by selecting a specific camera and a specific time period in which the suspected activity took place and all motion events associated with that camera and time period shall be displayed in either a trace or thumbnail format for review.
- 90. Remote Monitoring Application.
  - a. IPDVMS shall support a Remote Monitoring Application that allows the operator to monitor video from any computer connected to the CCAS network.
- 91. Video Authentication.
  - a. IPDVMS shall support imbedded authentication of video where the video is watermarked with an authentication key / signature during recording of live video to a hard drive. The video player shall have the ability to verify the authenticity during playback. This authentication shall provide the recorder name, camera name, video time and user information. The authentication shall have the ability to be password protected.
- 92. Intelligent Video Analysis System (IVAS).
  - a. The CCAS shall provide an option for an Intelligent Video Analysis solution that shall seamlessly integrate with the IPDVMS. The set of Intelligent Video Analysis algorithms shall provide the following functionality. In addition to the approved manufacturers of CCAS system, 3rd party integration with Vidient, 3M, and Object Video is acceptable. Provide the following IVAS functions.
    - 1) Alert Types.
      - a) Smart Video Motion Detection (the IVAS shall ignore minor vibration and provide motion masking).
      - b) Camera Tampering (shall occur when the IVAS detects a camera is moved from its original position, when the camera view is obstructed or when the focus is changed).
      - c) Sudden Change in Light Intensity (shall occur when the IVAS detects an extreme change in ambient light B light to dark or dark to light).

- d) New Object in Scene (shall occur when the IVAS detects an object not present when the IVAS originally learned the scene view is left in that view).
  - e) Object Removed from Scene (shall occur when the IVAS detects an object that was present when the IVAS originally learned the scene view).
  - f) Object Detected in Scene (shall occur when the VAS detects an object defined by specific properties including people, automobiles or an object of a specific color).
  - g) Congestion in Defined Area (shall occur when the IVAS detects congestion in a specific region).
  - h) Directional Motion (shall occur when the IVAS detects an object moving in a direction specified in the setup of this feature).
  - i) Object Crosses a Defined Region (shall occur when the IVAS detects an object moving across a virtual boundary or area from a specified direction).
  - j) Moving Object Stops (shall occur when the IVAS detects a moving object in the scene ceases to move).
  - k) Static Object Starts to Move (shall occur when the IVAS detects a static object in the scene starts to move).
  - l) Object moves too fast (shall occur when a pre-defined speed has been exceeded).
  - m) Loitering (shall occur when the IVAS detects a person in the scene slows down or ceases to move for a specified period of time).
  - n) Detection of a Human Face (shall occur when the IVAS detects a frontal view of a human face is detected in the scene).
  - o) People Counting (shall occur when the IVAS is set for a top down view of a portal. This feature shall provide an alarm with a positive count for entry and a negative count for exit).
- 2) The IVAS shall support the ability to store the graphical output for a specific event for use with IVAS alarms. This feature shall allow the graphical output of a specific event to be stored as a file and later used as an overlay to be used and associated with an alarm for historical searching.
  - 3) The IVAS shall support CIF, 4CIF and D1 video resolutions during video processing.
  - 4) The IVAS shall support video infra-red imaging.
93. TSA Reporting Functions:
- a. Provide Crystal Reports or similar 3rd party software to provide various reports required by TSA. Contractor shall work with PIA in developing all required reports in electronic formats for submittal to TSA. In addition, provide customized software if required, to automatically check the badge holder's information with TSA "watch list". The cross check shall be made during the initial issuance and renewal of the badge as well as on a periodic basis as required by TSA.

## 2.14 INTERFACE REQUIREMENTS

### A. Local Power

1. Local power at the locations specified on the Contract drawings will be 120 V ac, 60 Hz, single phase. Coordinate work with the terminal construction contractor. Extension or modifications to the power locations shown on the terminal contract shall be performed by this contractor.
2. The Contractor shall provide the necessary power conversion, distribution and isolation equipment to ensure the specified operation and protection of all CCAS equipment when fed from the normal and backup sources.
3. All power supply components by the Contractor shall be provided with indicating fuses or circuit breakers located to permit convenient and rapid identification and maintenance in accordance with UL 198, "Fuses," UL 512, "Fuse Holders," and NFPA 70, National Electrical Code," as applicable. Fuse holders shall be labeled to indicate fuse type, size, and identification. Circuit breakers shall be labeled to indicate their intended function.

### B. Fire Alarm System

1. The Contractor shall interface with the Fire Alarm System to provide a common alarm annunciation at the SCC wherever a fire alarm is received.
2. The Contractor shall provide the hardware and software necessary to interface these for operation as specified heretofore.
3. The Contractor shall interface with F.A. control relay (ZAM) to type 4 access point panic device to release them upon activation of the relay. The relay is activated upon activation of smoke detectors or sprinkler system flow switch. Coordinate with terminal construction contractor.

### C. Baggage Belt System

1. The contractor shall interface the baggage belt systems as indicated on the drawings.

### D. Automatic Vehicle Gates

1. The contractor shall interface with the sliding gate at Access Points as indicated on drawings with gate operators and card reader PINpad to operate as specified.
2. The Contractor shall provide the hardware and software necessary to interface these for operation as specified heretofore.

## PART 3 - EXECUTION

### 3.1 DELIVERY, STORAGE AND HANDLING

- A. CCAS components shall be delivered properly packaged in factory-fabricated type containers or wrappings which properly protect equipment from damage. The Contractor shall be responsible for all damaged equipment due to improper preparation for shipment.
- B. Equipment subject to deterioration by humidity at the project site shall be provided with plastic covers forming a vapor seal and an adequate quantity of desiccant. Desiccant shall be either visible or stored in a manner which can be easily reached

for inspection and replacement. Equipment so protected shall be noted on the packing list.

- C. CCAS components shall be stored in original cartons in a clean dry space protected from weather and construction traffic. The Contractor shall be responsible for observing the equipment manufacturers storage and handling procedures as required to maintain any implied or stated warranty.
- D. CCAS components shall be handled carefully to avoid breakages, impacts, denting and scoring finishes. Damaged equipment shall not be installed but returned for replacement.

### 3.2 INSTALLATION REQUIREMENTS

- A. Examination
  - 1. The Contractor shall examine areas and conditions under which the CCAS components are to be installed and notify the A/E, in writing, of conditions detrimental to proper completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in an acceptable manner.
- B. Installation
  - 1. CCAS components shall be installed in accordance with equipment manufacturer's written instructions, in compliance with NFPA 70, "National Electrical Code (NEC)," and ANSI C2, "National Electrical Safety Code," and with recognized industry practices, to ensure that the CCAS meets all requirements stated herein and serves its intended purposes.
  - 2. The Contractor shall coordinate installation of CCAS components with work performed by others.
  - 3. Surface-mounted equipment shall be securely fastened to indicated structural supports. The Contractor shall ensure that this equipment is plumb and level.
  - 4. Connectors and terminals, including screws and bolts, shall be tightened in accordance with equipment manufacturer's published torque tightening values. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with the tightening torques specified in UL 486A/13, "Wire Connectors and Soldering Lugs for Use with Copper / Aluminum Conductors," and the NEC.
- C. Grounding
  - 1. Equipment grounding connections for CCAS components shall be provided. Ground connections shall be tightened to comply with the tightening torques specified in UL 486A to assure permanent and effective grounds.
  - 2. The Contractor shall ensure and demonstrate that resistance to solid earth for signals is less than, or equal to, 3 ohms.
- D. Adjusting and Cleaning
  - 1. Upon completion of installation of CCAS components, the Contractor shall set all field-adjustable controls / components and align and calibrate all equipment for the required performance and operation as specified herein.
  - 2. The Contractor shall touch-up scratched and marred surfaces to match the original finishes.
  - 3. Installed CCAS components shall be protected from damage during the remainder of the construction period.

- E. Field Quality Control
  - 1. Prior to energization, the Contractor shall test all field-run wires and cables for electrical continuity and short circuits and to ensure proper polarity of all connections.

### 3.3 INSPECTIONS AND TESTS

- A. Inspections
  - 1. The prime responsibility for inspection of all materials and work furnished by the Contractor pursuant to the Contract rests with the Contractor. The inspection or waiving of inspections by the airport shall not relieve the Contractor of any obligations or responsibilities to perform in accordance with the Contract.
  - 2. The Contractor shall assure that components procured from Subcontractors comply with the requirements of the Contract. Suggested methods of providing this assurance are audits of the Subcontractor and its Quality Control program or receipt inspections and tests designed to demonstrate that the device(s) functions properly and complies with the specified requirements. The airport's "release" of any materials being furnished by the Contractor's Subcontractors shall not be construed to imply acceptance of same in the end product and shall not in any way relieve the Contractor of its responsibility of inspection.
  - 3. The Contractor shall cooperate fully with Peoria International Airport's representatives and shall grant Peoria International Airport free access to all documents and work areas which the airport deems necessary to perform thorough and meaningful tests and observations. The airport's representatives shall have the right to inspect the equipment, workmanship, labor, testing procedures and any other item or task performed, furnished or used by the Contractor under the Contract, and the airport may reject, without cost or liability, any which are defective or unsuitable for the use and purposes intended or which are not in accordance with the intent of the Specification. The Contractor, upon demand by the airport, shall remedy or replace, at the Contractor's expense, such defective or unsuitable equipment or performance item. The Contractor shall act promptly to obtain the airport's approval of corrective or remedial action(s) and shall implement these actions promptly after receipt of Peoria International Airport's approval.
  - 4. The Contractor shall give the airport's representatives at least ten (10) working days notice of events or conditions specifically requested by the representatives. Where specific inspections are required, the work involved shall not proceed beyond that point until the representatives have made or waived such inspection. The Contractor shall provide the representative with appropriate drawings and technical documentation for use during the inspection visits, as required.
- B. Field Verification Tests
  - 1. Field tests to verify that the system hardware and software, as approved for shipment, function in the same demonstrated manner after installation of the CCAS will be performed by PIA at the site. The Contractor shall provide any technical assistance required during the tests. A test procedure will be developed by Contractor and reviewed by PIA, prior to performance. These tests shall be performed on the entire system.

2. Where possible, malfunctioning components shall be corrected at the site; otherwise, the Contractor shall remove and replace. Upon correction / replacement, the component shall be retested.
3. System hardware acceptance will be provided by PIA upon satisfactory completion of the approved system hardware verification tests at the site.
4. System software acceptance will be provided by PIA upon satisfactory completion of the approved system software verification tests at the site.

C. Availability Test

1. The Contractor shall demonstrate a continuous operation of the CCAS at the site over a period of 1,440 hours with an availability of 99.5 percent or more to include all supplied hardware and software. This shall be demonstrated after the Field Verification Test of the CCAS.
2. Availability shall be calculated as follows:  

$$\text{Availability} = \text{Percent } \frac{(\text{TDT} - \text{AOT})}{\text{TDT}} \times 100$$
 where:
  - a. Test Duration Time (TDT) is the total elapsed time from start of the test to completion of the test. This time shall be a minimum of 1,440 hours. The TDT shall equal the time the WAS is undergoing testing less the time allocated for pre-scheduled preventive maintenance as required by the Contractors maintenance manual.
  - b. Accumulate Outage Time (AOT) is the total amount of time after start of the test when any part of the system or its function are not available (downtime) as specified below.
3. Downtime shall be calculated according to the following rules:
  - a. The duration of any outage shall be calculated from the time that a functional deficiency is first recognized to the time the deficiency has been corrected to the satisfaction of PIA.
  - b. If an intermittent failure (those which occur and then disappear three (3) or more times) occurs, the problem shall be isolated and repaired. The system shall be considered unavailable while corrective maintenance is being performed.
  - c. Central processor failure not specifically attributed to system hardware malfunctions shall be considered a system failure and downtime shall be accumulated when it occurs at any rate greater than once per week.
  - d. No minimum time shall be charged against any occurrence.
  - e. All time shall be recorded to the nearest minute.
  - f. In the event of the failure of existing equipment, site conditions and / or accidental operator damage to the equipment caused by actions of PIA, its agents or employees, the effect of which is to render the equipment unavailable as described above, the testing shall cease. Upon return to normal operation, the testing shall begin again. No downtime shall be accumulated during this outage.
4. The CCAS shall be considered available under the following conditions:
  - a. Loss of the primary central processor or any on-line memory section or I/O controller attributable specifically to hardware malfunction if backup units or features are automatically activated and all lost functions are successfully transferred to an operating unit without disruption of any real-time functions of the CCAS.
  - b. Loss of either 1 printer or 1 VDT at the SCC attributable specifically to hardware malfunction, if the other display/printing items are operational during the outage.



5. Commencement of the Availability Test shall be mutually agreed upon, but in no event shall it start prior to PIA's receipt and review of all manuals, working drawings and software documentation, unless prior waiver is obtained from PIA. In addition, the test shall not begin until training of PIA's operating personnel has been completed, recommended spare parts purchased by PIA are in stock and all scheduled preventive maintenance has been completed.
6. In the event that the AOT exceeds 22 hours, the start time shall be shifted to delete some of the earliest outages until the accumulated outages during the 1,440-hour test no longer exceed 20 hours. The shifted start date time shall be mutually agreed upon between PIA and the Contractor. No time shift shall be permitted until at least 25 percent (1100 hours) of the test has been completed.
7. A new test shall be started if major modifications are required to either hardware or software in order to conform to specified functional requirements.
8. The CCAS shall be maintained (parts and labor included) by the Contractor at its expense until completion of a successful Availability Test.
9. The Contractor shall provide a service representative on call 24 hours a day, 7 days a week for the duration of the Availability Test. The contractor has an option for on site availability of service representative or other appropriate means to ensure successful availability test as specified.
10. The CCAS must be operating at 100 percent at the end of the test.
11. During the Availability Test:
  - a. Alterations to software shall not be permitted unless required to correct an error and PIA's approval is obtained.
  - b. Alterations to the hardware shall not be permitted unless required to correct a failure or, if in the opinion of the Contractor, such changes will improve system reliability.
  - c. PIA shall be permitted to verify system performance as specified.
  - d. Any redesign or modification to the system that is a result of the Availability Test shall be made to and documented for all equipment supplied under the Contract.

### 3.4 TRAINING AND INSTRUCTION

#### A. General

1. The Contractor shall provide on-site training for operating, servicing and programming personnel designated by PIA and end-users (employees and tenant personnel).
  - a. Operating personnel shall receive detailed instruction in operating procedures, routine preventive maintenance and routine servicing of console and terminal equipment. The training of operating personnel shall be completed prior to the start of the Availability Test.
  - b. Servicing personnel shall receive detailed instruction in principles of operation, setup, adjustment, routine preventive maintenance, diagnosis and corrective repair of all CCAS equipment. The training of servicing personnel shall be completed at least 180 days prior to the end of the maintenance period.
  - c. Programming personnel shall receive detailed instruction in software architecture, addressing and instructions, device capabilities and program capabilities. The training of programmers shall be completed at least 180 days prior to the end of the maintenance period.

- d. End-users shall receive detailed instruction in the operation and use of CCAS access point equipment.
  2. Training shall be conducted by experienced, knowledgeable personnel, supported by modern training aids and shall utilize the actual system being supplied as much as possible. Participants shall receive individual copies of all pertinent technical manuals and documentation which apply specifically to the CCAS hardware and software.
  3. Each training program shall be video-recorded by the Contractor for use by PIA for future training. Record each session on DVD and include 2 copies with the OEAM submittal.
  4. DVD shall be of sufficient video quality such that all personnel and equipment involved with the training can be seen. In addition, the audio quality should be of sufficient quality such that all voices can clearly be heard throughout the recording. If these conditions are not met, the contractor will be required to perform the training and videotaping until these conditions are met.
  5. Training shall be scheduled at the convenience of PIA.
- B. Operator Training
1. Operating personnel must be familiar with the scope, operation and capabilities of the CCAS. This training shall include system concepts, general design features and detailed familiarization with the man machine interface. This training must be reinforced with hands-on experience on all equipment. All operator courses shall be conducted at the site and must be structured to minimize the length of the instructional periods. It shall be necessary to repeat each course several times to accommodate all personnel on each shift.
  2. The Contractor shall provide the operator training for up to 20 of PIA's personnel. This course shall have a duration of at least one (1) week.
- C. Maintenance Training
1. PIA's servicing personnel shall attend courses designed to instruct them in the internal operations of the CCAS hardware and in diagnostic software. It is expected that the courses will be divided into a series pertinent to maintenance and troubleshooting on the console and terminal equipment including the central processors, peripherals and communications hardware and a series pertaining to field devices (IFPs, card readers, CCTV cameras etc.). This will permit selective assignment of personnel by PIA to optimize the skills of the maintenance staff.
  2. Maintenance training courses shall include operation and troubleshooting using both test hardware and diagnostic programs and failure repair of actual system hardware. If actual system hardware is not available, an equivalent hardware system which simulates as closely as possible the system supplied, may be used in the training process.
  3. The maintenance training program offered by the Contractor shall familiarize PIA's personnel with a comprehensive preventive maintenance program structured specifically for the system supplied.
  4. The Contractor shall provide the hardware training for up to 20 of PIA's personnel.
- D. Software Training
1. The Contractor's software training program shall familiarize PIA's programming personnel with off-line and on-line procedures for generation

and modification of programs and the database, operation of peripherals, use of documentation, use of the Programmer's terminal, start-up and shut-down procedures, the use of off-line and on-line diagnostics and other pertinent operating, maintenance and development procedures. The courses shall include:

- a. A course offering a detailed study of the specialized software supplied by the Contractor and the detailed logical structure of all standard software used by the system.
  - b. A course detailing the programming required to expand the database to include new monitored points, new security area access points and new types of I/O devices.
2. The Contractor shall provide the software training for up to 20 of PIA's personnel.
- E. End-user Training
1. Airport employees and tenant personnel shall attend courses designed to instruct them in the proper operation of each access point type and in the use of its associated CCAS equipment. The course shall cover normal and emergency access procedures.
  2. The end-user course shall be repeated a sufficient number of times to accommodate all individuals assigned an ID badge / keycard.
- F. ID Badge / keycard Preparation Training
1. PIA personnel shall attend courses designed to instruct them in the preparation, encoding, printing, and controlling ID badges and Keycards.
  2. The training shall have a minimum duration of one (1) week, and shall occur sixty (60) days prior to activation of the system.
  3. The Contractor shall provide the ID badge / keycard preparation training for up to 20 of PIA's personnel.

### 3.5 MAINTENANCE SERVICES (WARRANTY)

- A. The Contractor shall provide "on-call" warranty maintenance service for all equipment supplied under this Contract for two (2) years after acceptance of the entire CCAS (hardware and software) by PIA. The service shall consist of all material, labor and travel expenses, as indicated in paragraph 1.10 "Maintenance Services" of this section.

END OF SECTION 13700

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

**SECTION 13742 – MULTI-USER  
FLIGHT INFORMATION  
DISPLAY SYSTEM (MUFIDS)**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
1. Display Devices
  2. Computer Control System
  3. Networking Hardware
  4. System Support Hardware
  5. Software
  6. Spare Parts

**1.2 ABBREVIATIONS**

ADA	Americans with Disabilities Act
AODB	Airport operational database
ASP	Application Service Provider
CUTE	Common use terminal equipment
DDC	Device display controller
MUFIDS	Flight Information Display System
GB	Gigabyte (approximately one billion bytes of memory)
GUI	Graphical user interface
IVA	Integrated voice announcement system
IVR	Interactive voice response system
LAN	Local area network
LCD	Liquid crystal display
LED	Light emitting diode
MB	Megabyte (approximately one million bytes of memory)
MUFIDS	Multi-User Flight Information Display System
MUSE	Multi-user system environment
PIA	Peoria International Airport
SNMP	Simple Network Management Protocol
SQL	Structured Query Language
VPN	Virtual Private Network
WYSIWYG	What-you-see-is-what-you-get
XML	Extensible Markup Language
XSL	Extensible Style sheet Language

**1.3 SYSTEM DESCRIPTION**

- A. Flexibility - The system must be scalable and easily adaptable to 3<sup>rd</sup> party additions - including multimedia advertising display and airline host interfaces - utilizing industry standard technologies. The database must be designed to extend through the MUFIDS field and lookup tables
- B. Open - The system must use industry standard language and interface standards language and tools.

- C. Cost Effective - The system provided must require minimal hardware and software overhead and include all necessary software and hardware for a fully functional flight information display system.
- D. Expandability - The system must accommodate application and hardware growth.. Hardware must be expandable by adding additional memory, disk, or processors, as well as by clustering multiple servers.
- E. Easy to Manage and Support - The MUFIDS operating system and database must provide a seamless solution. The MUFIDS provider must provide remote dial-in support to minimize involvement of airport's personnel.
- F. User friendly – The system must be easy to learn and use industry standard interfaces, including pop-up form windows, to minimize learning time. The Visual Page Designer must come supplied with many templates which can be modified in font, style, color, graphics and more
- G. Easy to Maintain – Operation and Maintenance Manuals must be provided for each piece of equipment. Cable pathways and identification must be recorded.

#### 1.4 PERFORMANCE REQUIREMENTS

- A. The MUFIDS shall provide the following functionality:
  - 1. Manage flight schedules and data and distribute it to flight, gate, and baggage information displays throughout the terminal as indicated on drawings.
  - 2. Provide easy-to-use client access capability to allow users, with the appropriate security rights, to update, change, and modify master and daily schedules and security access, and generally administer the operation of the system.
  - 3. Provide a design tool which includes templates and allows a user to modify screen template designs for flat panels and video monitors
  - 4. Provide interface to generate and distribute current and accurate flight information to the Airport's existing Web site and cellular portable devices.
  - 5. Provide visual paging that is easily accessible from the client workstations.
  - 6. Provide an integrated solution to continuously monitor hardware, software application, system and database performance and availability. Provide an integrated automatic notification system to alert Operational, IT, or Administrative Personnel of any failure.
  - 7. Provide interface with each Airline MUFIDS system to receive automated flight information updates.
  - 8. Provide HTTP/XML Web Server for XML Airline Host feeds.
- B. Provide all supports and hardware required to install all devices in neat and workman-like manner. All exposed wiring to the devices shall be limited to final connection points to the devices.
- C. Provide housing and cabinets for display devices as shown on the drawings.

#### 1.5 REFERENCES

- A. Electronic Industries Assn / Telecommunications Industries Assn (EIA/TIA)
  - 1. EIA/TIA 568 Commercial Building Communications Wiring Standards
  - 2. EIA/TIA 569 Commercial Building Standard for Telecommunications Pathways and Spaces
  - 3. EIA/TIA 606A Administrative Standard for Commercial Telecommunications Infrastructure
  - 4. EIA/TIA 607 Commercial Building Bonding and Grounding Requirements for Telecommunications
- B. National Fire Protection Association (NFPA)
  - 1. NFPA 70 National Electric Code (NEC)
- C. Underwriters Laboratories (UL)
  - 1. UL 969 Marking and Labeling Systems

## 1.6 SUBMITTALS

- A. Shop Drawings: Submit complete including:
  - 1. System components detailed drawings and engineering data.
  - 2. Installation instruction for each piece of equipment.
  - 3. 1/8-inch scale, floor plan drawings, rack layouts and riser diagrams indicating detail wiring and system components.
  - 4. Software and firmware information.
- B. Product data in manufacturers catalog cuts, description and drawing components.
- C. Within thirty (30) days of the contract award, the Contractor shall submit a detailed work schedule and approach to the system installation.
- D. Qualification Data: For qualified Installer list experience and certifications. Personnel shall be trained and certified by manufacturer for installation of equipment required for this project.
- E. Software and Firmware Operational Documentation updated at project completion:
  - 1. Software operating and upgrade manuals.
  - 2. Operator Manuals, System Administrator Manual, and the off-the-shelf Manufacturers' Product Documentation.
  - 3. Manufacturer's documentation on the LAN, Operating System, Windows Applications, and database.
  - 4. Program Software Backup on compact disk, complete with data files.
  - 5. Printout of software application and graphic screens.
- F. Display Cabinets: Provide a 1/4" scale shop drawing for the display cabinet. Provide all details indicating the mounting of the specified monitors.

## 1.7 QUALITY ASSURANCE

- A. Installer Qualifications: Firm shall have at least five years successful installation experience with similar FID systems. Personnel shall be trained and certified by manufacturer of equipment required for this project.

- B. Compliance: Comply with the applicable requirements of the referenced standards and specifications.
- C. Source Limitations for FID System and Components: Obtain system from single source from single manufacturer.
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

## 1.8 DELIVERY AND STORAGE

- A. Deliver all materials in manufacturer's packing in undamaged condition.
- B. Store all materials in clean, dry place and protect them from dirt, fumes, water, and physical damage.
- C. Handle components carefully to avoid damage to materials and finish.

## 1.9 WARRANTY AND SUPPORT

- A. The contract shall include a 12 month (one year) warranty for all system software and hardware commencing with completion of the successful reliability test period. Warranty shall include twenty-four (24) hours a day, seven (7) days a week, 365 days a year Help Desk facility for remote hardware and software support, OEM return-to-factory repair, overnight parts replacement, and emergency on-site service. The Help Desk must have a toll-free telephone number and be staffed by the MUFIDS provider's own employees.
  - 1. All hardware support shall be handled via Help Desk support.
  - 2. The MUFIDS provider shall coordinate return-to-factory repair, if applicable.
  - 3. Primary software support will be handled by telephone and dial-up modem by manufacturer's expert technicians at no additional charge during the warranty period.
- B. Provide 24 months (two years) of warranty service in addition to the one year of full warranty on installation. The maintenance agreement shall include site visits at the 3rd month, 12th month and 24th month to update software and restore system performance (total 3 trips).
- C. Software: The upgrade of all software shall be performed at no cost to the Owner during the warranty and maintenance service period. The proposal shall include labor and material for three upgrades. The fixing of errors in the system shall not be considered an upgrade.
  - 1. Provide all software licenses required for the project. All commercial software packages furnished as a part of the system shall have "PIA" as the owner of the software. All original software (CD-Rom, media and documentation) shall be turned over to the Owner with O&M manuals.
  - 2. Technical Support: Commencing with completion of the successful reliability test period, provide software support for three years.
  - 3. Upgrade Service: Update software to latest version at project completion. Install and program software upgrades that become available within three years from date of Substantial Completion. Upgrading software shall

include the operating system. Upgrades shall include new or revised licenses for use of software.

4. Provide thirty (30) days' notice to Owner to allow scheduling and access to system and to allow Owner to upgrade computer equipment if necessary.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide system by Com-Net or comparable product by one of the following:
  1. Com-Net Software Specialty, Inc.
  2. Air IT
  3. INFAX, Inc.
  4. Or approved equal.
- B. Display System Components:
  1. LCD display panel shall be as manufactured by NEC, Philips, Sony, LG, Mitsubishi, Samsung or approved equal. Section 2.6 – Display Devices
  2. Device Display Controller (DDC) shall be a computer as manufactured by Dell, HP, IBM or approved equal per Section 2.5 – MUFIDS Hardware Description.
- C. Control System Products
  1. Control system servers and workstations shall be computers as manufactured by Dell, HP, IBM or approved equal per Section 2.5 – MUFIDS Hardware Description.
  2. All computers including DDCs shall be manufactured by the same manufacturer

### 2.2 SYSTEM OVERVIEW

- A. System Requirements
  1. Whenever possible, the equipment and software specified with this system shall be off-the-shelf products from recognized sources in the industry
- B. System Architecture
  1. The architecture shall be client-server based and use industry-standard, off-the-shelf Internet/Web display tools and technologies. All display applications shall be developed with XML/XSL technology.
  2. The architecture shall be scalable and expandable to accommodate hardware and application changes and growth.
  3. The server operating system shall be Windows 2003 Server.
  4. The client operating system shall be Microsoft Windows XP Professional. Microsoft Internet Explorer shall be installed on each client.
  5. The MUFIDS components shall use existing security network switches. Contractor shall program and utilize VLANs to separate networks. Contractor shall verify no inter-VLAN routing is turned on between the Security network and MUFIDS network. Provide additional network switches as required.



6. The system shall be an open system that connects easily to external systems, such as airline host data feeds and gate management, interactive voice response (IVR), and MUSE/CUTE systems.
  7. The system's annual uptime shall be rated at 99.5% or better.
- C. System Management and Support
1. The system shall include system capability management tools, including Simple Network Management Protocol (SNMP)-compliant hardware and application-level support software. Approved tools include HP Openview or WhatsUp Gold.
  2. The MUFIDS provider must provide VPN or remote dial-in support to minimize involvement of Airport personnel
- D. Database management
1. The MUFIDS operating system and database must provide a seamless solution. The database management software used to store the MUFIDS operational data shall be an industry standard, scalable, reliable, relational, multi-user database, such as Microsoft SQL Server.
  2. The proposed MUFIDS must have the capability such that the MUFIDS provider can add database fields quickly without making changes to the MUFIDS application software or the database scheme.
- E. Operator Access
1. Operators shall access the system using client workstations. Each client workstations shall use XP Professional operating system and shall use Internet Explorer to access the MUFIDS application and flight information on the MUFIDS server. It shall be unnecessary for a MUFIDS client application to be installed on each workstation. An operator with the appropriate user privileges shall be able to access the MUFIDS application on the MUFIDS server from any browser-equipped client workstation on the MUFIDS network.
- F. Output Display Architecture & Formatting
1. Each device display controller (DDC) shall use the Windows XP Professional operating system and shall have its own TCP/IP address on the Ethernet-based LAN. The MUFIDS server transmits information, including public and private page data and miscellaneous system control information, to all display devices.
  2. To reduce network bandwidth and improve screen update speeds, the display device shall update only the areas that have actually changed rather than the entire page.
  3. Display output shall use Web technologies, such as HTML/DHTML for pages on display devices and XML/XSL for portable data transfer and data transformation
- G. Remote Management of DDCs
1. Each device display controller (DDC) shall be accessible using remote management software from the MUFIDS server and Airport Operations Client workstations.
  2. Remote Management shall allow the operator to view and fully interact with each DDCs active desktop.
  3. Remote Management software shall be Radmin 3.2, VNC Enterprise edition or equal.

## 2.3 MUFIDS APPLICATION

- A. The MUFIDS application shall be a Windows 2003 Server-based, browser-based application, such as Com-Net's ECLIPSX system or equal by an approved manufacturer.
- B. Database
  - 1. The MUFIDS application shall use two schedules to maintain flight information: a main (or master) schedule and a daily schedule. The main schedule shall be a long-term schedule from which the daily schedule is generated each day. The daily schedule shall allow the user to easily check schedules from yesterday, today and tomorrow. Both schedules shall be stored in the database and shall be maintained manually and through automated data feeds.
  - 2. The system shall not be designed with hard constraints that would limit the number of flights per day. The number of flights per day shall be only a matter of scalability based upon the hardware platform.
- C. User Interface
  - 1. The user interface shall take advantage of the Windows and Web graphical user interface (GUI) standards as appropriate throughout the system. Whenever possible, pick lists, buttons, and dialog boxes shall be implemented to enhance data entry and reduce data entry time. The user interface shall be designed for ease of use to minimize training time.
  - 2. User Flight Data Input:
    - a. The user shall use the main and the daily schedules to view and modify flight information. To eliminate the need to scroll through a schedule to view or modify data, the user shall be able to open a form-like dialog box. The dialog box shall allow the user to enter and modify easily all information that is associated with a particular flight in the schedule.
  - 3. User Definable Interface:
    - a. The user shall be able to customize the appearance of the user interface based upon roles and individual needs. The user shall be able to filter the data displayed in main and daily schedules to only those fields that he wants to view, such as city, gate, and actual time.
    - b. The user shall be able to customize the appearance of the user interface by changing the character and background colors of the user interface. The system shall retain each user's customizations, so that they are available to the user at any client workstation.
  - 4. Display Attributes:
    - a. The user interface shall provide an easy-to-use tool to modify the display attributes of flight information. Depending on the capabilities of the display device (that is, flat panel display, monitor, LED) the user shall be able to display text as bold, underlined, italicized, and blinking or foreground or background text color change. For example, the user shall be able to change the flight status "boarding" to display as blinking text. The user shall be able to select the attributes from easy to use pick lists.
  - 5. Canned Reports:
    - a. The user interface shall allow the user to easily generate, view, and print standard reports containing on-time statistics and gate

utilization, daily flight, and flight audit information. Only authorized users shall have access to the reporting feature

- D. Video Scheduling
  - 1. The MUFIDS software shall provide a fully integrated video scheduling system with tracking and reporting for billing purposes, to display full-motion advertising videos on flat panel displays and video monitors during owner determined timeframes.
- E. Report Generator
  - 1. A report generator shall be included with the MUFIDS. The report generator shall provide the ability to generate, and print custom information reports, using any data defined in the SQL database. Only authorized users shall have access to the reporting feature.
- F. World-Wide-Web Integration
  - 1. The MUFIDS software shall generate and distribute current and accurate flight information in HTML or XML format to the Airport's existing Web site. MUFIDS information shall be updated automatically
- G. MUFIDS Monitoring
  - 1. An integrated monitoring application shall be included to continuously monitor application, system, and database performance and availability. The monitoring application shall query the system's DDCs using SNMP methods. Other devices, such as print servers, shall also be monitored for availability.
  - 2. The monitoring application shall provide visual feedback and must be capable of automatically notifying the MUFIDS provider's Help Desk Facility if a failure occurs. A failure is defined as a minor event, such as a DDC failure, or a major event, such as server failure.
  - 3. The monitoring application shall allow a system administrator to configure the severity levels of error codes, the types of alerts, which diagnostic items you want to monitor, and the frequency level of each diagnostic check.
  - 4. Notification capabilities shall include e-mail, pager, network messaging, and SNMP forwarding to a higher-level network monitoring system.
- H. Visual Paging
  - 1. The visual paging system must be a user friendly, integrated component of the MUFIDS client application. To create and display messages, the user shall be able to access the paging function from any client workstation.
  - 2. The visual paging system shall provide a method of displaying a visual paging message, emergency messages, and other visual information to hearing-impaired travelers, accurately and completely via dynamic electronic display media. The visual paging system is intended for disabled passenger information paging and emergency messages only.
  - 3. Free format messages shall be limited to text messages only. No animation display mode shall be used.
  - 4. The user must have the option to display messages immediately or to schedule messages for timed display. Scheduling must allow the user to specify starting day and time and ending day and time.

5. The visual paging system must allow messages to be prioritized. These priorities control which messages get displayed first when there is not enough space to display all messages.
  6. The system shall provide predefined messages that the user can select with point-and-click mouse action and use "as is" or modify as necessary. These predefined messages will be maintained in the system database.
- I. Airline Host Data Feeds
1. A host data feed allows an airline to download its flight data to the MUFIDS database. The MUFIDS shall interface to and download flight data from host data feeds from the following airlines and their partner airlines:
    - a. American
    - b. Delta
    - c. United
    - d. Allegiant
  2. Contractor shall contact each airline a minimum of 45 days prior to interfacing to allow for Airline provided equipment and configurations.
  3. Contractor shall provide an HTTP server with customized web services for XML host data feeds.
- J. Security
1. The MUFIDS shall support a minimum of 25 security levels. The system administrator shall be able to configure access restrictions for each user level.
  2. Users shall have to log on the system by entering a user name and password, which shall be verified by the system.
  3. Only the system administrator shall have rights to add and delete users, modify user rights, and access user names and passwords.
  4. The system administrator shall be able to restrict a user's rights to any aspect of the MUFIDS, including specific airlines or multiple airlines, specific fields of information in the main and daily schedules, and read-only and read / write permissions.
  5. The system administrator shall be able to define rights for single users and to establish roles for a group of users
- K. System Administrator Controls
1. The system administrator shall have exclusive access for the modification of system parameters, system time, and system date. The MUFIDS shall allow the system administrator to control access to the system in a number of areas. The system manager shall have the capability to issue and control the user names and passwords needed by users to access the features and functions of the MUFIDS. The system administrator shall have the ability to limit user access to flight data to an individual operator or a group of operators.
  2. Additional menu items and entry screens shall be made available to the system administrator who will maintain various databases that are associated with MUFIDS operation. Data shall include (but not necessarily be limited to):
    - a. IATA Code / City Name
    - b. Airline Code / Airline
    - c. Status Code / Status Explanation
    - d. Remark Code / Remarks Text
    - e. Gate Remark Code / Gate Remark Text

- L. Auditing
1. The MUFIDS shall provide an audit trail of all transactions. The audit trail in the form of a report shall indicate any changes that occurred to any of the databases and shall contain the date and time of the change, the user identification of the user who made the change, and the contents of the changed record.
- M. Announcement Control System (ACS)
1. The MUFIDS system shall support an MUFIDS to ACS interface. This interface shall enable the Announcement Control System "Public Address" system to utilize MUFIDS information and for the Visual Paging/MUFIDS to utilize the ACS information.
  2. The MUFIDS interface shall enable the ACS system to automatically share MUFIDS database information to ensure Flight Announcement System data is updated and accurate. As flight information is updated in the MUFIDS, this information shall automatically be transferred to the ACS database to prevent the need for duplicate data entry. The following minimum information shall be passed from the MUFIDS to the ACS:
    - a. Primary Airline.
    - b. Flight Number.
    - c. Effective Date.
    - d. Discontinued Date.
    - e. Operation Days of Week.
    - f. Scheduled Arrival Time.
    - g. Estimated Arrival Time.
    - h. Arrival Cities.
    - i. Scheduled Departure Time.
    - j. Estimated Departure Time.
    - k. Departure Cities.
    - l. Gate.
    - m. Baggage Carousel.
    - n. Codeshare Airlines.
    - o. Codeshare Flight Numbers.
    - p. Equipment Used (type of aircraft).
    - q. Gate ID (date / time gate usage starts / stops).
    - r. Baggage Carousel ID (date / time carousel usage starts / stops).
    - s. Frequent Flyer Miles (if available).
    - t. Miscellaneous Audio Take Index (for compensation for overbooking, etc.) (if available).
  2. The MUFIDS interface shall also transmit the airport Master Clock System data from Master Clock Network Time Protocol (NTP) Servers (or similar mutually acceptable protocol) to enable the various components of the ACS to be synchronized with other special systems in the terminal. The following information shall be requested by the ACS components via NTP over Ethernet:
    - a. Current Date and Time.
  3. Data shall be passed from the MUFIDS to the ACS using a multiple one-way a two-way interface on a standard Ethernet connection utilizing one of the following methods:

- a. Built-in features of message queuing (MQ) to guarantee delivery of messages, persistence in the event of power outages and other interruptions, via Microsoft's version of MQ, MSMQ. Message content placed in the queue shall be XML (eXtensible Markup Language) compliant text; or
- b. A standard (proprietary) asynchronous message (using the UDP part of the TCP/IP).
- c. Data transfers will be monitored and logged within the MUFIDS, including transfer and completion times. The paging system shall inform the MUFIDS that data has been successfully received.

## 2.4 SCREEN DESIGN APPLICATION

- A. The approved solution shall incorporate templates that can be modified by incorporating text, graphics, full-motion video clips, and even Web sites.

At anytime during the design process, the screen designer shall allow the user to easily preview the screen design, using actual MUFIDS data

- B. Display Pages and Devices:
  - 1. The screen designer shall be capable of modifying any type of display template; for example, a public arrival screen or gate departure screen. The screen designer shall accommodate page design for monitors, and flat panel displays. The screen designer shall include templates of single pages and split screens, for various aspect ratios and display resolutions, including aspect ratios of 16:9 and 4:3 and their varied corresponding resolutions
- C. Designer Tools
  - 1. The screen designer shall supply tools that allow the user to cut, copy, and paste both text and graphics.
  - 2. The user shall be able to place, drag, and size fields that allow graphics, text, columns of text, full-motion video clips, and even Web sites on a page. The user shall be able to reposition and resize these fields with ease. The screen designer shall include features, such as grid lines, sizing handles, and snap-to-grid action, for the easy placement and dynamic sizing of images, rows and text
- D. Screen Designer Features
  - 1. The screen designer shall offer a variety of Windows fonts and point sizes, and allow the user to specify bold, underlined, and blinking text.
  - 2. Background and text colors shall be adjustable and shall be selectable from a palette of 16 million colors.
  - 3. The user shall be able to add time of day and date to each display page
- E. Graphics and Wallpaper
  - 1. The screen designer shall allow the user to easily select and insert graphical images of a standard format; that is, JPG, PCX, BMP, and GIF. It shall allow multiple images to be placed on a page.
  - 2. The screen designer shall allow the user to easily select and insert background wallpaper graphical images of a standard format; that is, JPG, PCX, BMP, and GIF. It shall allow text and graphics to be placed over the wallpaper

- F. Full-Motion Video
  - 1. The screen designer shall allow the user to easily select and insert full-motion video clips on a flat panel display or monitor page.
- G. Web pages
  - 1. The screen designer shall allow the user to easily select and insert a Web site URL to display an actual Web page on a flat panel display or monitor page
- H. Additional Features
  - 1. The screen designer shall accommodate code sharing on a display by allowing the user to display airline logos or names and flight numbers and cities on the same line or on separate lines or by using a transition that alternately displays code-sharing information, fading from one to the other.
  - 2. The screen designer shall provide templates that have split-screen displays. Screens must be able to be split into two, three, or four sections for a different display of information in each section. Each section must be individually addressable.
  - 3. Page templates should be available to ensure uniformity in the appearance of displays throughout the Airport
- I. Live Data Display
  - 1. At anytime during the design process, the screen designer shall allow the user to easily preview the screen design, using actual MUFIDS data.
- J. Templates
  - 1. Include in the scope of work for the production of six templates (3 MUFIDS and 3 BIDS) to be available no later than 30 days before the installation. The Airport administration will provide digitized graphics to be placed into the software for display throughout the system.

## 2.5 MUFIDS HARDWARE DESCRIPTION

- A. MUFIDS Server
  - 1. The MUFIDS server shall be Windows 2003-certified computers.
  - 2. MUFIDS Server shall be redundant server configuration.
  - 3. At a minimum, the servers shall include the following:
    - a. Dual-Core Intel Xeon 5160, 3.0GHz
    - b. 1 GB 667MHz (2 x 512MB), Single Ranked DIMMs
    - c. (3) 80GB 7.2K RPM Serial ATA 3GB/s Hard Drives in a RAID5 configuration
    - d. Dual 10/100/1000 Ethernet network interface cards
    - e. 24X CD-RW/DVD ROM
    - f. 4USB 2.0 Ports
    - g. 2U Rackmounted Chassis
    - h. Windows Server 2003, R2, Standard Edition with SP2 and CALS as required.
    - i. Dell PowerEdge 2950 III or equal.
- B. Client Workstation
  - 1. The client workstations shall be Windows XP-certified computers.
  - 2. At a minimum, each client workstation shall include the following:
    - a. Pentium processor, 3.0GHz, 512MB RAM, or greater

- b. 80GB hard drive
- c. Ethernet network interface card (100/1000)
- d. Keyboard, mouse
- e. 17-inch LCD-TFT flat panel monitor
- f. 48X CD-R/RW/DVD-ROM Combo drive
- g. 2 USB 2.0 Ports
- h. Small or Ultra Small Form Factor Chassis.

C. Device Display Controller (DDC)

1. Device Display Controller (DDC) computers will provide the interface between the data network and the display devices. DDCs will decode the data and generate the necessary control signals to drive the display devices.
2. DDCs shall be Windows XP-certified computers. Each DDC must be capable of being upgraded with the addition of video cards, to drive one to four display devices.
3. The minimum DDC specifications are as follows:
  - a. Intel Core 2 Duo E8400 3.0 GHz, 6MB, 1333 FSB
  - b. 2GB DDR2 Non-ECC SDRAM, 800MHz
  - c. 80GB SATA 3.0Gb/s, 8MB Cache hard drive
  - d. 10/100/1000 Ethernet network interface
  - e. 8X DVD+/-RW drive, SATA
  - f. 90% Efficient Power Supply
  - g. PCIe riser for Full Height/Half Length Card Support if required.
  - h. 512MB NVIDIA NVS 420 PCIe with quad DVI output or approved equivalent
  - i. 4 USB 2.0 Ports
  - j. Rackmount Shelf
  - k. DDC shall be Dell Optiplex 960 Desktop, SFF or equal.
  - l. Connect DDC onboard video to KVM.
4. DDCs shall use DVI over CAT6 Video Extenders for video distribution to monitors. The minimum video extender specifications are as follows:
  - a. Video Transmitter
    1. Video Support: DVI UXGA
    2. Resolution: 1600 x 1200 @ 60 Hz & HD modes
    3. Rackmountable Kit, 1U (3 TX units) OR 2U (6 TX units)
    4. Transmitter shall be Magenta Infinea DVI Tx UTP or equal.
  - b. Video Receiver
    1. Video Support: DVI UXGA
    2. Resolution: 1600 x 1200 @ 60 Hz & HD modes
    3. Distance: 500 ft.
    4. Receiver shall be Magenta Infinea DVI Rx UTP or equal.

D. HTTP Server

1. A HTTP server shall be provided to handle XML Posts and Requests from Airline Host feeds that support XML.
2. Contractor shall create XML Web Services as required to interface each airline host feed.
3. HTTP Server shall be located behind a firewall in a DMZ.
4. HTTP Server shall be hosted on a non standard port in the range of 1024-9999 unless standard port is required by airline feed.
5. Coordinate with network scope.
6. HTTP Server shall run Apache Server 2.2 or Microsoft IIS 5.1 HTTP Services.



7. The HTTP server shall be Windows XP-certified.  
The minimum HTTP Server specifications are as follows:
  - a. Intel Pentium Dual Core E2180 2.0 GHz, 1MB, 800 FSB
  - b. 1GB DDR2 Non-ECC SDRAM, 677MHz
  - c. 80GB SATA 3.0Gb/s, 8MB Cache hard drive
  - d. 10/100/1000 Ethernet network interface
  - e. 48X CD-ROM drive, SATA
  - f. Integrated Video Graphics
  - g. 4 USB 2.0 Ports
  - h. Rackmount Shelf
  - i. DDC shall be Dell Optiplex 755 Desktop or equal.
  - j. Connect HTTP Server to KVM.
- E. Network Hardware
  1. See Network Scope on sheet E6-04.
- F. KVM (Keyboard, Video Mouse)
  1. Contractor shall connect to 17" LCD w/ KVM in the MDF rack as indicated on E5-02.
- G. Gate Departure Control System
  1. The gate departure control system shall display gate-specific flight departure information. The system shall be controlled from the MUFIDS server. A micro-terminal shall allow podium personnel to modify and update flight information.
  2. The system shall utilize a display device, numeric-key input micro-terminal, and a DDC. Provide display devices as shown on the drawings.
  3. The display device shall display the following information: airline logo (full graphics), flight number, airline designator, departure time, status, and remarks. The DDC shall have sufficient memory capacity to store a minimum of 250 logos and images.
  4. The display devices shall operate automatically, displaying the correct data from the MUFIDS server.
  5. There shall be one display device, DDC, and micro-terminal provided at each podium position as indicated on the drawings.

Selective inputs made at the gate micro-terminals shall change the MUFIDS database and all other displays on the airport system. The gate micro-terminals shall be capable of changing flight status fields, actual times and / or gate remarks.

## 2.6 DISPLAY DEVICES

- A. LCD Flat Panel Displays. The flat panel LCD displays shall be as manufactured by NEC, Mitsubishi, Samsung, LG, Philips or approved equal. The units shall not cause any permanent image burn-in. The displays shall have multi-screen capabilities and full motion video. Contractor shall present various multiscreen options to "PIA" for approval. The screen layout configurations shown on the drawings are for example only. "PIA" will select final configuration after the presentation.
- B. See plans for model numbers.

- C. Provide supports and mounting brackets for all monitors as indicated on the drawings.

## 2.7 SPARE PARTS:

- A. Provide the following spare parts.
  1. One (1) DDC controllers.
  2. One (1) LCD Monitor of each size used.
  3. Two (2) Video Extender kits.

## PART 3 - EXECUTION

### 3.1 PLANNING

- A. Prior to beginning of the work detailed planning and lay-out shall be performed to meet schedule and ensure proper installation of MUFID system.
- B. The MUFIDS Contractor shall plan conduit layout, power requirements, exact termination of the conduit and wiring to provide clean installation. No surface mounted conduit shall be installed without prior approval of Architect / Engineer.

### 3.2 COORDINATION

- A. The Contractor shall coordinate all work efforts with the Owner, A/E and other trades. The phasing-in schedule for the new system shall be submitted within 30 days of the contract award for approval.
- B. Conduit pathways and cable identification shall be coordinated with other contractors and A/E.

### 3.3 EQUIPMENT INSTALLATION

- A. The contractor shall provide all supports and installation hardware for the equipment furnished under the contract. The installation shall be in neat and workmanlike manner. The exact monitor location, height and other items shall be field coordinated with the A/E and owner.
- B. Locations of all cutting and patching shall be approved by the Architect / Engineer and Owner. All repairs must match the surrounding surfaces.
- C. Install all equipment in accordance with the manufacturer's written instructions.
- D. Install a complete and operational MUFID System.

### 3.4 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Division 16 Section "Electrical Identification."
- B. Provide 'as-built' record of wiring pathways and cable identification in dwf or dwg CAD format on CD.

### 3.5 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing. Field tests shall be witnessed by Design Engineer or designated alternate.
- B. Visual Inspection: Conduct visual inspection prior to testing.

### 3.6 FINAL TESTS AND DEMONSTRATION

- A. Final tests and inspection shall be held in the presence of Architect/Engineers and Owner's representatives and to their satisfaction. The Contractor shall supply personnel and required auxiliary equipment for this test without additional cost.
- B. Conduct reliability test for two months to indicate compliance with 99.5 percent system reliability requirements. The reliability shall be determined as follows:  
Reliability Test
  - 1. The Contractor shall demonstrate a continuous operation of the MUFIDS at the site over a period of 1,440 hours (60 days) with an availability of 99.5 percent or more to include all supplied hardware and software. This shall be demonstrated after the Acceptance Test of the MUFIDS.
  - 2. Availability shall be calculated as follows:  

$$\text{Availability} = \text{Percent } \frac{(\text{TDT} - \text{AOT}) \times 100}{\text{TDT}}$$
    - a. Test Duration Time (TDT) is the total elapsed time from start of the test to completion of the test. This time shall be a minimum of 1,440 hours.
    - b. Downtime shall be calculated according to the following rules:
  - 3. The duration of any outage shall be calculated from the time that a functional deficiency is first recognized to the time the deficiency has been corrected to the satisfaction of "PIA".
  - 4. If an intermittent failure (those which occur and then disappear 3 or more times) occurs, the problem shall be isolated and repaired. The system shall be considered unavailable while corrective maintenance is being performed.
  - 5. Central processor failure not specifically attributed to system hardware malfunctions shall be considered a system failure and downtime shall be accumulated when it occurs at any rate greater than once per week.
  - 6. No minimum time shall be charged against any occurrence.
  - 7. All time shall be recorded to the nearest minute.
  - 8. In the event of the failure of existing equipment, site conditions and / or accidental operator damage to the equipment caused by actions of "PIA", its agents or employees, the effect of which is to render the equipment unavailable as described above, the testing shall cease. Upon return to normal operation, the testing shall resume again. No downtime shall be accumulated during this outage.
- C. Test Report: A copy of the test report shall be submitted documenting the test procedure and detail results, indicating proper functioning of system, and conformance to the specifications. System shall be left in operating condition.

### 3.7 TRAINING

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain MUFID system.
- B. The MUFIDS contractor shall provide 2 day(s) of on-site training for the airport staff on each operating shift. Each class shall contain both lecture discussions and hands-on experience and shall last approximately three to four hours. Each class shall be no larger than ten (10) students
- C. Provide one 12 hour training for airport personnel. The training shall be video recorded for future use and shall include the following.
  - 1. MUFIDS operation.
  - 2. Review the documentation and software submitted to test and manage the system.
  - 3. Operation of network equipment.
  - 4. Review maintenance procedures, labeling orientation, communication closets and equipment rooms.
  - 5. Trouble shooting of signal and power cabling.
  - 6. The training shall be conducted by qualified personnel. Submit qualification of the trainer for approval by Architect / Engineer.
- D. Send a letter to the Owner, for Owner's signature, acknowledging that instruction in system operation has been received. One copy to be retained by Owner and one copy sent to Contractor.

END OF SECTION 13742

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

**SECTION 13915 - FIRE PROTECTION  
SUPPRESSION PIPING**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. This Section includes general requirements for valves, piping and appurtenances for the following water based fire suppression systems:
  - 1. Standpipe, sprinkler and combined risers and cross mains.
  - 2. Sprinkler main and branch piping downstream of the floor control valve.
  - 3. Automatic, semi-automatic, and manual water based suppression systems including wet-pipe, dry-pipe and pre-action systems.

**1.2 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Related Sections include the following:
  - 1. Division 2 Section 02510 "Water Distribution".
  - 2. Division 7 Section 07270 "Firestopping".
  - 3. Division 9 Section 09910 "Painting".
  - 4. Division 13 Section 13050 "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 pip, 175-psig (1200-kPa) pressure rating; with steel housing, butylene O-rings, and pipe stop. Include UL 45-listed fitting manufacturer's pressure-sealing tools.

J. Cast-Copper:

1. Cast Alloy Fittings: ASME B16.18.
2. Wrought-Copper Fittings: ASME B16.22.
3. Cast-Bronze Flanges: ASME B16.24.
4. Copper, Grooved-End Fittings: ASTM B 75 (ASTM B 75M), copper tube or ASTM B 584, bronze castings. Fittings may be copper tube with ends factory or field expanded to steel-pipe OD.
5. Copper, Keyed Couplings: UL 213 and equivalent to AWWA C606, for copper-tube dimensions. Include ASTM A 47 (ASTM A 47M), malleable-iron or ASTM A 536, ductile-iron housing with copper-colored enamel finish, rubber gaskets, and steel bolts and nuts.

- K. Transition Couplings: AWWA C219, sleeve type, or other manufactured fitting the same size as, with pressure rating at least equal to, and with ends compatible with piping to be joined.

## 2.11 JOINING MATERIALS

- A. Refer to Division 13 Section 13053 "Fire Protection 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

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

**SECTION 13921 - ELECTRIC-DRIVEN  
HORIZONTAL FIRE PUMPS**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

- A. This Section includes electric-drive, horizontal fire pumps for building fire-suppression systems and the following:
  - 1. Split-case fire pumps.
  - 2. Pressure-maintenance pumps.
  - 3. Full-service, fire-pump controllers.
  - 4. Automatic transfer switches.
  - 5. Pressure-maintenance-pump controllers.
  - 6. Fire-pump specialties and accessories.
  - 7. Pressure-maintenance-pump specialties and accessories.
  - 8. Alarm panels.
  - 9. Flow-measuring systems.
- B. Related Sections include the following:
  - 1. Division 13 Section 13915 "Fire-Suppression Piping" for feed-main, fire-suppression piping at fire pumps.
  - 2. Division 13 Section 13916 "Fire-Suppression Sprinklers" for feed-main, fire-suppression piping at fire pumps.
  - 3. Division 13 Section 13975 "Standpipes and Hoses" for feed-main, fire-suppression piping at fire pumps.
  - 4. Division 16 Section "Fire Alarm Systems" for connection to alarm panel.
  - 5. Division 16 Sections for power and connections to fire-pump and pressure-maintenance-pump controllers.

**1.3 DEFINITIONS**

- A. End-Suction Fire Pump: Radially split-case, horizontal fire pump with suction nozzle on side of casing opposite stuffing box and flange of discharge nozzle perpendicular to longitudinal axis of shaft.
- B. Fire Pump: Horizontal-type fire pump used to supply water at rated capacity and total head required for fire-suppression service.
- C. Fire-Pump Unit: Assembly with fire pump, driver, controller, and related accessories.

- D. In-Line Fire Pump: Radially split-case, horizontal fire pump with drive unit supported by pump, suction and discharge flanges on same centerline, and pump shaft in vertical position.
- E. Pressure-Maintenance Pump: Electric-drive pump used to maintain water pressure in fire-suppression piping system.
- F. Pressure-Maintenance-Pump Unit: Assembly with pressure-maintenance pump, driver, controller, and related accessories.
- G. Residential Fire-Pump Unit: Packaged assembly with fire pump, driver, controller, piping, and related accessories.
- H. Split-Case Fire Pump: Axially split-case, horizontal fire pump with its housing split parallel to shaft.

#### 1.4 SYSTEM PERFORMANCE REQUIREMENTS

- A. Fire-Pump Systems: Fire-pump and pressure-maintenance-pump units that comply with performance requirements specified and are compatible with building fire-suppression systems.
- B. Pump, Equipment, Accessory, and Piping Pressure Rating: **175-psig (1200-kPa)** minimum working-pressure rating, unless higher rating is indicated.

#### 1.5 SUBMITTALS

- A. Product Data: Include rated capacities; certified pump performance curves with each selection point indicated; shipping, installed, and operating weights; furnished specialties; and accessories for each fire-pump and pressure-maintenance-pump unit and flow-measuring system.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, methods of field assembly, components, and location and size of each field connection for each fire-pump and pressure-maintenance-pump unit.
  - 1. Wiring Diagrams: Detail wiring for power, signal, and control systems and differentiate between manufacturer-installed and field-installed wiring.
  - 2. Shop Drawings may be incorporated into other Division 13 Section 13915 "Fire-Suppression Piping System" Shop Drawings.
- C. Product Certificates: Signed by manufacturers of fire pumps and fire-pump controllers certifying that products furnished comply with requirements.
- D. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.
- E. Maintenance Data: For each fire-pump and pressure-maintenance-pump unit to include in maintenance manuals specified in Division 1.

#### 1.6 QUALITY ASSURANCE

- A. **Manufacturer Qualifications:** Firms whose fire pumps, pressure-maintenance pumps, drivers, controllers, and accessories are listed by product name and manufacturer in UL's "Fire Protection Equipment Directory" and FM's "Fire Protection Approval Guide" and that comply with requirements indicated. The following are exceptions and are not required:
  - 1. UL listing and FM approval of pressure-maintenance pumps.
  - 2. FM approval of residential fire pumps and controllers.
  - 3. FM approval of pressure-maintenance-pump controllers.
  - 4. UL listing of flow-measuring systems.
  - 5. Either UL listing or FM approval, but not both, if product otherwise complies with specifications.
- B. **Source Limitations:** Obtain fire-pump and pressure-maintenance-pump units through one source with responsibility and accountability to respond to and resolve problems regarding compatibility, installation, performance, and acceptance of units.
- C. **Product Options:** Drawings indicate size, profiles, connections, and dimensional requirements of fire-pump and pressure-maintenance-pump units and are based on specific models indicated. Other manufacturers' pump units with equal performance characteristics may be considered. Refer to Division 1 Section "Substitutions."
- D. **Provide listing/approval stamp, label, or other marking on equipment made to specified standards.**
- E. **Electrical Components, Devices, and Accessories:** Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.
- F. **Comply with standards of authorities having jurisdiction pertaining to materials, hose threads, and installation.**
- G. **Comply with NFPA 20, "Centrifugal Fire Pumps," for fire pumps, drivers, controllers, accessories, and installation.**

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. **Preparation for Shipping:** After assembling and testing fire pumps and pressure-maintenance pumps, protect flanges and exposed machined metal surfaces, pipe openings, and nozzles.
- B. **Retain shipping flange protective covers and protective coatings during storage.**
- C. **Protect bearings and couplings against damage from sand, grit, or other foreign matter.**

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Single-Stage, Horizontally Mounted, Split-Case Fire Pumps:
    - a. Armstrong Darling, Inc.
    - b. Fairbanks Morse Pump Corp.
    - c. General Signal Pump Group; Aurora Pump Unit.
    - d. ITT Fluid Technology Corp.; ITT A-C Pump Unit.
    - e. Paco Pumps, Inc.
    - f. Patterson Pump Co.
    - g. Peerless Pump Co.
    - h. Reddy-Buffaloes Pump, Inc.
  - 2. Multistage, Pressure-Maintenance Pumps:
    - a. Grundfos Pumps Corp.
    - b. Jacuzzi Brothers.
    - c. Paco Pumps, Inc.
    - d. Peerless Pump Co.
    - e. Taco, Inc.
  - 3. Fire-Pump Controllers:
    - a. Firetrol, Inc.
    - b. Hubbell Industrial Controls, Inc.
    - c. Joslyn Clark Controls, Inc.
    - d. Master Control Systems, Inc.
    - e. Metron, Inc.
  - 4. Pressure-Maintenance-Pump Controllers:
    - a. Firetrol, Inc.
    - b. Hubbell Industrial Controls, Inc.
    - c. Joslyn Clark Controls, Inc.
    - d. Master Control Systems, Inc.
    - e. Metron, Inc.
  - 5. Alarm Panels:
    - a. Firetrol, Inc.
    - b. Hubbell Industrial Controls, Inc.
    - c. Joslyn Clark Controls, Inc.
    - d. Master Control Systems, Inc.
    - e. Metron, Inc.
  - 6. Flow-Measuring Systems:
    - a. Dieterich Standard Corp.

- b. Gerand Engineering Co.
- c. Hyspan Precision Products, Inc.
- d. Preso Industries, Ltd.
- e. Reddy-Buffaloes Pump, Inc.
- f. Scott Fetzer Co.; Meriam Instrument Div.
- g. Victaulic Company of America.

## 2.2 GENERAL

- A. Fire Pumps: Provide factory tested pumps thoroughly cleaned and painted with machinery enamel prior to shipment.
- B. The pumps shall be hydrostatically tested to twice the working pressure, but in no case less than 250 psig. Prior to shipment, the pump, motor and controller shall be thoroughly shop tested by the manufacturer. A characteristic curve of pump performance from the test results shall be drawn and furnished to the Architect and Engineer.
- C. Provide fire pump systems that include fire pump units, pressure-maintenance pump units, accessories, and piping that comply with performance requirements specified and are compatible with building fire protection systems. Refer to schedule on drawings for pump capacities and characteristics.

## 2.3 SPLIT-CASE FIRE PUMPS

- A. Single-Stage, Horizontally Mounted, Split-Case Fire Pumps: UL 448, factory-assembled and -tested, electric-drive, double-suction, horizontal type. Include pump and driver mounted on same base and connected with coupling.

## 2.4 PRESSURE-MAINTENANCE PUMPS (JOCKEY PUMP)

- A. Description: Factory-assembled and -tested, electric-drive pumps with cast-iron or stainless-steel casing and bronze or stainless-steel impellers and mechanical seals. Include flanged suction and discharge flanges machined to ASME B16.1, Class 125 dimensions, unless Class 250 flanges are indicated and except that connections may be threaded in sizes where flanges are not available.
  - 1. Multistage, Pressure-Maintenance Pumps: Multiple-impeller type complying with HI 1.1-1.5 requirements for multistage centrifugal pumps. Include base.

## 2.5 PUMP DRIVERS

- A. Description: NEMA MG 1, open-dripproof, squirrel-cage, induction motor. Include construction complying with NFPA 20 and NFPA 70, and include wiring compatible with controller used.
  - 1. Finish: Manufacturer's standard red paint applied to factory-assembled and -tested unit before shipping.
  - 2. Nameplate: Complete with motor horsepower, characteristics, and other pertinent data.



## 2.6 PUMP CONTROLLERS, GENERAL

- A. Description: Combined automatic and nonautomatic operation; factory assembled and wired; factory tested for capacities and electrical characteristics; and with the following features:
1. Enclosure: UL 50, Type 2, dripproof, indoor, unless special-purpose enclosure is indicated.
  2. Controls, devices, alarms, functions, and operations listed in NFPA 20 as required for drivers and controller types used, and specific items listed for each controller type.
  3. Nameplate: Complete with capacity, characteristics, approvals and listings, and other pertinent data.
  4. Controller Sensing Pipes: Fabricate pipe and fittings according to NFPA 20 with nonferrous-metal sensing piping, **NPS 1/2 (DN15)**, with globe valves for testing controller mechanism from system to pump controller as indicated. Include bronze check valve with **3/32-inch (2.4-mm)** orifice in clapper or ground-face union with noncorrosive diaphragm having **3/32-inch (2.4-mm)** orifice.

## 2.7 FULL-SERVICE, FIRE-PUMP CONTROLLERS

- A. Description: UL 218 and NFPA 20; listed for electric-drive, fire-pump service and service entrance.
- B. The motor control equipment shall be completely assembled, wired and tested at the factory. The controller shall be the manual wound rotor speed regulating type built according to NFPA Pamphlet 20 standards.
1. Type Starting: Wye-delta, closed transition.
- C. Rate controllers for scheduled horsepower. Include short-circuit withstand rating at least equal to short-circuit current available at controller location. Take into account cable size and distance from substation or supply transformers.
- D. Automatic Transfer Switches: UL 218 and UL 1008 and requirements for and attached to fire-pump controllers. Include enclosure complying with UL 50, Type 2, with automatic transfer switch with rating at least equal to fire-pump driver-motor horsepower. Include ampere rating not less than 115 percent of motor full-load current and suitable for switching motor-locked rotor current. (i.e. - 600% of motor full load current).
- E. Controllers: As follows:
1. Isolating means and circuit breaker.
  2. "Power on" pilot lamp.
  3. Fire alarm system connections for indicating motor running condition, loss-of-line power, and line-power phase reversal.
  4. Automatic and manual operation, and minimum run-time relay to prevent short cycling.
  5. Water-pressure-actuated switch with independent high and low calibrated adjustments responsive to water pressure in fire-suppression system.
  6. Automatic and manual shutdown.

7. System pressure recorder, electric ac driven with spring backup.
8. Mounting: Wall type for field electrical connections.
9. Enclosure Finish: Manufacturer's standard red paint applied to factory-assembled and -tested unit before shipping.
10. Circuit breakers shall have minimum interrupting capacities as follows:
  - a. For pump motors up to 50 HP
    - 1) 30,000 amps symmetrical at 460 (480) volts
    - 2) 42,000 amps symmetrical at 200 (208) volts
  - b. For pump motors over 50 HP
    - 1) 150,000 amps symmetrical at all voltages.

## 2.8 PRESSURE-MAINTENANCE-PUMP CONTROLLERS

- A. Description: UL 508; factory-assembled, -wired, and -tested across-the-line type for combined automatic and nonautomatic operation.
  1. Enclosure: UL 508 and NEMA 250, Type 2, wall-mounting type for field electrical wiring. Rate controller for scheduled horsepower (KW) and include the following:
    2. Fusible disconnect switch.
    3. Pressure switch. (adjustable high and low pressure)
    4. Hand-off-auto selector switch.
    5. Pilot light.
    6. Running period timer.
  7. Enclosure Finish: Manufacturer's standard color paint applied to factory-assembled and -tested unit before shipping.

## 2.9 FIRE-PUMP SPECIALTIES AND ACCESSORIES

- A. Match fire-pump suction and discharge ratings as required for fire-pump capacity rating. Include the following:
  1. Automatic air-release valve.
  2. Circulation relief valve.
  3. Suction and discharge pressure gages.
  4. Eccentric-tapered reducer at suction inlet.
  5. Concentric-tapered reducer at discharge outlet.
  6. Test-Header Manifold: Ductile-iron or brass body for hose valves. Include nozzle outlets arranged in single line; horizontal, flush-wall mounting attachment; and rectangular, brass escutcheon plate with lettering equivalent to "PUMP TEST CONNECTION."
    - a. Escutcheon Plate Finish: Polished chrome-plated.
    - b. Escutcheon Plate Finish: Rough brass.
  7. Test-Header Manifold: Ferrous for hose valves. Manufacturer's standard finish. Include bronze or cast-iron, exposed-type valve header with nozzle outlets; and round, brass escutcheon plate with lettering equivalent to "PUMP TEST CONNECTION."

8. Hose Valves: UL 668, straightway pattern, bronze with cap and chain. Include NFPA 1963 hose thread that complies with local fire department standards and finish same as for test-header-manifold escutcheon plate.
9. Ball Drip Valve: UL 1726.
10. Main Relief Valve: UL 1478, pilot operated.
11. Main Relief Valve: UL 1478, spring loaded.
12. Discharge Cone: Closed.
13. Discharge Cone: Open.
14. Hose valves with caps and chains.
15. Coupling guard.
16. Finish: Manufacturer's standard factory-applied red paint, unless brass or other finish is specified.

## 2.10 PRESSURE-MAINTENANCE-PUMP SPECIALTIES AND ACCESSORIES

- A. Match pressure-maintenance-pump suction and discharge ratings as required for pump capacity rating. Include the following:
  1. Circulation relief valve.
  2. Suction and discharge pressure gages.

## 2.11 ALARM PANELS

- A. Description: Factory-assembled and -wired remote panel complying with UL 508 and requirements in NFPA 20. Include audible and visible alarms matching controller type.
  - 1. Enclosure: NEMA 250, Type 2, remote wall-mounting type.
  - 2. Enclosure Finish: Manufacturer's standard red paint applied to factory-assembled and -tested unit before shipping.
- B. Features: Include manufacturer's standard features and the following:
  - 1. Motor-operating condition.
  - 2. Loss-of-line power.
  - 3. Phase reversal.
  - 4. Low-water alarm.

## 2.12 FLOW-MEASURING SYSTEMS

- A. Description: FM-approved, fire-pump, flow-measuring systems that indicate flow to not less than 175 percent of fire-pump rated capacity. Include sensor of size to match pipe, tubing, flow meter, and fittings.
  - 1. Pressure Rating: 175 psig (1200 kPa) minimum.
  - 2. Sensor: Venturi, annular probe, or orifice plate, unless otherwise indicated.
  - 3. Flow Meter: Compatible with flow sensor with dial not less than 4-1/2 inches (115 mm) in diameter or manufacturer's equivalent size.
  - 4. Permanently Mounted: Flow meter suitable for wall mounting with copper tubing to connect to flow sensor.
  - 5. Portable: Flow meter, with two 12-foot (4-m) hoses, in carrying case with handle.
  - 6. Include complete operating instructions.

## 2.13 SOURCE QUALITY CONTROL

- A. Factory Tests: Hydrostatically test and test run fire pumps before shipping. Test at 150 percent of shutoff head plus suction head, but not less than 250 psig (1725 kPa). Produce certified test curves showing head capacity and brake horsepower of each pump.

## 2.14 GROUT

- A. Description: ASTM C 1107, Grade B, factory-mixed and -packaged nonshrink and nonmetallic grout; suitable for interior and exterior applications.
- B. Characteristics: Post-hardening, volume-adjusting, dry, hydraulic-cement grout.
- C. Properties: Nonstaining, noncorrosive, and nongaseous.
- D. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas, equipment foundations, and conditions, with Installer present, for compliance with requirements for installation and other conditions affecting fire-pump performance.
  - 1. Proceed with installation only after unsatisfactory conditions have been corrected.
- B. Examine roughing-in of fire-suppression piping systems. Verify actual locations of piping connections before pump installation.

### 3.2 CONCRETE BASES

- A. Install concrete bases of dimensions indicated for fire pumps, pressure-maintenance pumps, and controllers. Refer to Division 3 Section "Cast-in-Place Concrete" and Division 15 Section "Basic Mechanical Materials and Methods."

### 3.3 INSTALLATION

- A. Comply with fire-pump, pressure-maintenance-pump, and controller manufacturers' written installation and alignment instructions, and with NFPA 20.
- B. Install pumps and controllers to provide access for periodic maintenance, including removal of motors, impellers, couplings, and accessories.
- C. Set base-mounting-type pumps on concrete bases. Disconnect coupling halves before setting. Do not reconnect couplings until alignment operations have been completed.
  - 1. Support pump baseplate on rectangular metal blocks and shims or on metal wedges having small taper, at points near foundation bolts to provide **3/4- to 1-1/2-inch (19- to 38-mm)** gap between pump base and foundation for grouting.
  - 2. Adjust metal supports or wedges until pump and driver shafts are level. Check coupling faces and pump suction and discharge flanges to verify that they are level and plumb.
- D. Install suction and discharge piping equal to or greater than diameter of fire-pump nozzles.
- E. Install valves that are the same size as piping connecting fire pumps, bypasses, test headers, and other piping systems.
- F. Install pressure gages on fire-pump suction and discharge at pressure-gage tapings.
- G. Support pumps and piping separately so weight of piping does not rest on pumps.
- H. Install piping accessories, hangers and supports, anchors, valves, meters and gages, and equipment supports.

- I. Install flow meters and sensors where indicated. Install flow-measuring-system components and make connections according to manufacturer's written instructions.
- J. Electrical Wiring: Install electrical devices furnished by equipment manufacturers but not specified to be factory mounted. Furnish copies of manufacturers' wiring diagram Submittals to electrical Installer.
  - 1. Verify that electrical wiring is installed according to manufacturers' submittal and installation requirements in Division 16 Sections. Proceed with equipment startup only after wiring installation is satisfactory.

### 3.4 ALIGNMENT

- A. Align fire-pump and driver shafts after complete unit has been leveled on foundation, grout has set, and foundation bolts have been tightened.
- B. After alignment is correct, tighten foundation bolts evenly but not too firmly. Fill baseplate completely with grout, with metal blocks and shims or wedges in place. Tighten foundation bolts after grout has hardened. Check alignment and make required corrections.
- C. Make piping connections, check alignment, and make required corrections.
  - 1. Adjust alignment of pump and driver shafts for angular and parallel alignment by one method in HI 1.1-1.5, Section 1.4, "Installation, Operation and Maintenance."
  - 2. Alignment Tolerances: Comply with manufacturer's written instructions.
- D. Align vertically mounted, split-case pump and driver shafts after complete unit has been made plumb on foundation, grout has set, and foundation bolts have been tightened. Follow pump manufacturer's written instructions.

### 3.5 CONNECTIONS

- A. Piping installation requirements are specified in other Division 13 Sections. Drawings indicate general arrangement of piping and specialties. The following are specific connection requirements:
  - 1. Install piping adjacent to fire and pressure-maintenance pumps to allow service and maintenance.
  - 2. Connect water supply to fire and pressure-maintenance pumps.
  - 3. Connect fire-pump and pressure-maintenance-pump discharge piping to building fire-suppression piping.
  - 4. Connect relief-valve discharge to point of disposal.
- B. Connect flow-measuring-system meters and sensors according to manufacturer's written instructions.
- C. Connect fire-pump controllers to building fire alarm system. Refer to Division 16 Section "Fire Alarm Systems."
- D. Connect controllers to pumps.

- E. Electrical wiring and connections are specified in Division 16 Sections.
- F. Ground equipment.
  - 1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

### 3.6 FIELD QUALITY CONTROL

- A. Automatic Sequence of Operation:
  - 1. Pump unit shall start automatically by pressure drop in fire protection system. Jockey pump shall automatically maintain pressure on system. Make necessary adjustments during test.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including fire-pump and pressure-maintenance-pump units, piping and electrical connections. Report results in writing.
  - 1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
  - 2. Check suction line connections for tightness so no air gets into pumps.
  - 3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation. Remove malfunctioning units, replace with new units, and retest.
  - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
  - 5. Furnish fire hoses in number, size, and length required to reach storm drain or other acceptable location to dispose of fire-pump test water. Fire hoses are for field-acceptance tests only and are not property of Owner.
  - 6. Final Checks before Startup: Perform the following preventive-maintenance operations and checks:
    - a. Lubricate oil-lubrication-type bearings.
    - b. Remove grease-lubrication-type bearing covers, flush bearings with kerosene, and clean thoroughly. Fill with new lubricant according to manufacturer's written instructions.
    - c. Disconnect coupling and check electric motor for proper rotation. Rotation shall match direction of rotation marked on pump casing.
    - d. Verify that pump is free to rotate by hand. If pump is bound or if it drags even slightly, do not operate until cause of trouble is determined and corrected.
  - 7. Starting procedure for pumps is as follows:
    - a. Prime pump by opening suction valve and closing drains, and prepare pump for operation.
    - b. Open sealing liquid supply valves if pump is so fitted.
    - c. Start motor.
    - d. Open discharge valve slowly.

- e. Observe leakage from stuffing boxes and adjust sealing liquid valve for proper flow to ensure lubrication of packing. Do not tighten gland immediately but let packing run in before reducing leakage through stuffing boxes.
  - f. Check general mechanical operation of pump and motor.
8. The pumps shall be hydrostatically tested to twice the working pressure, but in no case to less than 250 PSIG. Prior to shipment, the pump and motor and control panel shall be thoroughly shop tested by the manufacturer. A characteristics curve of pump performance from the test results shall be drawn and furnished to the Architect and Engineer.
- C. Perform field tests for each fire-pump unit and system piping when installation is complete. Comply with operating instructions and procedures in NFPA 20 to demonstrate compliance with requirements. Where possible, field correct malfunctioning equipment, then retest to demonstrate compliance. Replace equipment that cannot be satisfactorily corrected or that does not perform as indicated, then retest to demonstrate compliance. Verify that each fire-pump unit performs as indicated. Report test results in writing.

### 3.7 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain units as specified below:
- 1. Train Owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining units for a period of not less than one 8-hour working day.
  - 2. Review data in maintenance manuals. Refer to Division 1 Section "Closeout Procedure."
  - 3. Review data in maintenance manuals. Refer to Division 1 Section 01700 "Execution Requirements".
  - 4. Schedule training with Owner with at least seven days' advance notice.

END OF SECTION 13921



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

**SECTION 13967 - CLEAN-AGENT  
EXTINGUISHING SYSTEMS**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. This Section includes clean-agent extinguishing systems and the following:
  - 1. Piping and piping specialties.
  - 2. Extinguishing-agent containers.
  - 3. Extinguishing agent.
  - 4. Detection and alarm devices.
  - 5. Control and alarm panels.
  - 6. Accessories.
  - 7. Connection devices for and wiring between system components.
  - 8. Connection devices for power and integration into building's fire alarm system.

**1.2 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Related sections include the following:
  - 1. Division 13 Section 13050 "Fire Protection General Requirements".

**1.3 DEFINITIONS**

- A. FM-200: Trade name for HFC 227ea fire-extinguishing clean agent.

**1.4 SYSTEM DESCRIPTION**

- A. Description: Engineered system for discharge and total flooding of hazard areas with "FM-200".

## 1.5 PERFORMANCE REQUIREMENTS

- A. Performance Requirements: Discharge FM-200 within 10 seconds and maintain 7.1 percent concentration by volume at 70 deg F (21 deg C) for 10-minute holding time in hazard areas.
  - 1. FM-200 concentration in hazard areas greater than 9.0 percent immediately after discharge or less than 5.8 percent throughout holding time will not be accepted without written authorization from Owner and authorities having jurisdiction.
  - 2. System Capabilities: Minimum 620-psig (4278-kPa) calculated working pressure and 360-psig (2484-kPa) initial charging pressure.
- B. Cross-Zoned Detection: Include devices located in two separate zones. Sound alarm on activating single-detection device, and discharge extinguishing agent on actuating single-detection device in other zone. (Note: Cross-zoned detection subject to approval by local authorities having jurisdiction).
- C. System Operating Sequence: As follows:
  - 1. Actuating First Detector: Give visual indication on annunciator panel, energize audible alarm, shut down air-conditioning and ventilating systems serving protected area, release and close doors in protected area, and send signal to fire alarm system.
  - 2. Actuating Second Detector: Give visual indication on annunciator panel, energize audible alarm, shut down power to protected equipment, actuate time delay for extinguishing-agent discharge for 30 seconds, and release extinguishing agent.
  - 3. Extinguishing-agent discharge will operate audible alarms and strobe lights.
- D. Operating manual-release stations will discharge extinguishing agent when activated.
- E. Operating abort switches will delay extinguishing-agent discharge while being activated, and switches must be reset to prevent agent discharge. Release of switch will discharge agent.

## 1.6 SUBMITTALS

- A. Product Data: For the following:
  - 1. Extinguishing-agent containers.
  - 2. Extinguishing agent.
  - 3. Discharge nozzles.
  - 4. Control panels.
  - 5. Detection devices.
  - 6. Manual-release stations.
  - 7. Switches.
  - 8. Alarm devices.

- B. Shop Drawings: Signed and sealed by a qualified professional engineer. Include design calculations. Include the following for hazard-area enclosure, drawn to scale:
1. Plans, elevations, sections, details, and attachments to other Work. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  2. Wiring Diagrams: Detail wiring for power, signal, and control systems and differentiate between manufacturer-installed and field-installed wiring.
  3. Design Calculations: For weight, volume, and concentration of extinguishing agent required for each hazard area.
  4. Reflected Ceiling Plans: Show ceiling penetrations, ceiling-mounted items, and the following:
    - a. Extinguishing-agent containers, piping, discharge nozzles, detectors, and accessories.
    - b. Method of attaching hangers to building structure.
    - c. Other ceiling-mounted items including light fixtures, diffusers, grilles, speakers, sprinklers, and access panels.
  5. Occupied Work Area Plans: Show the following:
    - a. Controls and alarms.
    - b. Extinguishing-agent containers, piping and discharge nozzles if mounted in space, detectors, and accessories.
    - c. Equipment and furnishings.
  6. Access Floor Space Plans: Show the following:
    - a. Extinguishing-agent containers, piping, discharge nozzles, detectors, and accessories.
    - b. Method of supporting piping.
- C. Permit Approved Drawings: Working plans, prepared according to NFPA 2001, that have been approved by authorities having jurisdiction. Include design calculations.
- D. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.
- E. Maintenance Data: For components to include in maintenance manuals specified in Division 1.

## 1.7 QUALITY ASSURANCE

- A. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of clean-agent extinguishing systems that are similar to those indicated for this Project in material, design, and extent.
- B. Source Limitations: Obtain extinguishing agent and equipment through one source.

- C. Product Options: Drawings indicate size, profiles, and dimensional requirements of clean-agent extinguishing systems and are based on the specific system indicated. Other manufacturers' systems with equal performance characteristics may be considered. Refer to Division 1 Section 01330 "Submittal Procedures."
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- E. ASME Compliance: Fabricate piping to comply with ASME B31.1, "Power Piping."
- F. FM Compliance: Provide components that are FM approved and are listed in FM's "Fire Protection Approval Guide."
- G. NFPA Compliance: Fabricate and label clean-agent extinguishing systems to comply with NFPA 2001, "Clean Agent Extinguishing Systems."
- H. UL Compliance: Provide equipment components complying with UL 1058, "Halogenated Agent Extinguishing System Units," and are UL listed for clean-agent extinguishing system units in UL's "Fire Protection Equipment Directory."

## 1.8 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents. Deliver extra materials to Owner.
  - 1. Detection Devices: Not less than 20 percent of amount of each type installed.
  - 2. Container Valves: Not less than 10 percent of amount of each size and type installed.
  - 3. Nozzles: Not less than 20 percent of amount of each type installed.
  - 4. Extinguishing Agent: Not less than 100 percent of amount installed in largest hazard area. Include pressure-rated containers with valves.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Clean-Agent Extinguishing Systems:
    - a. Cerberus Pyrotronics.
    - b. Chemetron Fire Systems.
    - c. Fike Corp.; Fire Protection Systems Div.
    - d. Kidde-Fenwal, Inc.
    - e. Modular Protection Corp.
    - f. Ansul, Inc.

## 2.2 PIPING MATERIALS

- A. Refer to Part 3 piping applications Article retained for applications of pipe, tube, fitting, and joining materials.
- B. Piping, Valves, and Discharge Nozzles: Comply with types and standards listed in NFPA 2001, Section "Distribution," and Appendix A, for charging pressure of system.

## 2.3 PIPES AND TUBES

- A. Black Steel Pipe: ASTM A 53, Type S, Grade A or ASTM A 106, Grade A; Schedule 40, unless Schedule 80 is indicated.
- B. Galvanized Steel Pipe: ASTM A 53, Type S, Grade A, Schedule 40, unless Schedule 80 is indicated.

## 2.4 PIPE AND TUBE FITTINGS

- A. Malleable-Iron, Threaded Fittings: ASME B16.3, Class 300.
- B. Steel Flanges and Flanged Fittings: ASME B16.5, Class 300, unless Class 600 is indicated.
- C. Forged-Steel Welding Fittings: ASME B16.11, Class 3000, socket pattern.
- D. Steel, Grooved-End Fittings: FM approved and UL listed, **ASTM A 47** (**ASTM A 47M**) malleable iron or ASTM A 536 ductile iron, with dimensions matching steel pipe and ends factory grooved according to AWWA C606.

## 2.5 JOINING MATERIALS

- A. Refer to Division 13 Section 13053 "Fire Protection General Materials and Methods" for basic joining materials.
- B. Steel, Keyed Couplings: UL 213, AWWA C606, approved or listed for halon or clean-agent service, and matching steel-pipe dimensions. Include ASTM A 536, ductile-iron housing, rubber gasket, and steel bolts and nuts.

## 2.6 VALVES

- A. General: Brass; suitable for intended operation.
- B. Container Valves: With rupture disc or solenoid, capable of immediate and total agent discharge and suitable for intended flow capacity.
- C. Valves in Sections of Closed Piping and Manifolds: Fabricate to prevent entrapment of liquid, or install valve and separate pressure-relief device.

- D. Valves in Manifolds: Check valve; installed to prevent loss of extinguishing agent when container is removed from manifold.

## 2.7 EXTINGUISHING-AGENT CONTAINERS

- A. Description: Steel tanks complying with ASME Boiler and Pressure Vessel Code: Section VIII, for unfired pressure vessels. Include minimum working-pressure rating that matches system charging pressure, valve, pressure switch, and pressure gage.
  1. Finish: Red, enamel or epoxy paint.
  2. Manifold: Fabricate with valves, pressure switches, and connections for multiple storage containers, as indicated.
  3. Storage-Tank Brackets: Factory- or field-fabricated retaining brackets consisting of steel straps and channels; suitable for container support, maintenance, and tank refilling or replacement.

## 2.8 FIRE-EXTINGUISHING CLEAN AGENT

- A. Clean Agent: FM-200; HFC 227ea, heptafluoropropane.

## 2.9 DISCHARGE NOZZLES

- A. Equipment manufacturer's standard one-piece brass or aluminum alloy of type, discharge pattern, and capacity required for application.

## 2.10 ORIFICE UNIONS

- A. Description: UL-listed device with minimum **2000-psig (13.8-MPa)** pressure rating, to control flow and reduce pressure of INERGEN gas in piping.
  1. **NPS 2 (DN50)** and Smaller: Piping assembly with orifice, sized for system design requirements.
  2. **NPS 2-1/2 (DN65)** and Larger: Piping assembly with nipple, sized for system design requirements.

## 2.11 CONTROL PANELS

- A. Description: FM approved or UL listed, including equipment and features required for testing, supervising, and operating fire-extinguishing system.
- B. Power Requirements: 120/240-V ac; with electrical contacts for connection to system components and fire alarm system, and transformer or rectifier as needed to produce power at voltage required for accessories and alarm devices.
- C. Enclosure: NEMA ICS 6, Type 1, enameled-steel cabinet.
  1. Mounting: Surface.

D. Supervised Circuits: Separate circuits for each independent hazard area.

1. Provide the following crossed-zoned-detection applications:
  - a. Zone 1 detection circuit.
  - b. Zone 2 detection circuit.
  - c. Manual pull-station circuit.
  - d. Alarm circuit.
  - e. Release circuit.
2. Provide the following control-panel features:
  - a. Electrical contacts for shutting down fans, activating dampers, and operating system electrical devices.
  - b. Automatic switchover to standby power at loss of primary power.
  - c. Storage container, low-pressure indicator.
3. Annunciator Panel: Graphic type showing protected, hazard-area plans and locations of detectors and manual-release stations. Include lamps to indicate device-initiating alarm, electrical contacts for connection to control panel, and stainless-steel or aluminum enclosure.
4. Standby Power: Lead-acid or nickel-cadmium batteries with capacity to operate system for 72 hours and alarm for minimum of 15 minutes. Include automatic battery charger, with varying charging rate between trickle and high depending on battery voltage, that is capable of maintaining batteries fully charged. Include manual voltage control, dc voltmeter, dc ammeter, electrical contacts for connection to control panel, and suitable enclosure.

## 2.12 DETECTION DEVICES

- A. Description: Comply with NFPA 2001 and NFPA 72, and include the following types:
1. Ionization Detectors: UL 268, dual-chamber type, having sampling and referencing chambers, with smoke-sensing element.
  2. Photoelectric Detectors: UL 268, consisting of LED light source and silicon photodiode receiving element.
  3. Other Detectors: Contractor's option, complying with NFPA 2001 and NFPA 72.

## 2.13 MANUAL-RELEASE STATIONS

- A. Description: FM approved or UL listed, with "PULL STATION" caption, 120-V ac or low voltage compatible with controls, and red finish. Include contacts for connection to control panel. Unit can manually discharge extinguishing agent with operating device that remains engaged until unlocked.
1. Mounting: Surface.

## 2.14 SWITCHES

- A. Description: FM approved or UL listed, where available, 120-V ac or low voltage compatible with controls. Include contacts for connection to control panel.
  - 1. Pressure Switches: Pneumatic operation.
  - 2. Transfer Switches: Key-operation selector, for transfer of release circuit signal from main supply to reserve supply.
  - 3. Abort Switches: Dead-man type, requiring constant pressure, for delay of system discharge.
  - 4. Door Closers: Magnetic retaining and release device.

## 2.15 ALARM DEVICES

- A. Description: FM approved or UL listed, low voltage, and surface mounting, unless otherwise indicated.
- B. Bells: Minimum 6-inch (150-mm) diameter.
- C. Horns: 90 to 94 dBA.
- D. Strobe Lights: Translucent lens, with "FIRE" or similar caption.

## 2.16 ELECTRICAL POWER AND WIRING

- A. Electrical power, wiring, and devices are specified in Division 16 Sections.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with hazard-area leakage requirements, installation tolerances, and other conditions affecting work performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PIPING APPLICATIONS FOR 360-PSIG (2484-kPa) CHARGING PRESSURE

- A. Flanged pipe and fittings and flanged joints may be used to connect to specialties and accessories and where required for maintenance.
- B. Fittings Working Pressure: 620 psig (4278 kPa) minimum.



- C. Flanged Joints: Class 300 minimum.
- D. **NPS 3 (DN80)** and Smaller:
  1. Copper tube; copper, solder-joint fittings; and brazed joints.
  2. Black steel pipe, malleable-iron threaded fittings, and threaded joints.
  3. Galvanized steel pipe, malleable-iron threaded fittings, and threaded joints.
- E. **NPS 2½" (DN65)** and Larger:
  1. Black steel pipe; steel, grooved-end fittings; steel, keyed couplings; and grooved joints.
  2. Galvanized steel pipe; steel, grooved-end fittings; steel, keyed couplings; and grooved joints.
- F. **NPS 4 (DN100)** and Larger: Black steel pipe, forged-steel welding fittings, and welded joints.

### 3.3 CLEAN-AGENT EXTINGUISHING PIPING INSTALLATION

- A. Install clean-agent extinguishing piping and other components level and plumb and according to manufacturers' written instructions.
- B. Refer to Division 13 Section "Basic Fire Protection Materials and Methods" for basic pipe installation and joint construction.
- C. Grooved Piping Joints: Groove pipe ends according to AWWA C606 dimensions. Assemble grooved-end steel pipe and steel, grooved-end fittings with steel, keyed couplings and lubricant according to manufacturer's written instructions.
- D. Install extinguishing-agent containers anchored to substrate.
- E. Install pipe and fittings, valves, and discharge nozzles according to requirements listed in NFPA 2001, Section "Distribution," and related Appendix A paragraphs; and ASME B31.1.
  1. Install valves designed to prevent entrapment of liquid or install pressure-relief devices in valved sections of piping systems.
  2. Support piping using supports and methods according to NFPA 13 and Division 15 Section "Hangers and Supports."
  3. Install seismic restraints for extinguishing-agent containers and piping systems.
  4. Install control panels, detection system components, alarms, and accessories, complying with requirements of NFPA 2001, Section "Detection, Actuation, and Control Systems," as required for supervised system application.

### 3.4 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties. The following are specific connection requirements:
- B. Install piping adjacent to extinguishing-agent containers to allow service and maintenance.

- C. Connect electrical devices to control panel and to building's fire alarm system. Electrical power, wiring, and devices are specified in Division 13 Section "Fire Alarm."
- D. Ground electrical components.
  - 1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

### 3.5 LABELING

- A. Install labeling on piping, extinguishing-agent containers, other equipment, and panels according to NFPA 2001.

### 3.6 FIELD QUALITY CONTROL

- A. Professional Engineer: Inspect installed clean-agent extinguishing systems, prepare installation report, and certify that installation complies with the Contract Documents and calculations, and comments of authorities having jurisdiction.
- B. Perform field-acceptance tests of each clean-agent extinguishing system when installation is complete. Perform system testing only after hazard-area enclosure construction has been completed and openings sealed. Comply with operating instructions and procedures of NFPA Section 2001, "Approval of Installations." Include the following inspections and tests to demonstrate compliance with requirements:
  - 1. Check mechanical items.
  - 2. Inspect extinguishing-agent containers and extinguishing agent, and check mountings for adequate anchoring to substrate.
  - 3. Check electrical systems.
  - 4. Check enclosure integrity. Comply with NFPA Section 2001, "Enclosure Inspection," and Appendix B, "Enclosure Integrity Procedure."
  - 5. Perform functional predischage test.
  - 6. Perform system functional operational test.
  - 7. Check remote monitoring operations.
  - 8. Check control-panel primary power source.
  - 9. Perform "puff" test on piping system, using nitrogen.
- C. Correct malfunctioning equipment, then retest to demonstrate compliance. Replace equipment that cannot be corrected or does not perform as specified and indicated, then retest to demonstrate compliance. Repeat procedure until satisfactory results are obtained.
  - 1. Report test results promptly and in writing to Architect and authorities having jurisdiction.
- D. Perform the following field quality-control testing:
  - 1. After installing clean-agent extinguishing piping system and after electrical circuitry has been energized, test for compliance with requirements.

2. Perform each visual and mechanical inspection and electrical test stated in NETA ATS, Section 7, "Inspection and Test Procedures," and Section 8, "System Function Tests." Certify compliance with test parameters.
- E. Repair or replace malfunctioning units. Retest as specified above after repairs or replacements are made.
- F. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including piping and electrical connections. Report results in writing.
1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
  2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation. Remove malfunctioning units, replace with new units, and retest.
  3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

### 3.7 COMMISSIONING

- A. Engage a factory-authorized service representative to perform startup service.
- B. Verify that extinguishing system is installed and connected according to the Contract Documents.
- C. Verify that electrical wiring installation complies with the Contract Documents.
- D. Complete installation and startup checks according to manufacturer's written instructions and do the following:
1. Verify that tests of piping system are complete.
  2. Check for complete enclosure integrity.
  3. Check operation of ventilation and exhaust systems.
- E. Startup Procedures: Follow manufacturer's written procedures. If no procedures are prescribed by manufacturer, proceed as follows:
1. Fill extinguishing-agent containers with extinguishing agent and pressurize to indicated charging pressure.
  2. Install filled extinguishing-agent containers.
  3. Energize circuits.
  4. Adjust operating controls.

### 3.8 DEMONSTRATION

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

1. Train Owner's maintenance personnel on procedures and schedules for troubleshooting, servicing, and maintaining equipment and schedules.
2. Review data in maintenance manuals. Refer to Division 1 Section "Contract Closeout."
3. Review data in maintenance manuals. Refer to Division 1 Section "Operation and Maintenance Data."
4. Schedule training with Owner, through Architect, with at least seven days' advance notice.

END OF SECTION 13967

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

**SECTION 13970 - PRE-ACTION  
SPRINKLER SYSTEM**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. This Section includes pre-action sprinkler systems and the following:
1. Piping and piping specialties.
  2. Detection and alarming devices.
  3. Controls and alarm devices.
  4. Accessories
  5. Connection devices between system components.
  6. Connection devices for power and integration into building fire alarm system.

**1.2 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Related Sections include the following:
1. Division 13 Section 13851 "Fire Alarm."
  2. Division 13 Section 13915 "Fire Suppression Piping".

**1.3 DEFINITIONS**

- A. The following definitions are based on NFPA 13 - Standard for Installation of Sprinkler Systems.
1. Preaction Sprinkler System - Preaction sprinkler system are categorized into three following types:
    - a. Non-Interlock System. A non-interlock system admits water to sprinkler piping upon operation of detection devices or automatic sprinklers.
    - b. Single Interlock System. A single interlock system admits water to sprinkler piping upon operation any single fire detection device. Operation of an automatic sprinkler and subsequent loss of air pressure will sound supervisory alarm, but will not charge the sprinkler pipes with water. Heat detectors, shall be temperature rise-of-rise type, to avoid nuisance charging of the sprinkler pipes with water.
    - c. Double Interlock System. A double interlock system admits water to sprinkler piping upon operation of both the fire detection devices and automatic sprinklers. Double interlock systems are not permitted in New York City without special permission. The special permission would be required from NYC Fire Department for unusual applications.

2. A manual electrical pull station is required within the protected space for each of the above systems. In addition, each of the above systems must also be equipped with a local manual control (hydraulic operation) for sprinkler activation. This station is generally located at the location of the sprinkler control valve.
3. Deluge Sprinkler System. A sprinkler system equipped with open sprinklers that are attached to a piping system that is connected to a water supply controlled by a valve that is opened by the operation of a detection system installed in the same areas as the sprinklers. When this valve opens, water flows into the piping system and discharges from all sprinklers simultaneously. (Explanatory note: Deluge sprinkler nozzles are always open. The detectors are usually the heat detectors.)
4. Dry Type System. A system with automatic sprinklers that are attached to a piping system containing air or nitrogen under pressure, the release of which (as from the opening of a sprinkler) permits the water pressure to open a valve known as a dry pipe valve, and the water then flows into the piping system and out the opened sprinklers. (Smoke or heat detectors are not utilized).
5. Cross-Zoning. This term refers to actuation of at least two (2) fire detection devices wired on separate wiring circuit zones. If the fire detectors are individually addressable type, then the operation of any two detectors would result in the same function. (In New York City the cross zoning of fire detectors for pre-action system operation is not permitted. Time delays and abort switched are also not permitted in sprinkler systems).

#### 1.4 PRE-ACTION SPRINKLER SYSTEMS:

- A. Single interlock preaction systems are used to protect areas where there is danger of serious water damage that might result from damaged automatic sprinklers or piping. Typically such areas include computer rooms, storage areas for valuable artifacts, libraries and archives. Also, preaction systems are effectively used to protect properties where a prealarm of a possible fire condition may allow time for fire extinguishment by alternate suppression means, prior to sprinkler discharge. In the event the fire cannot otherwise be extinguished preaction sprinkler system will then perform as the primary fire protection system. Single interlock preaction systems employ automatic sprinklers attached to a piping system containing 10 psi (0,7 bar) supervisory pressure, with a supplemental electric fire detection system installed in the same area as the sprinklers. Preaction systems with 10 psi (0, 7 bar) supervisory pressure may also be activated by either wet or dry pilot sprinklers instead of electric detectors. Actuation of the fire detection system from a fire opens the deluge valve, allowing water to flow into the sprinkler piping system and to be discharged only from those sprinklers that have been operated by heat over the fire. Loss of supervisory pressure from the system piping as a result of damaged sprinklers or broken piping will activate a trouble alarm to indicate impairment of the system. The deluge system valve will not open due to loss of supervisory pressure.
- B. Double interlock preaction systems are designed for applications such as refrigerated areas that require the maximum degree of protection against an inadvertent operation that could result in unnecessary flooding of the sprinkler system piping. The double interlock system consists of a deluge valve and swing check valve with releasing trim featuring both a solenoid valve and a dry pilot actuator in a series configuration. The swing check valve isolates the body of the deluge valve from the system air or nitrogen pressure that holds the dry pilot actuator closed. The solenoid valve remains closed until it is electrically energized by a deluge releasing panel that responds to the operation of a fire detection device. In order to actuate the double interlock preaction system, two independent events, caused by a fire condition, must occur. The sprinkler system piping must lose air or nitrogen pressure due to the operation of one or more sprinklers, and the deluge

releasing panel must energize and open the solenoid valve upon the operation of a fire detection device. The double interlock system will operate only when both the dry pilot actuator and the solenoid valve are open at the same time. Opening of the dry pilot actuator only (for example: a forklift truck accidentally dislodges a sprinkler) or of the solenoid valve only (for example: accidental operation of an electric manual pull station) will cause an alarm, and will not trip the system or flood the sprinkler system piping.

C. Pre-action system components and basic operation as follows:

1. Check valve on discharge side of deluge valve to retain supervisory air pressure.
2. Deluge valve to withhold release of water in system.
3. External reset provision to facilitate testing of deluge valve.
4. Electric releases to retain or release clapper in deluge valve.
5. Release control panel to supervise and control release mechanism.
6. End-line resistors to regulate supervisory current in detector units.
7. Trouble signal and bell to signal circuit faults.
8. Power supply panels to provide primary power supply to release mechanism.
9. Storage battery units to provide secondary source of power supply.
10. Tamper switches to supervise O.S.&Y. control valves, control valves to control water supply to deluge valve.
11. Detector heads to initiate operation of release mechanisms through release control panels.
12. Emergency manual pull stations to act as manual provisions for operating the release mechanism.
13. Electric alarm switches to operate electric alarms upon water flow.
14. Supervisory air supply, self-contained, with air compressor panel, air compressor, check valve, pressure gage, tubing, audible and visual alarm, silence switch, O.S.&Y. monitor switch.
15. Air maintenance device w/valve, filter, regulator, low pressure alarm, pressure gage, check valve.

D. Work Included

1. Provide approved type automatic supervised preaction sprinkler system, consisting of closed sprinkler heads properly spaced to cover the areas protected, a system of properly spaced electric smoke detector heads including electrically operated deluge valves and manual break glass releases. All wiring of system, including detectors, shall be provided. The electric smoke detector system must actuate, and a sprinkler head must fuse (lowers air pressure in pipe system) before water will enter system thru deluge valve. Activation of one switch, i.e., (alarm condition) or opened (fused) sprinkler head (i.e., trouble alarm) will sound alarm only. Primary electric power source shall be 220 volt A.C. current with transformation and rectification to 24 volt D.C. for system operation. Provide all electric work from 220 volt power source. Secondary power source by means of 24 volt storage batteries and battery charger. Low air pressure switch and automatically maintained low air pressure source. Wiring of air compressor motor by electrical contractor. System shall be in full accordance with the requirements of the Local Fire Protection Publications and shall be approved by the local authorities having jurisdiction.

- E. Quality Assurance
  - 1. Applicator: Company specializing in sprinkler installation with seven years minimum experience.
  - 2. Submit manufacturer's installation instructions in accordance with specifications.
- F. Pre-Action Sprinkler Systems Utilizing Deluge Valve and Electric Solenoid Valve
  - 1. Refer to drawing for detail of pre-action sprinkler system utilizing an electric solenoid valve.
- G. The pre-action system shall consist of the detection system with combination fixed temperature and rate-of-rise heat and smoke detectors, and the sprinkler distribution piping with closed type sprinkler heads.
- H. The detection system shall include manual release stations, which shall be able to override detectors network. The detection system shall be a single zone system. (i.e., not cross-zoned).
- I. The sprinkler distribution piping of the pre-action system shall be supervised by compressed air provided by system's air compressor.
- J. The system shall include external reset provisions to facilitate testing of a deluge valve.
- K. Primary electric power source shall be 120 volt A.C. current with transformation and rectification to 24 volt D.C. for system operation. Provide all electric work from 120 volt power source. Secondary power source by means of 24 volt storage batteries and battery charger.
- L. The single interlock pre-action system utilizes a deluge valve which is tripped by the actuation of a solenoid valve from the operation of the detection system. This puts water in the system piping prior to fusing of the sprinklers, thereby permitting a more rapid fire attack.
- M. An activation of first detector will initiate an alarm signal.
- N. An activation of a second detector or manual pull station shall open solenoid valve releasing water into piping system and sounding an alarm at building Fire Alarm system panel.
- O. The system piping is pressurized with air for supervisory purposes. If the system piping or a sprinkler heads is broken, without activation of the detection system the pressure will be reduced and an alarm will sound but water will not discharge.
- P. Pre-action system water supply control valve is provided with a tamper switch to supervise the systems water supply.



## 1.5 GENERAL SYSTEM OPERATION

- A. Water pressure is maintained in the top chamber of deluge valve by passing through a small check valve and restricted orifice. System piping is pressured with air so alarm will sound if a sprinkler head opens or piping is damaged, but no water will flow. When detection system is activated, the solenoid valve in the magnetic bypass or release control unit vents the top chamber of deluge valve faster than water can be replaced through restricted orifice which causes it to open and operate alarm system. The damage of sprinkler piping or fuse of sprinkler head without activation of detection system shall cause a low pressure alarm due to the rapid drop of supervised compressed air in the system piping but shall not fill the system piping with water.
- B. When two detectors operate within the affected area and the system is armed with water, and the temperature at the sprinkler heads reaches their fusing point (normally 165°F) water will flow to suppress a fire.

## 1.6 SEQUENCE OF OPERATION

- A. Activation of any single detector shall:
  - 1. Illuminate detector zone on pre-action system control panel.
  - 2. Activate combination horn/light within the affected area to indicate fire situation.
  - 3. Initiate signal to the building fire alarm system to automatically notify local Fire Department. (Coordinate contact closure requirements).
  - 4. Activate circuits to operate fire safety system, opening of exist doors, etc.
  - 5. Transfer contacts to building Fire Alarm Panel within affected areas as designated by the tenant and his appointed personnel directly in charge and responsible for the area and equipment protected by the pre-action system.
  - 6. Activate output alarm contact.
  - 7. Activate solenoid release valve
- B. Activation of any additional detector shall perform the following actions in addition to the actions above:
  - 1. Activate solenoid release valve.
- C. Activation of pre-action manual pull station system located within the protected area shall:
  - 1. Illuminate manual pull station zone on pre-action system control panel.
  - 2. Activate operations. See 1.5A and 1.5B.
- D. Activation of pre-action manual pull station system located at valve assembly (testing of pre-action system) shall:
  - 1. Illuminate waterflow switch zone on pre-action system control panel.
  - 2. Activate operations. See 1.5A and 1.5B.
- E. Activation of a tamper switch shall:
  - 1. Transfer common trouble contact to building Fire Alarm Panel.

- F. Low air pressure, caused by fused element or not, shall: The damage of sprinkler piping or fuse of sprinkler head without activation of detection system shall cause a low pressure alarm due to the rapid drop of supervised compressed air in the system piping but shall not fill the system piping with water.

## 1.7 PERFORMANCE REQUIREMENTS

- A. Piping and Piping Specialties: **175-psig (1200-kPa)** minimum working pressure, unless otherwise indicated.

## 1.8 SUBMITTALS

- A. Product Data: For the following:

1. Pipe and fitting materials and methods of joining for sprinkler piping.
2. Pipe hangers and supports and restraints.
3. Control panels.
4. Valves with tamper switches.
5. Deluge valve.
6. Accessories.
7. Discharge devices. Include flow characteristics.
8. Detection and alarm devices. Include electrical data.

- B. Shop Drawings: Signed and sealed by a qualified professional engineer. Include design calculations. Include the following for each hazard area, drawn to scale:

1. Include plans, elevations, sections, details, and attachments to other Work. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Wiring Diagrams: Power, signal, and control wiring. Differentiate between manufacturer-installed and field-installed wiring.
3. Design Calculations: hydraulic calculations are required for each sprinkler zone.
4. Plans: Show the following:
  - a. Pre-action valve assembly, details conforming to NFPA 13, piping, discharge devices, detector and alarm devices, and accessories.
  - b. Method of attaching hangers to building structure.
  - c. Fire alarm panel.
  - d. Electrical equipment requiring high and low voltage systems and furnishings.
  - e. A complete layout of flashing lights, horn, bells, manual pull stations and wiring for same, indicating horizontal and vertical locations.
  - f. A complete layout of detection system components indicating location of detectors and wiring for same.
  - g. A complete electrical system (one-line) drawing and details indicating all electrical components and equipment requiring high and low voltage electrical systems and alarm systems.
  - h. Additional dry contacts within control panel and/or additional pressure switches (number and identify) to operate all required alarms, bells, horns, lights, shutdown of equipment of other trades as required.

- C. Permit-Approved Drawings: Working plans, prepared according to NFPA 11, that have been approved by authorities having jurisdiction. Include design calculations.
- D. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.
- E. Maintenance Data: For components to include in maintenance manuals specified in Division 1.

## 1.9 QUALITY ASSURANCE

- A. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of kind indicated. Engineering services are defined as those performed for installations of pre-action systems that are similar to those indicated for this Project in material, design, and extent.
- B. Source Limitations: Obtain pre-action valve and major accessories through one source.
- C. Product Options: Drawings indicate size, profiles, and dimensional requirements of pre-action systems and are based on the specific system indicated. Other manufacturers' pre-action systems complying with requirements may be considered. Refer to Division 1 Section 01330 "Submittal Procedures."
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- E. NFPA Compliance: Pre-action systems to comply with NFPA 13.
- F. ASME Compliance: Fabricate piping to comply with ASME B31.1. "Power Piping".
- G. FM Compliance: Provide components that are FM approved and that are listed in FM's "Fire Protection Approval Guide."
- H. UL Compliance: Provide pre-action and equipment complying with UL "Pre-Action Systems" and with systems that are listed in UL's "Fire Protection Equipment Directory."

## 1.10 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Sprinkler Heads: Not less than 20 percent of amount of each type installed.
  - 2. Electrical Detector: Not less than 20 percent of amount installed.

## 1.11 PRE-ACTION SYSTEM BASIC OPERATION COMPONENTS

- A. Addressable control panels
  - 1. Notifier AFP-400 w/VGAS Custom Graphic Annunciation System.
  - 2. For each other system, Notifier AFP-200.
- B. O.S.&Y type control valve with tamper switch with monitor module (Notifier MMX-1) to supervise water supply to the pre-action system.
- C. Check valve on discharge side of deluge valve to retain supervisory air pressure.
- D. Electrically operated deluge valve to withhold release of water in system.
- E. External reset provision to facilitate testing of deluge valve.
- F. Electric releases to retain or release clapper in deluge valve.
- G. Release control panel to supervise and control release mechanism.
- H. End-line resistors to regulate supervisory current in detector units.
- I. Trouble signal and bell signal circuit faults.
- J. Power supply panels to provide primary and emergency power supply to release mechanism.
- K. Storage battery units to provide secondary source of power supply.
- L. Addressable analog thermal detector head (Notifier FDX-55IR) as required, to initiate operation of release control panels.
- M. Sprinkler heads, piping, hangers, drains, etc.,.
- N. Addressable Emergency break glass stations as manual provisions for operating of detection system. (Notifier BGX-101L)
- O. Electric alarm switches with monitor module (Notifier MMX-1) to operate electric alarms upon water flow.
- P. Supervisory air supply, self-contained, with air compressor panel, air compressor, check valve, pressure gauge, tubing, audible and visual alarm, silence switch, O.S.&Y. monitor switch.
- Q. Air maintenance device with valve, filter, regulator, low pressure alarm, pressure gauge, check valve.
- R. Bells with strobe units and horn units.
- S. Provisions for equipment shut-down with control module (Notifier CMX-2).

- T. All equipment shall perform as a part of a single system. All components shall be approved by the authorities having jurisdiction.
- U. Materials and equipment shall be standard products of a single manufacturer's latest design and suitable to perform the functions intended. Field fabricated equipment will not be accepted and will be grounds for system rejection.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. All equipment shall perform as a part of a single system. All components shall be approved by authorities having jurisdiction.
  - 2. Materials and equipment shall be standard products of a single manufacturer's latest design, and suitable to perform the functions intended. Field fabricated equipment will not be accepted and will be grounds for system rejection. This specification covers the requirement for Automatic Pre-Action system using herein specified control panel, detectors, and related equipment. In order to insure system effectiveness and Owner satisfaction, the contractor shall supply all specified equipment and accessories for a complete, electrically supervised system as described. The contractor shall prepare plans which are to indicate, with lettering no smaller than 3.2mm (one-eighth inch), the location and marking of all system components and a description of all pipe routing.
  - 3. Upon completion of the installation, a meeting shall be held at the site with contractor and Owners personnel present. The contractor shall familiarize the Owners personnel present with system components, system functions and recommended procedures. At this time, a functional test of the system will be demonstrated. The contractor shall provide the necessary personnel and instruments to conduct this test. A detection system acclimation period shall be utilized to insure stability of the overall system. The contractor will provide the Owner with two complete operational and maintenance manuals as well as a written summary of the conducted tests. The contractor will provide the Owner with a system checklist which the Owners Representative will sign as acceptance of the system.
  - 4. Equipment and accessories furnished by the contractor shall be approved components of a single manufacturer.
  - 5. Substitution of components shall be equal to those specified in the system design. Contractor shall provide a cover sheet list of all equipment item model numbers and the model number of specified item to be included.
- B. Operating Requirements:
  - 1. The pre-action control system shall include a detection sub-system and releasing sub-system.
  - 2. The detection sub-system shall employ ionization detectors on separate circuits. These detectors shall be cross-zoned with the pre-action system low air pressure switch. A single detector activating will cause an alarm signal (bells) to be

generated. The pre-action solenoid valve shall activate only when both the thermal detector has alarmed and the system has lost air pressure (due to fusing of sprinkler head).

3. Detectors shall comply with spacing standards as described in standard fire code, but shall in no case exceed one detector per every 37 square meters (400 sq.ft.).

C. System Components:

1. Provide and install an integrated system of automatic detection devices and related wiring. The devices shall be used to activate a control panel. Auxiliary outputs shall be available to shunt trip power, contact other agencies, or annunciate on remote devices. System shall have as standard equipment, battery standby power so as to provide a minimum of ninety (90) hours of battery power. In addition system is provided with building emergency power.
2. Wiring must be in 3/4" conduit. Use 18 AWG, 600 volt, 105°C, UL listed wire for all control wiring except for detection and release wiring where 16 AWG shall be used. Splices must be soldered; wire nuts are not acceptable. The 220 volt, 50 Hz single phase power input line must be separate conduit and connected to the main building line through a separate 15 amp breaker, dedicated to the pre-action system.
3. The control panel to be used for the automatic detection system shall be a two zone releasing control or approved equal.
4. A multi-zone control panel complete with all required relays and controls for each pre-action sprinkler system shall be listed and approved by the fire code.
  - a. The housing shall be 18 gauge sheet steel and shall have a hinged removable door with a key lock. The finish shall be baked enamel. The unit shall be microprocessor based and the main circuit board module shall be removable without disconnecting the field wiring.
  - b. A combination power supply/battery charger shall be provided as a part of the control. Adequate space shall be provided for standby batteries that are capable of operating the system for up to ninety (90) hours. All overcurrent protection devices shall be resettable type circuit breakers. All circuits powered for the control panel shall meet UL requirements for power limited circuits. Regulated 24 VDC rated at ½ ampere shall be available for the operating of four (4) wire detectors or other auxiliary devices.
  - c. Two (2) supervised signal initiating device circuits, for ionization and/or thermal detectors, with a capacity of 25-100 uA., two (2) wire detectors shall be provided. Each circuit shall be switch selectable to be Style D (Class A).
  - d. Two (2) supervised signal indicating device circuits shall be provided that reverse polarity when an alarm condition occurs. These circuits shall supply regulated 24 VDC rated at 1.0 amperes to the indicating devices.
  - e. A separate, supervised FM approved Style A (Class A) supervisory circuit shall be provided for the connection of such items as valve, pressure, or temperature monitoring switches. Operation of this circuit shall result in a distinct supervisory indication.
  - f. A supervised extinguishing agent releasing circuit shall be provided that reverses polarity when a releasing condition occurs. This circuit shall be rated at 24 VDC, 1.0 ampere continuous or 3 amperes momentary.
  - g. The following visual indicators shall be visible with the door closed: AC On-Green LE, Alarm Red, System Trouble-Yellow LED, System Discharge-Red LED, and Supervisory Condition-Yellow LED. A thirty-two (32) character alpha-numeric liquid crystal display with backlight, shall also be provided to

- display in an English format, the condition, status, and circuit for all Alarm, Trouble and Supervisory signals. The time to discharge will be displayed whenever the pre-discharge timer is activated.
- h. The unit shall contain the following Control Switches: A common Silence Switch that silences the alarm indicating devices and Trouble Buzzer, a Reset Switch that must be held for three (3) seconds to prevent accidental resetting, a Test Switch that turns on all Alarm and Trouble indicators and outputs, a Zone Disable Switch for each zone, a Releasing Circuit Disable Switch, and an Auto-Reset Switch that disables the latching function making a "One Man Test" possible.
  - i. The control panel must be arranged to provide three (3) distinctive signals:
    - 1) Alarm signal for manual station, fire detection (either smoke or heat), and sprinkler waterflow.
    - 2) Supervisory alarm for tamper switch and low air pressure.
    - 3) Trouble - Common trouble signal for control panel.
  - j. Activation of a waterflow, smoke detector, heat detector, or manual station shall cause fan shutdown of those building systems serving the area. The shut-down of free-standing self-contained units within the protected area is operational.
  - k. Time delays and abort switches are prohibited.
  - l. Operation of preaction system (waterflow, smoke or heat detection or manual station) must report as an alarm condition in where Class E, J, or C fire alarm system is installed.
  - m. Reporting to the building system of preaction low air pressure, tamper alarm or trouble.
5. Ionization Detector: The detector shall utilize solid state circuitry and be of the dual chamber configuration. One (1) chamber shall be open to sense the particles of combustion while the other will be used as a reference chamber for stability. The unit shall be designed so as to be unaffected by RF energy from 1kHz through 100 MHZ. The detectors shall also be unaffected by air velocity up to 1200 FPM. The detector shall be capable of having its calibration checked or adjusted in the field via the standard detector sensitivity monitor. The detector may have its sensitivity tested either in place as it is exposed to the environment, or in a calibrated smoke chamber to give a reading of sensitivity which can be referenced against other like detectors under know conditions. The detector shall be approved, ULC listed and UL listed to UL Standard 268. Configuration of unit shall be approved prior to purchasing.
6. Remote Control and Indicators: Alarm Signals - Will be provided by six inch 150 alarm bells with Xenon flashing strobe. Control panel shall include relay configuration to satisfy operational requirements as outlined in paragraph g.
7. Sequence of Operation:
- a. Common Alarm - Activation of one (1) thermal detector, or ionization detector, the water flow switch, or manual pull station shall cause the following:
    - 1) Activate local alarm bell/strobe.
    - 2) Annunciate alarm condition to building system.
  - b. Discharge Release - Activation of one (1) thermal detector and loss of air pressure shall cause the following:
    - 1) Activate pre-action solenoid valve.

- c. Common Abnormal Trouble - Abnormal condition on control panel or activation of tamper switch or low air pressure switch or loss of electrical power, shall cause the following:

- 1) Annunciate panel trouble condition to building system.

- 8. All associated wiring for the tamper switch, high and low air pressure switch, water flow switch, and solenoid pre-action valve shall be provided by this contractor.
- 9. All associated wiring to building system, from system control panel (alarm, trouble, and release) shall be provided by the electrical contractor.

D. Drawings and Manuals:

- 1. As-built drawings complete with hydraulic calculations shall be furnished to the Owner. The contractor shall revise and provide all drawings to agree with the construction as actually accomplished and stamped "As-Built".
- 2. Prior to final acceptance, the contractor shall provide complete operation and maintenance manuals (two (2) copies for each system) to the Owner.

E. Check valve on discharge side of deluge valve to retain supervisory air pressure.

F. Deluge valve to withhold release of water in system.

G. Tamper switches to supervise fire system control valves, control valves to control water supply to deluge valve.

H. Supervisory air supply, self-contained, with air compressor and tank, check valve, pressure gage, dehydrator, tubing, audible and visual alarm, silence switch, O.S.& Y. monitor switch.

I. Air maintenance device w/valve, filter, regulator, low pressure alarm, power failure relay switch, pressure gage, check valve. Provide compressor support and fasteners.

J. System shall be complete and tested in accordance with all authorities having jurisdiction.

K. A **(single) (double)** inter locked preaction sprinkler valve manufactured by the Viking or Piping shall be as per specifications Reliable Sprinkler Company of the same design configuration and appurtenances is an acceptable alternate.

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

- 1. Pre-Action Valve (Deluge)

- a. Tyco Protection Inc.
  - b. Globe Fire Sprinkler Corp.
  - c. Reliable Sprinkler Co., Inc.
  - d. Viking Corp.

- 2. Detectors

- a. Game Well Co.
  - b. Potter Electric Signal.
  - c. System Sensor Div Pittwa Corp.



d. Viking Corp.

## 2.2 PIPES AND FITTINGS

- A. Refer to Section 13915 "Fire Protection Suppression Piping".

## 2.3 JOINING MATERIALS

- A. Refer to Division 15 Section 13053 "Fire Protection General Materials and Methods" for basic joining materials.

## 2.4 VALVES

- A. Refer to Section 13915 "Fire Protection Suppression Piping".
- B. Deluge Valves: UL 260, cast-iron body, 175-psig (1200-kPa) working pressure; hydraulically operated, differential-pressure type. Include flanged inlet and outlet, bronze seat with O-ring seals, trim sets for bypass, drain, electric sprinkler alarm switch, pressure gages, drip cup assembly piped without valves and separate from main drain line, fill-line attachment with strainer, and push-rod chamber supply connection.
  1. Air-Pressure Maintenance Devices: Automatic device to maintain correct air pressure in piping. Include shutoff valves to permit servicing without shutting down sprinkler piping, bypass valve for quick filling, pressure regulator or switch to maintain pressure, strainer, pressure ratings with 14- to 60-psig (95- to 410-kPa) adjustable range, and 175-psig (1200-kPa) maximum inlet pressure.
  2. Air Compressor: Fractional horsepower, 120-V ac, 60 Hz, single phase.
  3. Dry, Pilot-Line Trim Set: Include dry, pilot-line actuator; air- and water-pressure gages; low-air-pressure warning switch; air-relief valve; and actuation device. Dry, pilot-line actuator includes cast-iron, 175-psig (1200-kPa) working-pressure, air-operated, diaphragm-type valve with resilient facing plate, resilient diaphragm, and replaceable bronze seat. Valve includes threaded water and air inlets and water outlet. Loss of air pressure on dry, pilot-line side allows pilot-line actuator to open and causes deluge valve to open immediately.

## 2.5 PRESSURE GAGES

- A. Description: Comply with UL 393, with 3-1/2-inch- (90-mm-) minimum diameter dial, 0- to 300-psig (0- to 2500-kPa) dial range, and caption "WATER" on dial face.

## 2.6 DISCHARGE DEVICES

- A. Sprinklers: See Section 13916 "Fire Suppression Sprinklers" for requirements.

## 2.7 DETECTION DEVICES WATER

A. Comply with NFPA 13 and NFPA 72.

1. Water-Flow Indicators: UL 346, electrical-supervision, vane-type water-flow detector, with 250-psig (1725-kPa) pressure rating; designed for horizontal or vertical installation. Include two single-pole, double-throw, circuit switches for isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal if removed.
2. Valve Supervisory Switches: UL 753, electrical, single pole, double throw, with normally closed contacts. Include design that signals controlled valve is in other than fully open position.
3. Other Detectors: Comply with NFPA 13 and NFPA 72.

## 2.8 ALARM DEVICES

- A. Description: UL listed or FM approved, low voltage, and surface mounting, unless otherwise indicated.
- B. Bells: 6-inch (150-mm) diameter, minimum.
- C. Horns: 90 to 94 dBA.
- D. Strobe Lights: Translucent lens, with "FIRE" or similar caption.

## 2.9 CONTROL PANELS

- A. Description: FM approved or UL listed, including equipment and features required for testing, supervising, and operating fire-extinguishing system.
- B. Power Requirements: 120/240-V ac; with electrical contacts for connection to system components and fire alarm system, and transformer or rectifier as needed to produce power at voltage required for accessories and alarm devices.
- C. Enclosure: NEMA ICS 6, Type 1, enameled-steel cabinet.
  1. Mounting: **[Recessed flush with surface] [Surface]**.
- D. Supervised Circuits: Separate circuits for each independent hazard area.
  1. Provide the following crossed-zoned-detection applications:
    - a. Zone 1 detection circuit.
    - b. Zone 2 detection circuit.
    - c. Manual pull-station circuit.
    - d. Alarm circuit.
    - e. Release circuit.
  2. Provide the following verified-detection applications:
    - a. Detection circuit.
    - b. Manual pull-station circuit.

- c. Alarm circuit.
  - d. Release circuit.
- 3. Provide the following control-panel features:
  - a. Electrical contacts for shutting down fans, activating dampers, and operating system electrical devices.
  - b. Automatic switchover to standby power at loss of primary power.
  - c. Storage container, low-pressure indicator.
- 4. Annunciator Panel: Graphic type showing protected, hazard-area plans and locations of detectors and manual-release stations. Include lamps to indicate device-initiating alarm, electrical contacts for connection to control panel, and stainless-steel or aluminum enclosure.
- 5. Standby Power: Lead-acid or nickel-cadmium batteries with capacity to operate system for 72 hours and alarm for minimum of 15 minutes. Include automatic battery charger, with varying charging rate between trickle and high depending on battery voltage, that is capable of maintaining batteries fully charged. Include manual voltage control, dc voltmeter, dc ammeter, electrical contacts for connection to control panel, and suitable enclosure.

## 2.10 DETECTION DEVICES - ELECTRICAL

- A. Description: Comply with NFPA 2001 and NFPA 72, and include the following types:
  - 1. Ionization Detectors: UL 268, dual-chamber type, having sampling and referencing chambers, with smoke-sensing element.
  - 2. Photoelectric Detectors: UL 268, consisting of LED light source and silicon photodiode receiving element.
  - 3. Other Detectors: Contractor's option, complying with NFPA 13 and NFPA 72.

## 2.11 MANUAL-RELEASE STATIONS

- A. Description: FM approved or UL listed, with "PULL STATION" caption, 120-V ac or low voltage compatible with controls, and red finish. Include contacts for connection to control panel. Unit can manually discharge extinguishing agent with operating device that remains engaged until unlocked.
  - 1. Mounting: **[Surface]** **[Semirecessed]**.

## 2.12 SWITCHES

- A. Description: FM approved or UL listed, where available, 120-V ac or low voltage compatible with controls. Include contacts for connection to control panel.
  - 1. Pressure Switches: Pneumatic operation.
  - 2. Transfer Switches: Key-operation selector, for transfer of release circuit signal from main supply to reserve supply.
  - 3. Abort Switches: Dead-man type, requiring constant pressure, for delay of system discharge.
  - 4. Door Closers: Magnetic retaining and release device.

## 2.13 ELECTRICAL POWER AND WIRING

- A. Electrical power, wiring, and devices are specified in Division 16 Sections.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with hazard-area leakage requirements, installation tolerances, and other conditions affecting work performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PIPING APPLICATIONS

- A. Flanged pipe and fittings and flanged joints may be used to connect to specialties and accessories and where required for maintenance.
- B. Fittings Working Pressure: maximum 175 psig.
- C. Flanged Joints: Class 200 minimum.
- D. **NPS 2 (DN50)** and Smaller: Copper tube; copper, solder-joint fittings; and brazed joints.
- E. **NPS 2 (DN50)** and Smaller: Black steel pipe, malleable-iron threaded fittings, and threaded joints.
- F. **NPS 2 (DN50)** and Smaller: Galvanized steel pipe, malleable-iron threaded fittings, and threaded joints.
- G. **NPS 2-1/2 and NPS 3 (DN65 and DN80)**: Copper tube; copper, solder-joint fittings; and brazed joints.

- H. **NPS 2-1/2 and NPS 3 (DN65 and DN80)**: Black steel pipe, malleable-iron threaded fittings, and threaded joints.
- I. **NPS 2-1/2 and NPS 3 (DN65 and DN80)**: Galvanized steel pipe, malleable-iron threaded fittings, and threaded joints.
- J. **NPS 2-1/2 and NPS 3 (DN65 and DN80)**: Black steel pipe; steel, grooved-end fittings; steel, keyed couplings; and grooved joints.
- K. **NPS 2-1/2 and NPS 3 (DN65 and DN80)**: Galvanized steel pipe; steel, grooved-end fittings; steel, keyed couplings; and grooved joints.
- L. **NPS 4 (DN100) and Larger**: Black steel pipe; steel, grooved-end fittings; steel, keyed couplings; and grooved joints.
- M. **NPS 4 (DN80) and Larger**: Galvanized steel pipe; steel, grooved-end fittings; steel, keyed couplings; and grooved joints.
- N. **NPS 4 (DN100) and Larger**: Black steel pipe, forged-steel welding fittings, and welded joints.

### 3.3 PRE-ACTION PIPING INSTALLATION

- A. Install pre-action piping and other components level and plumb and according to manufacturers' written instructions.
- B. Refer to Division 13 Section 13050 "Basic Fire Protection Materials and Methods" for basic pipe installation and joint construction.
- C. Grooved Piping Joints: Groove pipe ends according to AWWA C606 dimensions. Assemble grooved-end steel pipe and steel, grooved-end fittings with steel, keyed couplings and lubricant according to manufacturer's written instructions.
- D. Install pipe and fittings, valves, and sprinkler according to requirements listed in NFPA 13, Section "Distribution," and related Appendix.
  - 1. Install valves designed to prevent entrapment of liquid or install pressure-relief devices in valved sections of piping systems.
  - 2. Support piping using supports and methods according to NFPA 13 and Division 13 Section 13060 "Fire Protection Hangers and Supports."
  - 3. Install seismic restraints for pre-action valve and piping systems.
  - 4. Install control panels, detection system components, alarms, and accessories, complying with requirements of NFPA 70, Section "Detection, Actuation, and Control Systems," as required for supervised system application.
- E. Deluge Valve: Install trim sets for air supply, drain, priming level, alarm connections, ball drip valves, pressure gages, priming chamber attachment, and fill-line attachment.
  - 1. Air-Pressure Maintenance Devices for Dry-Pipe Systems: Install shutoff valves to permit servicing without shutting down sprinkler system; bypass valve for quick system filling; pressure regulator or switch to maintain system pressure; strainer; pressure ratings with **14- to 60-psig (95- to 410-kPa)** adjustable range; and **175-psig (1200-kPa)** maximum inlet pressure.

2. Install air compressor and compressed-air supply piping.
3. Install compressed-air supply piping from building compressed-air piping system.

### 3.4 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties. The following are specific connection requirements:
- B. Install piping adjacent to extinguishing-agent containers to allow service and maintenance.
- C. Connect electrical devices to control panel and to building's fire alarm system. Electrical power, wiring, and devices are specified in Division 13 Section 13851 "Fire Alarm."
- D. Ground electrical components.
  1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

### 3.5 FIELD QUALITY CONTROL

- A. Professional Engineer: Inspect installed pre-action systems, prepare installation report, and certify that installation complies with the Contract Documents and calculations, and comments of authorities having jurisdiction.
- B. Comply with operating instructions and procedures of NFPA 13. Include the following inspections and tests to demonstrate compliance with requirements:
  1. Check mechanical items.
  2. Inspect extinguishing-agent containers and extinguishing agent, and check mountings for adequate anchoring to substrate.
  3. Check electrical systems.
  4. Perform functional predischARGE test.
  5. Perform system functional operational test.
  6. Check remote monitoring operations.
  7. Check control-panel primary power source.
  8. Perform "puff" test on piping system, using nitrogen.
- C. Perform field-acceptance tests of each pre-action system when installation is complete. Perform system testing only after hazard-area enclosure construction has been completed and openings sealed. Comply with operating instructions and procedures of NFPA 13. Include the following to demonstrate compliance with requirements:
  1. Perform functional predischARGE test.
  2. Perform system functional operational test.
  3. Check remote monitoring operations.
  4. Check control-panel primary power source.
  5. Perform pressure test on piping system.
- D. Correct malfunctioning equipment, then retest to demonstrate compliance. Replace equipment that cannot be corrected or does not perform as specified and indicated, then

retest to demonstrate compliance. Repeat procedure until satisfactory results are obtained.

1. Report test results promptly and in writing to Architect and authorities having jurisdiction.

E. Perform the following field quality-control testing:

1. After installing pre-action piping system and after electrical circuitry has been energized, test for compliance with requirements.
2. Perform each visual and mechanical inspection and electrical test stated in NETA ATS, Section 7, "Inspection and Test Procedures," and Section 8, "System Function Tests." Certify compliance with test parameters.

F. Repair or replace malfunctioning units. Retest as specified above after repairs or replacements are made.

G. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including piping and electrical connections. Report results in writing.

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation. Remove malfunctioning units, replace with new units, and retest.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

### 3.6 CONCRETE BASES

- A. Install concrete bases of dimensions indicated. Refer to Division 3 Section "Cast-in-Place Concrete" and Division 13 Section 13050 "Basic Fire Protection Materials and Methods."

### 3.7 LABELING

- A. Install labeling on piping, equipment, and panels according to NFPA 13 and Division 13 Section 13075 "Fire Protection Identification".

### 3.8 COMMISSIONING

- A. Engage a factory-authorized service representative to perform startup service.
- B. Verify that pre-action system is installed and connected according to the Contract Documents.
- C. Verify that electrical wiring installation complies with the Contract Documents.
- D. Complete installation and startup checks according to manufacturer's written instructions and do the following:

1. Verify that tests of piping system are complete.
2. Check for complete enclosure integrity.

E. Startup Procedures: Follow manufacturer's written procedures. If no procedures are prescribed by manufacturer, proceed as follows:

1. Fill system with water and pressurize to indicated pressure.
2. Energize circuits.
3. Adjust operating controls.

### 3.9 DEMONSTRATION

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

1. Train Owner's maintenance personnel on procedures and schedules for troubleshooting, servicing, and maintaining equipment and schedules for a period of not less than one 8-hour working day.
2. Review data in maintenance manuals. Refer to Division 1 Section 01770 "Closeout Procedures."
3. Review data in maintenance manuals. Refer to Division 1 Section 01700 "Execution Requirements."
4. Schedule training with Owner, through Architect, with at least seven days' advance notice.

### 3.10 SYSTEM INSTALLATION

A. Contractor shall provide and install the following sprinkler items:

1. System control valve with tamper switch;
2. Deluge control valve with all trimming;
3. Check valve;
4. Supervisory air supply with all necessary appurtenances;
5. Heat detector.
6. Control panel with batteries and battery charger;
7. Air pressure supply;
8. Piping and piping materials, hangers and supports;
9. Sprinkler heads;
10. Bell/strobe and horn/strobe units.
11. Power and control wiring between control panel and detectors, air compressor, all audio and visual alarms, pull stations.
12. Separate pressure switch (water flow) for the each pre- action sub-system with individual connection and read-out and alarm at the building Fire Alarm system command station.
13. Separate manual pull stations as indicated on the drawings for the each protected area.
14. Means of testing water flow switches for the each pre-action sub-system.
15. Means of testing detectors for the each pre-action sub- system.
16. Means of shutting down A/C unit supplying air to protected area and all equipment within the protected area, upon actuation of any device controlling the pre-action system.
17. Label all spare wires in pre-action sub-system control panel.



18. All pre-action system piping shall pitch back to valve assembly (for proper drainage) in accordance with NFPA #13.
- B. The Sprinkler contractor shall engage the electrical contractor to provide and install the following electrical items:
1. Uninterrupted power supply to pre-action system control panel and air compressor;
  2. Feed to panel to be 120 VAC, 60 HZ., single phase from line side of local floor panel with battery backup on constant trickle charge provided in control unit through an approved, lockable fuse cutout with a solid copper neutral.
  3. All control and alarm wiring between pre-action system control panel and building Fire Alarm panel. Interconnection to building Fire Alarm system shall be coordinated with building engineer and vendor of building system;
  4. Separate fuse cut-out box with solid removable copper bar for each pre-action system. Fuse cutout shall be painted Fire Department red and permanently and properly labeled;
  5. Separate #10 green ground wire from building main water pipe or building structural member for each Firecycle system control panel;
  6. Electrical contractor shall file his portion of the work with all local authority having jurisdiction.
  7. No conduit or wire may enter top of control panel.
  8. All wiring shall be type THWR or THWN in rigid threaded conduit in strict compliance with all codes of authorities having jurisdiction.
  9. All field device wiring shall be series parallel loop. No parallel branching (tee tapping) is permitted.
- C. The sprinkler contractor shall coordinate with the plumbing contractor for location and installation of funnel or floor drains for proper drainage and testing of pre-action valve assembly.

END OF SECTION 13970

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

**SECTION 13975 - STANDPIPES AND HOSES**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. This Section includes piping and equipment for the following building systems:
  - 1. Standpipes, combined (sprinkler and standpipe) risers and cross mains.

**1.2 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Related Sections include the following:
  - 1. Division 2 Section 02510 "Water Distribution".
  - 2. Division 7 Section 07270 "Firestopping".
  - 3. Division 9 Section 09910 "Painting".
  - 4. Division 13 Section 13050 "Fire Protection 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 13915 "Fire Protection Suppression Piping".
  - 9. Division 13 Section 13921 "Fire Protection Horizontal Fire Pumps."
  - 10. Division 16 Section "Fire Alarm Systems" for alarm devices not in this Section.

**1.3 DEFINITIONS**

- A. Hose Connection: Valve with threaded outlet matching fire hose coupling thread for attaching fire hose.
- B. Hose Station: Hose connection, fire hose rack, and fire hose.
- C. Automatic: As applied to fire protection devices, is a device or system providing an emergency function without the necessity for human intervention and activated as a result of a predetermined temperature rise, rate of temperature rise, or combustion products.
- D. Automatic Sprinkler System: A sprinkler system, for fire protection purposes, is an integrated system of underground and overhead piping designed in accordance with fire protection engineering standards. The system includes a suitable water supply. The portion of the system above the ground is a network of specially sized or hydraulically designed piping installed in a structure or area, generally overhead, and to which automatic sprinklers are connected in a systematic pattern. The system is usually activated by heat from a fire and discharges water over the fire area.

- E. Deluge System: A sprinkler system employing open sprinklers attached to a piping system connected to a water supply through a valve that is opened by the operation of a detection system installed in the same areas as the sprinklers. When this valve opens, water flows into the piping system and discharges from all sprinklers attached thereto.
- F. Detector, Heat: A fire detector that senses heat produced by burning substances. Heat is the energy produced by combustion that causes substances to rise in temperature
- G. Fire Protection System: Approved devices, equipment and systems or combinations of systems used to detect a fire, activate an alarm, extinguish or control a fire, control or manage smoke and products of a fire or any combination thereof.
- H. Initiating Device: A system component that originates transmission of a change-of-state condition, such as in a smoke detector, manual fire alarm box, or supervisory switch.
- I. Listed: Equipment, materials or services included in a list published by an organization acceptable to the code enforcement official and concerned with evaluation of products or services that maintains periodic inspection of production of listed equipment or materials or periodic evaluation of services and whose listing states either that the equipment, material or service meets identified standards or has been tested and found suitable for a specified purpose
- J. Record Drawings: Drawings ("as built") that document the location of all devices, appliances, wiring, sequences, wiring methods, and connections of the components of a fire alarm system as installed.
- K. Smokeproof Enclosure: An exit stairway designed and constructed so that the movement of the products of combustion produced by a fire occur ring in any part of the building into the enclosure is limited.
- L. Standpipe System, Classes of: Standpipe classes are as follows:
  - 1. Class I system. A system providing 2.5-inch (64 mm) hose connections to supply water for use by fire departments and those trained in handling heavy fire streams.
  - 2. Class II system. A system providing 1.5-inch (38 mm) hose stations to supply water for use primarily by the building occupants or by the fire department during initial response.
  - 3. Class III system. A system providing 1.5-inch (38 mm) hose stations to supply water for use by building occupants and 2.5-inch (64 mm) hose connections to supply a larger volume of water for use by fire departments and those trained in handling heavy fire streams.
- M. Standpipe, Types of: Standpipe types are as follows:
  - 1. Automatic dry. A dry standpipe system, normally filled with pressurized air, that is arranged through the use of a device, such as a dry pipe valve, to admit water into the system piping automatically upon the opening of a hose valve. The water supply for an automatic dry standpipe system shall be capable of supplying the system demand.
  - 2. Automatic wet. A wet standpipe system that has a water supply that is capable of supplying the system demand automatically.

3. Manual dry. A dry standpipe system that does not have a permanent water supply attached to the system. Manual dry standpipe systems require water from a fire department pumper to be pumped into the system through the fire department connection in order to supply the system demand.
  4. Manual wet. A wet standpipe system connected to a water supply for the purpose of maintaining water within the system but which does not have a water supply capable of delivering the system demand attached to the system. Manual wet standpipe systems require water from a fire department pumper (or the like) to be pumped into the system in order to supply the system demand.
  5. Semiautomatic dry. A dry standpipe system that is arranged through the use of a device, such as a deluge valve, to admit water into the system piping upon activation of a remote control device located at a hose connection. A remote control activation device shall be provided at each hose connection. The water supply for a semiautomatic dry standpipe system shall be capable of supplying the system demand.
- N. Working Plans: Documents, including drawings, calculations, and material specifications prepared according to Local Code and NFPA 14 for obtaining approval from authorities having jurisdiction.

#### 1.4 SYSTEM PERFORMANCE REQUIREMENTS

- A. Design standpipes and obtain approval from authorities having jurisdiction. Include minimum residual pressures at hydraulically remote outlets according to the following:
1. **NPS 2-1/2 (DN65) Hose Connections: 120 psig (704 kPa).**
- B. Components and Installation: Capable of producing piping systems with **175-psig (1200-kPa)** minimum working-pressure rating, unless otherwise indicated, or required by Local Code.

#### 1.5 SUBMITTALS

- A. Product Data: In addition to the requirements of Division 13, Section 13050 "Fire Protection General Requirements", and other applicable sections, provide the following:
1. Pipe and fitting materials and methods of joining for standpipe piping.
  2. Pipe hangers, supports, and restraints. Include calculations and loading criteria.
  3. Valves, including specialty valves, accessories, and devices.
  4. Alarm devices. Include electrical data.
  5. Air compressors. Include electrical data.
  6. Fire department connections. Include type; number, size, and arrangement of inlets; caps and chains; size and direction of outlet; escutcheon and marking; and finish.
  7. Hose connections. Include size, type, and finish.
  8. Hose stations. Include size, type, and finish of hose connections; type and length of fire hoses; finish of fire hose couplings; type, material, and finish of nozzles; and finish of rack.
- B. Fire-Hydrant Flow Test Report: As specified in Division 13 Section 13050 "Fire Protection General Requirements".

- C. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 14. Include "Contractor's Material and Test Certificate for Aboveground Piping" and "Contractor's Material and Test Certificate for Underground Piping."
- D. Product Requirement: For each type of standpipe specialty to include in maintenance manuals specified in Division 1 Section 01600 and Division 13 Section 13050.

## 1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has designed and installed fire-suppression piping similar to that indicated for this Project and obtained design approval and inspection approval from authorities having jurisdiction.
- B. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified professional engineer. Base calculations on results of fire-hydrant flow test.
- C. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of fire-suppression piping that are similar to those indicated for this Project in material, design, and extent.
- D. Manufacturer Qualifications: Firms whose equipment, specialties, and accessories are listed by product name and manufacturer in UL's "Fire Protection Equipment Directory" and FM's "Fire Protection Approval Guide" and that comply with other requirements indicated.
- E. Standpipe Components: Listing/approval stamp, label, or other marking by a testing agency acceptable to authorities having jurisdiction.
- F. Electrical Components, Devices, and Accessories: Listed and labeled as required by Local Code and as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.
- G. NFPA Standard: Equipment, specialties, accessories, installation, and testing complying with NFPA 14, "Standpipe and Hose Systems."

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Refer to Section 13915 "Fire Protection Suppression Piping".
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Backflow Preventors/Double Check Valves

- a. Febco.
- b. Watts Regulator Co.
- c. Wilkins Regulator Div. Zurn Industries, Inc.

## 2. Specialty Valves and Devices:

- a. Badger Fire Protection, Inc.
- b. Tyco Sprinkler Corp.
- c. Firematic Sprinkler Devices, Inc.
- d. Globe Fire Sprinkler Corp.
- e. Grinnell Corp.
- f. Reliable Automatic Sprinkler Co., Inc.
- g. Viking Corp.

## 2.2 PIPING MATERIALS

- A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.

## 2.3 PIPES AND TUBES

- A. Refer to Section 13915 "Fire Protection Suppression Piping".

## 2.4 PIPE AND TUBE FITTINGS

- A. Refer to Section 13915 "Fire Protection Suppression Piping".

## 2.5 JOINING MATERIALS

- A. Refer to Section 13915 "Fire Protection Suppression Piping".

## 2.6 GENERAL-DUTY VALVES

- A. Refer to Division 13 Section Refer to Section 13053 "Fire Protection General Materials and Methods" for gate, ball, butterfly, globe, and check valves not required to be UL listed and FM approved.

## 2.7 FIRE-PROTECTION-SERVICE VALVES

- A. Refer to Section 13915 "Fire Protection Suppression Piping".
- B. General: UL listed and FM approved, with minimum nonshock working-pressure rating of 175-psig (1200-kPa) or as required, by Local Code.
- C. Riser and Sectional Control Valves, NPS 2-1/2 (DN65) and Larger: UL 262, Type I [Class 175] [Class 300] [Class 500] iron body, OS&Y rising stem or other positive indicator. Provide tamper switch.

- D. Provide supervisory tamper switches on all control valves.

## 2.8 SPECIALTY VALVES

- A. Refer to Section 13915 "Fire Protection Suppression Piping".
- B. Ball Drip Valves: UL 1726, automatic drain valve, **NPS 3/4 (DN20)**, ball check device with threaded ends.
- C. Backflow Prevention: Provide in accordance with Section 13050 "Basic Fire Protection Materials and Methods".

## 2.9 MANUAL CONTROL STATIONS

- A. Manual Control Stations: Hydraulic operation, with union, **NPS 1/2 (DN15)** pipe nipple, and bronze ball valve. Include metal enclosure labeled "MANUAL CONTROL STATION" with operating instructions and cover held closed by breakable strut to prevent accidental opening.

## 2.10 HOSE CONNECTIONS

- A. Description: UL 668, **300-psig (2070-kPa)** minimum pressure rating, brass, hose valve for connection of fire hose. Include 90-degree angle pattern design; female NPS inlet and male hose outlet; and lugged cap, gasket, and chain. Include **NPS 1-1/2 or NPS 2-1/2 (DN40 or DN65)** as indicated, and hose valve threads according to NFPA 1963 and matching local fire department threads.
  1. Valve Operation: Nonadjustable type, or pressure-regulating type as indicated.
  2. Finish: Rough brass.

## 2.11 HOSE STATIONS

- A. Description: UL 47, semiautomatic hose stations. Include brass, rack nipple; hose rack; and the following features:
  1. Valves: UL 668, **300-psig (2070-kPa)** minimum pressure rating, 90-degree angle pattern hose valve with female NPS inlet and outlet, unless otherwise indicated.
    - a. Valve Operation: Nonadjustable type, or pressure-regulating type as indicated.
  2. Threads and Gaskets: NFPA 1963 and matching local fire department threads.
  3. Flow-Restricting Devices: **NPS 1-1/2 (DN40)** brass, adjustable for **NPS 1-1/2 (DN40)** fire hose inlet.
  4. Fire Hose: NFPA 1961 and UL 219, lined fire hose with couplings, gaskets, and nozzle. Include the following fire hose materials:
    - a. Jacket: Natural, synthetic, or combination of natural and synthetic threads.

- b. Lining: Rubber, plastic, or combination of rubber and plastic compounds.
    - c. Cover: Rubber, plastic, or combination of rubber and plastic compounds.
  - 5. Nozzles: UL 401.
  - 6. Drain Valves: UL 1726.
  - 7. Mountings: Pipe clamp or wall bracket for freestanding units.
  - 8. Mountings: Pipe escutcheon for cabinet-mounted units.
- B. **NPS 2-1/2 by NPS 1-1/2 (DN65 by DN40)** Hose Stations: **NPS 2-1/2 (DN65)** hose valve; **NPS 2-1/2 by NPS 1-1/2 (DN65 by DN40)** reducer adapter; hose rack with water-retention device and pins for folded, **NPS 1-1/2 (DN40)** lined hose; **NPS 1-1/2 (DN40)** lined hose with swivel inlet coupling and nozzle; and reducer adapter spanner wrench.
- 1. Hose-Rack Finish: Red enamel.
  - 2. Hose Valve and Trim Finish: Rough brass.
  - 3. Fire Hose: Lined, **50-foot (15-m)** length.
  - 4. Fire Hose: Lined, **75-foot (23-m)** length.
  - 5. Fire Hose: Lined, **100-foot (30-m)** length.
  - 6. Nozzle: Brass, adjustable from shutoff to fog spray or straight stream.
  - 7. Nozzle: Polycarbonate plastic, plain type.
  - 8. Nozzle: Brass, plain type.
- C. **NPS 1-1/2 (DN40)** Hose Stations: **NPS 1-1/2 (DN40)** hose valve; hose rack with water-retention device and pins for folded, **NPS 1-1/2 (DN40)** lined hose; and **NPS 1-1/2 (DN40)** lined hose with swivel inlet coupling and nozzle.
- 1. Hose-Rack Finish: Red enamel.
  - 2. Hose Valve and Trim Finish: Rough brass.
  - 3. Fire Hose: Lined, **50-foot (15-m)** length.
  - 4. Fire Hose: Lined, **75-foot (23-m)** length.
  - 5. Fire Hose: Lined, **100-foot (30-m)** length.
  - 6. Nozzle: Brass, adjustable from shutoff to fog spray or straight stream.
  - 7. Nozzle: Polycarbonate plastic, plain type.
  - 8. Nozzle: Brass, plain type.
  - 9. Nozzle: Brass, adjustable fog; for use on electrical fires.
- D. **NPS 2-1/2 (DN65)** Hose Station: **NPS 2-1/2 (DN65)** hose valve with male threaded outlet, cap, and chain.
- 1. Hose Valve and Trim Finish: Rough brass.



## 2.12 ROOF HOSE CABINETS

- A. Description: FM-approved, low-profile-type, hose station for roof mounting. Include the following:
1. Housing: Sheet-steel construction with steel reinforcement and modified to hold not less than length of fire hose indicated.
  2. Shutoff Valve: **NPS 1-1/2 (DN40)** gate valve with extended stem.
  3. Hose Connection: **NPS 1-1/2 (DN40)** valve.
  4. Fittings: Brass.
  5. Hose: **NPS 1-1/2 (DN40)**, lined and suitable for exterior service. Include two **75-foot (23-m)** lengths coupled together.
  6. Nozzle: **NPS 1-1/2 (DN40)** brass, adjustable from shutoff to fog spray or straight stream.
  7. Nozzle: Brass, adjustable-fog type.
  8. Drain Valve: **NPS 1/2 (DN15)** gate valve with extended stem.
  9. Finish: Red enamel paint.
  10. Roof Curb: Matching housing dimensions.
  11. Mounting Materials: Structural steel and wood blocking as recommended in writing by manufacturer.

## 2.13 WALL FIRE HYDRANTS

- A. Description: Cast-brass body with brass, wall, escutcheon plates; brass, lugged caps with gaskets and brass chains; and brass, lugged swivel connections. Include outlets with threads according to NFPA 1963 and matching local fire department sizes and threads, inlet with pipe threads, extension pipe nipple, and valve control.
1. Type: Flush mounting.
  2. Type: Exposed, projecting mounting.
  3. Escutcheon Plates: Round.
  4. Escutcheon Plates: Square or rectangular.
  5. Finish: Polished chrome-plated.
  6. Finish: Rough chrome-plated.
  7. Finish: Polished brass.
  8. Hydrant, Escutcheon-Plate Marking: "HYDRANT."
  9. Hydrant, Valve Control: Wall-mounting assembly with extension rod for manual control of valve inside building.
  10. Hydrant, Valve Escutcheon Plate Marking: "HYDRANT VALVE CONTROL."

## 2.14 FIRE DEPARTMENT CONNECTIONS

- A. Wall, Fire Department Connections: UL 405; cast-brass body with brass, wall, escutcheon plate; brass, lugged caps with gaskets and brass chains; and brass, lugged swivel connections. Include inlets with threads according to NFPA 1963 and matching local fire department sizes and threads, outlet with pipe threads, extension pipe nipples, check devices or clappers for inlets, and escutcheon plate with marking "STANDPIPE AND/OR SPRINKLER/STANDPIPE."
1. Type: Flush mounting.

2. Type: Exposed, projecting mounting.
3. Escutcheon Plate: Round.
4. Escutcheon Plate: Square.
5. Escutcheon Plate: Rectangular.
6. Finish: Polished chrome-plated.
7. Finish: Rough chrome-plated.
8. Finish: Polished brass.

- B. Exposed, Freestanding, Fire Department Connections: UL 405, cast-brass body, inlets with threads according to NFPA 1963 and matching local fire department sizes and threads, and bottom outlet with pipe threads. Include brass, lugged caps, gaskets, and brass chains; brass, lugged swivel connection and drop clapper for each hose-connection inlet; 18-inch- (460-mm-) high brass sleeve; and round, floor, brass, escutcheon plate with marking "STANDPIPE AND/OR SPRINKLER."

1. Finish Including Sleeve: Polished chrome-plated.
2. Finish Including Sleeve: Rough chrome-plated.
3. Finish Including Sleeve: Polished brass.

## 2.15 PRESSURE GAGES

- A. Pressure Gages: UL 393, 3-1/2- to 4-1/2-inch- (90- to 115-mm-) diameter dial with dial range of 0 to 250 psig (0 to 1725 kPa) or two time (2x) the operating pressure.

## 2.16 CONTROL PANELS

- A. Description: Single-area, two-area, or single-area cross-zoned type as indicated. Control panel includes NEMA ICS 6, Type 1 enclosure, detector, alarm, and solenoid-valve circuitry for operation of deluge valves. Panels contain power supply; battery charger; standby batteries; field-wiring terminal strip; electrically supervised solenoid valves and polarized fire alarm bell; lamp test facility; single-pole, double-throw auxiliary alarm contacts; and rectifier.
1. Panels: UL listed and FM approved when used with thermal detectors and Class A detector circuit wiring. Electrical characteristics are 120-V ac, 60 Hz, with 24-V dc rechargeable batteries.
  2. Manual Control Stations: Electric operation, metal enclosure, labeled "MANUAL CONTROL STATION" with operating instructions and a cover held closed by breakable strut.
  3. Manual Control Stations: Hydraulic operation, with union, NPS 1/2 (DN15) pipe nipple, and bronze ball valve. Include metal enclosure labeled "MANUAL CONTROL STATION" with operating instructions and a cover held closed by breakable strut.

## 2.17 DRIP PANS

- A. Examine the drawings and in cooperation with the Electrical Trade confirm the final location of all electrical equipment to be installed in the vicinity of piping. Plan and arrange all overhead piping no closer than two feet from a vertical line to electric motors and controllers, switchboards, panelboards, or similar equipment.
- B. Where the installation of piping does not comply with the requirements of foregoing paragraph. Furnish gutters as follows:
  - 1. Provide and erect a gutter 18 gauge galvanized steel, under every pipe which is within 2'-0" from a vertical line to any motor, electrical controllers, switchboards, panelboards, or the like.
  - 2. Each gutter shall be reinforced, rimmed, soldered and made watertight, properly suspended and carefully pitched to a convenient point for draining. Provide a 3/4" drain, with valve as directed, to nearest floor drain or slop sink, as approved.
  - 3. In lieu of such separate gutters, a continuous protecting sheet of similar construction adequately supported and braced, properly rimmed, pitched and drained, may be provided over any such motor, and extending 2'-0" in all directions beyond the motor, over which such piping has to run.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Perform fire-hydrant flow test according to NFPA 291. Use results for system design calculations required in "Quality Assurance" Article in Part 1 of this Section.
- B. Report test results promptly and in writing.

### 3.2 EARTHWORK

- A. Refer to Division 2 Section 02300 "Earthwork" for excavating, trenching, and backfilling.

### 3.3 EXAMINATION

- A. Examine roughing-in for hose connections and stations to verify actual locations of piping connections before installation.
- B. Examine walls and partitions for suitable thickness, fire- and smoke-rated construction, framing for hose-station cabinets, and other conditions where hose connections and stations are to be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.4 PIPING APPLICATIONS

- A. Do not use welded joints with galvanized steel pipe.
- B. Flanges, unions, and transition and special fittings with pressure ratings the same as or higher than system's pressure rating may be used in aboveground applications, unless otherwise indicated.
- C. Piping between Fire Department Connections and Check Valves: Use galvanized, standard-weight steel pipe with threaded ends; cast- or malleable-iron threaded fittings; and threaded joints.
- D. Piping between Fire Department Connections and Check Valves: Use galvanized, standard-weight steel pipe with grooved ends; steel, grooved-end fittings; steel, keyed couplings; and grooved joints.
- E. Underground Service-Entrance Piping: Use ductile-iron, push-on-joint pipe and fittings and restrained joints.
- F. Underground Service-Entrance Piping: Use ductile-iron, mechanical-joint pipe and fittings and restrained joints.
- G. Underground Service-Entrance Piping: Use ductile-iron, grooved-end pipe and fittings; ductile-iron, keyed couplings; and grooved joints.
- H. Standpipes: For applications up to 350 psi: Non-Shock Working Pressure: Use the following:
  - 1. **NPS 12 (DN300)** and Smaller: Standard-weight steel pipe with
    - a. threaded ends, cast- or malleable-iron threaded fittings, and threaded joints.
    - b. grooved ends; steel, grooved-end fittings; steel, keyed couplings; and grooved joints.
    - c. plain ends, steel welding fittings, and welded joints.
  - 2. **NPS 12 (DN300)** and Smaller: Galvanized, standard-weight steel pipe with
    - a. threaded ends; cast- or malleable-iron threaded fittings; and threaded joints.
    - b. grooved ends; steel, grooved-end fittings; steel, keyed couplings; and grooved joints.
  - 3. **NPS 4 (DN100)** and Smaller: Schedule 30 steel pipe with
    - a. threaded ends, cast- or malleable-iron threaded fittings, and threaded joints.
    - b. roll-grooved ends; steel, grooved-end fittings; steel, keyed couplings; and grooved joints.
    - c. plain ends, steel welding fittings, and welded joints.
  - 4. **NPS 10 (DN250)** and Smaller: Schedule 10 steel pipe with
    - a. roll-grooved ends; steel, grooved-end fittings; and grooved joints.
    - b. plain ends, steel welding fittings, and welded joints.
  - 5. **NPS 6 (DN150)** and Smaller: **Type K (Type A)** or **Type L (Type B)** copper tube with roll-grooved ends; copper, grooved-end fittings; copper, keyed couplings; and grooved joints or **Type K (Type A)** or **Type L (Type B)** copper tube with expanded and roll-grooved ends; copper fittings with expanded and roll-grooved ends; steel, keyed couplings; and grooved joints.
  - 6. **NPS 6 (DN150)** and Smaller: **Type K (Type A)** or **Type L (Type B)** copper tube with plain ends, wrought-copper fittings, and brazed joints.

### 3.5 VALVE APPLICATIONS

- A. Refer to Section 13915 "Fire Protection Suppression Piping".
- B. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
  - 1. Fire-Protection-Service Valves: UL listed and FM approved for applications where required by NFPA 14 or Local Code.
    - a. Shutoff Duty: Use gate valves.
  - 2. General-Duty Valves: For applications where UL-listed and FM-approved valves are not required by NFPA 14 or Local Code.
    - a. Shutoff Duty: Use gate, ball, or butterfly valves.
    - b. Throttling Duty: Use globe, ball, or butterfly valves.

### 3.6 JOINT CONSTRUCTION

- A. Refer to Division 13 Section 13053 "Fire Protection General Materials and Methods" for basic piping joint construction.
- B. Use gaskets listed for dry-pipe service for dry piping.
- C. Dissimilar-Piping-Material Joints: Construct joints using adapters or couplings compatible with both piping materials. Use dielectric fittings if both piping materials are metal. Refer to Division 13 Section 13053 "Fire Protection General Materials and Methods" for dielectric fittings.

### 3.7 SERVICE-ENTRANCE PIPING

- A. Connect standpipe piping to water-service piping of size and in location indicated for service entrance to building. Refer to Division 2 Section "Water Distribution" for exterior piping.
- B. Install shutoff valve, backflow preventer, pressure gage, drain, and other accessories indicated at connection to water-service piping. Refer to Division 2 Section "Water Distribution" for backflow preventers.
- C. Install shutoff valve, check valve, pressure gage, drain, and other accessories at connection to water service.

### 3.8 WATER-SUPPLY CONNECTION

- A. Connect standpipe piping to building interior water distribution piping. Refer to Division 15 Section "Water Distribution Piping" for interior piping.
- B. Install shutoff valve, check valve, pressure gage, drain, and other accessories at connection to water service.

### 3.9 PIPING INSTALLATION

- A. Refer to Division 13 Section 13053 "Fire Protection General Materials and Methods" for basic piping installation.
- B. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated, as far as practical.
  - 1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.
- C. Install underground service-entrance piping according to the Requirements of the Authority having Jurisdiction, NFPA 24 and Section 13053 with restrained joints.
- D. Use approved fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.
- E. Install drain valves on standpipes.
- F. Install ball drip valves to drain piping between fire department connections and check valves. Drain to floor drain or outside building as indicated on drawings.
- G. Install alarm devices in piping systems.
- H. Hangers and Supports: Comply with Section 13060, "Fire Protection Hangers and Supports" for hanger materials.
- I. Install piping with grooved joints according to manufacturer's written instructions. Construct rigid piping joints, unless otherwise indicated.
- J. Install pressure gages on riser or feed main, at each sprinkler test connection, and at top of each standpipe. Include pressure gages with connection not less than **NPS 1/4 (DN8)** and with soft metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they will not be subject to freezing.

### 3.10 VALVE INSTALLATION

- A. For installing general-duty valves. Install fire-protection specialty valves, trim, fittings, controls, and specialties according to Local Code, NFPA 13 and NFPA 14, manufacturer's written instructions, and authorities having jurisdiction.
- B. Gate Valves: Install fire-protection-service valves supervised-open, located to control sources of water supply except from fire department connections. Provide permanent identification signs indicating portion of system controlled by each valve.
- C. Valves for Wall Fire Hydrants: Install gate valve with nonrising stem in supply pipe.
- D. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water supply sources.

- E. Dry-Pipe Valves: Install trim sets for air supply, drain, priming level, alarm connections, ball drip valves, pressure gages, priming chamber attachment, and fill-line attachment.
  - 1. Air-Pressure Maintenance Devices for Dry-Pipe Systems: Install shutoff valves to permit servicing without shutting down sprinkler system; bypass valve for quick system filling; pressure regulator or switch to maintain system pressure.
  - 2. Install air compressor and compressed-air supply piping.
  - 3. Install compressed-air supply piping from building compressed-air piping system.
- F. Deluge Valves: Install in vertical position, in proper direction of flow, in main supply to deluge system.
- G. Provide equalizing bypass for control valves 6" and larger.

### 3.11 HOSE-CONNECTION INSTALLATION

- A. Install hose connections adjacent to standpipes, unless otherwise indicated.
- B. Install hose connections to provide maximum access and minimum passage restriction.
- C. Install **NPS 1-1/2 (DN40)** hose-connection valves with pressure regulating device, unless otherwise indicated.
- D. Install **NPS 2-1/2 (DN65)** hose connections with **NPS 2-1/2 by NPS 1-1/2 (DN65 to DN40)** reducer adapter and pressure regulating device, unless otherwise indicated.
- E. Install wall-mounting-type hose connections in cabinets. Include pipe escutcheons, with finish matching valves, inside cabinet where water-supply piping penetrates cabinet. Install valves at angle required for connection of fire hose.

### 3.12 HOSE-STATION INSTALLATION

- A. Comply with the requirements of Sub-Section 3.11 "Hose Connection Installation".
- B. Install hose stations with support or bracket attached to standpipe or substrate.
- C. Install wall-mounting, rack-type hose stations in cabinets. Include pipe escutcheons, with finish matching valves, inside cabinet where water-supply piping penetrates cabinet. Install valves at angle required for connection of fire hose. Cabinets are specified in Division 13 Section 13520 "Fire-Protection Cabinets".
- D. Install hose-reel hose stations on wall with bracket attached to suitable structural support.

### 3.13 ROOF HOSE CABINET INSTALLATION

- A. Install cabinets according to manufacturer's written instructions.

### 3.14 CONNECTIONS

- A. Connect water-supply piping and standpipes to fire pumps. Include backflow preventers.

- B. Connect water supplies to standpipes. Include backflow preventers.
- C. Install ball drip valves at each check valve for fire department connection. Drain to floor drain or outside building.
- D. Connect piping to specialty valves, hose valves, specialties, fire department connections, and accessories.
- E. Electrical Connections: Power wiring is specified in Division 16.
- F. Connect alarm devices to fire alarm.
- G. Connect compressed-air supply to dry-pipe valve.
- H. Connect air compressor to the following piping and wiring:
  - 1. Pressure gages and controls.
  - 2. Electrical power system.
  - 3. Fire alarm system devices, including low-pressure alarm.

### 3.15 LABELING AND IDENTIFICATION

- A. Install labeling and pipe markers on equipment and piping according to Local Code requirements and requirements of NFPA 14, and Division 13 Section 13075 "Fire Protection Identification."

### 3.16 FIELD QUALITY CONTROL

- A. Flush, test, and inspect standpipes according to Local Code and NFPA 14, "Tests and Inspection" Chapter.
- B. Replace piping system components that do not pass test procedures and retest to demonstrate compliance. Repeat procedure until satisfactory results are obtained.
- C. Report test results promptly and in writing to Architect and authorities having jurisdiction.

### 3.17 COMMISSIONING

- A. Verify that specialty valves, trim, fittings, controls, and accessories are installed and operate correctly.
- B. Verify that air compressors and their accessories are installed and operate correctly.
- C. Verify that specified tests of piping are complete.
- D. Verify that potable-water supplies have correct types of backflow preventers.
- E. Verify that hose connections and fire department connections have threads compatible with local fire department equipment.



- F. Drain dry-type standpipe piping.
- G. Pressurize and check dry-pipe valve air-pressure maintenance devices and air compressors.
- H. Fill wet-pipe standpipe piping with water. Restrict flow rate to prevent water hammer or other hydraulic shock to systems.
- I. Verify that hose connections and stations are correct type and size.
- J. Energize circuits to electrical equipment and devices.
- K. Start and run air compressors.
- L. Adjust operating controls and pressure settings.
- M. Coordinate with fire alarm tests. Operate as required.
- N. Coordinate with fire-pump tests. Operate as required.

### 3.18 DEMONSTRATION

- A. Demonstrate equipment, specialties, and accessories. Review operating and maintenance information.
- B. Schedule demonstration with Owner with at least seven days' advance notice.

END OF SECTION 13975

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

**SECTION 14240 - HYDRAULIC  
ELEVATORS**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

- A. This section includes hydraulic passenger elevators.
  - 1. Engineering, equipment, labor and permits required to satisfactorily complete elevator installation as required by contract documents.
  - 2. Hydraulic elevator system: hydraulic elevators with double and single entrances.
  - 3. Motor and pump, controllers, hoistway, equipment, and accessories.
  - 4. Maintenance service as described herein.
- B. Related Sections: The following sections contain requirements that relate to this section:
  - 1. Field painting of hoistway entrances is specified in Division 9, Section 09900 - PAINTING.
  - 2. Ventilation of hoistway(s) and machine room(s) is specified in Division 15.
  - 3. Vibration isolation is specified in Division 15, Section 15241 - VIBRATION CONTROL.
  - 4. Electrical service to each elevator, including fused disconnect switch, is specified in Division 16 sections.

**1.3 DEFINITIONS**

- A. Hydraulic elevators are hereby defined to include systems in which cars are hoisted either directly or indirectly by action of a hydraulic plunger and cylinder (jack); with other components of the work including fluid storage tank, pump, piping, valves, car enclosures, hoistway entrances, control systems, signal equipment, guide rails, electrical wiring, roping, buffers, and devices for operating, dispatching, safety, security, leveling, alarm, maintenance, and similar required performances and capabilities.

**1.4 REFERENCES:**

- A. ADA - Americans with Disabilities Act.
- B. AISC - Design, Fabrication and Erection of Structural Steel for Buildings.
- C. ANSI A117.1 - Buildings and Facilities - Providing Accessibility and Usability for Physically Handicapped People.
- D. ANSI/ASME A17.1 - Safety Code for Elevators and Escalators 1996 Edition.

- E. ANSI/ASME A17.2 - Inspector's Manual For Elevators and Escalators 1996 Edition.
- F. ANSI/ASME A17.5 - Elevator and Escalator electrical Equipment.
- G. ANSI/AWS D1.1 - Structural Welding Code, Steel.
- H. ANSI/NFPA 70 - National Electrical Code.
- I. ANSI/NFPA 80 - Fire Doors and Windows.
- J. ANSI/UL 10B - Fire Tests of Door Assemblies.
- K. APA - American Plywood Association.
- L. ASTM A 36 - Structural Steel.
- M. ASTM A 53 - Pipe, Steel, Black and Hot Dipped Zinc-Coated, Welded and Seamless.
- N. ASTM A139- Electric-Fusion (ARC)-Welded Steel Pipe (NPS 4-in. and Over).
- O. ASTM A 167 - Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
- P. ASTM A 366 - Steel, Sheet, Carbon, Cold-Rolled, Commercial Quality.
- Q. ASTM A 446 - Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Structural (Physical) Quality.
- R. ASTM B 221 - Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes.
- S. NEMA LD3 - High Pressure Decorative Laminates.
- T. NEMA MG1 - Motors and Generators.
- U. NFPA 101 Life Safety Code.
- V. Steel Structures Painting Council (SSPC) - Steel Structures Painting Manual.

#### 1.5 DESIGN REQUIREMENTS:

- A. Terms used are defined in the latest edition of the safety code for Elevators and Escalators, ASME A17.1, A17.2, A17.5, NFPA 70, NFPA 101, ADA.
- B. "Code" refers to ASME A17.1, A17.2, A17.5, NFPA 70, NFPA 101, ADA, and applicable Building Code. All work performed shall be strict accordance with the code including all maintenance and testing requirements.
- C. Where a device or part of the equipment is herein referred to in the singular number, such reference shall apply to as many such devices as are required to complete the installation.

## 1.6 PERFORMANCE REQUIREMENTS:

- A. Car Speed:  $\pm 10$  percent of speed under any loading condition.
- B. Car Capacity: safely lower, stop and hold up to 125 percent of rated load.
- C. Car stopping Zone:  $\pm 3/8$ " under any loading condition.
- D. Pressure: fluid system components shall be designed and factory tested for 500 p.s.i. maximum operating pressure shall be 400 p.s.i.

## 1.7 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specifications Sections.
- B. Product Data for each principal component or product of each elevator, including certified test reports on required testing. Indicate capacities, sizes, performance and operating characteristics, features of control system, finishes, and similar information. Indicate any variations from specified requirements.
- C. Shop Drawings:
  - 1. Submit complete Shop Drawings including dimensioned drawings showing plans, elevations, sections and large-scale details indicating service at each landing, excavation requirements for jack, coordination with building structure, and relationships with other construction.
  - 2. Submit complete Shop Drawings of elevator car enclosures, showing details of construction and location of signal and car equipment.
  - 3. Submit complete Shop Drawings of elevator hoistway entrances and doors, showing method of operation, details of construction, and method of fastening to structural members.
  - 4. Submit elevating diagrams to indicate elevator service to each level.
  - 5. Submit wiring diagram detailing wiring for power, signal and control systems, differentiating clearly between manufacturer-installed wiring and field-installed wiring. Indicate maximum and average power demands. Each device on wiring diagram shall be properly identified by name, letter, or standard symbol identical with markings on devices or controller panel.
  - 6. Submit layout of graphics components for coordination by the Architect.
  - 7. Submit certification of compliance with Code and ANSI A17.2 requirements for testing of elevator components.
  - 8. Indicate variations from specified requirements, maximum dynamic and static loads imposed on building structure at points of support, and locations of signals. Include maximum and average power demands.
  - 9. Submission of manufacturer's "generic" non project specific shop drawing, not showing actual project hoistway will be considered nonresponsive and returned.
- E. Samples of exposed finishes of car enclosures, hoistway entrances, and signal equipment, 12" x 12" samples of sheet materials and 12" lengths of running trim members.
- F. Maintenance Manuals: Bound manual for elevator, with operating and maintenance instructions, parts listing, recommended parts inventory listing,

purchase source listing for major and critical components, emergency instructions, and similar information.

- G. **Certificates and Permits:** Provide Owner with copies of all inspection / acceptance certificates and operating permits as required by governing authorities to allow normal, unrestricted use of elevators.

## 1.8 QUALITY ASSURANCE

- A. **Manufacturer Qualifications:** Fabrication of hydraulic elevators shall be performed only by a qualified fabricator. The term qualified means experienced in performing the Work required by this section. The qualified fabricator shall have experience on Projects similar in size and scope to this Project. The fabricator shall submit evidence of such qualifications upon request.
- B. **Installer Qualifications:** Installation of hydraulic elevators shall be performed only by a qualified Installer. The term qualified means experienced in performing the Work required by this section. The qualified installer shall have experience on Projects similar in size and scope to this Project. The installer shall submit evidence of such qualifications upon request.
- C. **Document Verification:** in order to discover and resolve conflicts or lack of definition which might create problems, review contract documents for compatibility with proposed product prior to bidding. Review structural, architectural, electrical and mechanical documents, and elevator specification.
- D. **Source Limitations:** unless otherwise indicated, obtain elevator system through one source from a single manufacturer.
- E. **Regulatory Requirements:** In addition to local governing regulations, comply with applicable requirements of ASME/ANSI A17.1, Safety Code for Elevators and Escalators (hereafter referred to as the "Code").

## 1.9 WARRANTY

- A. **General Warranty:** The elevator warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.
- B. **Special Project Warranty:** Provide special project warranty, signed by Contractor, installer, and manufacturer, agreeing to replace, repair, or restore defective materials and workmanship of elevator work during warranty period. This warranty shall be in addition to, and not a limitation of, other rights the Owner may have against the Contractor under the Contract Documents.
  - 1. "Defective" is hereby defined to include, but not by way of limitation, operation or control system failures, performances below required minimums, excessive wear, unusual deterioration or aging of materials or finishes, unsafe conditions, the need for excessive maintenance, abnormal noise or vibration, and similar unusual, unexpected, and unsatisfactory conditions.
  - 2. Warranty period is twelve (12) months starting on date of Substantial Completion.

- C. Warranties: Provide coincidental product warranties where available for major components of elevator work. Submit with maintenance manuals.

## 1.10 MAINTENANCE SERVICE

- A. Initial Maintenance Service: Provide full maintenance service by skilled, competent employees of the elevator installer for period of twelve (12) months following Date of Substantial Completion. Include monthly preventive maintenance performed during normal working hours. Include repair or replacement of worn or defective parts or components and lubricating, cleaning, and adjusting as required for proper elevator operation in conformance with specified requirements. Include 24-hours-per-day, 7-days-per-week emergency callback service with a response time of 2 hours or less. Exclude only repair or replacement due to misuse, abuse, accidents, or neglect caused by persons other than installer's personnel.
- B. Continuing Maintenance Service: Installer shall provide a continuing maintenance proposal to Owner, in the form of a standard yearly (or other period) maintenance agreement, starting on date construction contract maintenance requirements are concluded. State services, obligations, conditions, and terms for agreement period and for future renewal options.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturer: Subject to compliance with requirements, provide products of one of the following:
  1. Thyssen Krupp Elevator Corp., Horn Lake, MS.
  2. KONE, Moline IL 61265,
  3. Otis Elevator Co., Chicago, IL 60607,
  4. Schindler Elevator Corp., Morristown, NJ 07962.

### 2.2 MATERIALS AND COMPONENTS

- A. General Requirement: Provide manufacturer's standard pre-engineered elevator systems that will comply with or fulfill the requirements of elevator schedule sheet at end of this section or, at manufacturer's option, provide custom-manufactured elevator systems that will fulfill requirements. Where components are not otherwise indicated, provide standard components published by manufacturer as included in standard pre-engineered elevator systems and as required for a complete system.
- B. Hydraulic Machines and Elevator Equipment: Provide manufacturer's standard two stage hydraulic plunger-cylinder unit for each elevator, with electric pump-tank-control system equipment in machine room as indicated.
- C. Piping: Provide size, type, and weight piping recommended by manufacturer, and provide isolation couplings to prevent sound / vibration transmissions from power unit.

- D. Inserts: Furnish required concrete inserts and similar anchorage devices for the installation of guide rails, machinery, and other components of elevator work where installation of devices is indicated as work of another specification section.
- E. Car Frame and Platform: Manufacturer's standard welded steel units.

## 2.3 CONTROL SYSTEMS

- A. General: Provide manufacturer's standard control system for each elevator or group of elevators as required to provide automatic or group automatic operation of the type indicated and defined in the Code as "Operations."
- B. Single Elevator Control - Passenger: Provide solid-state "Selective Collective Automatic Operation," as defined in ASME/ANSI A17.1.
- C. Auxiliary Operations / Controls: In addition to primary control system features, provide the following controls or operational features for passenger elevators, except where otherwise indicated:
  - 1. Emergency power operation. Connect elevator controller / pump devices to emergency power circuitry shown in the electrical drawings.
  - 2. Loaded car by-pass.
  - 3. Independent service.
  - 4. Automatic 2-way leveling.
  - 5. Automatic dispatching of loaded car, in conjunction with load weighing device.
- D. Security Features: In addition to above operational features, provide the following security features for passenger elevators, except where otherwise indicated. Security features shall not affect emergency firefighter's service.
  - 1. Keyswitch operation feature with car and hall pushbuttons activated and deactivated by security keyswitches. Key is removable only in the deactivated position.
  - 2. Anticrime feature activated by a keyswitch that causes car to return immediately to a predetermined floor and open door for inspection. On deactivation by keyswitch, car completes calls registered before keyswitch activation and resumes normal operation.
- E. Firefighter's Service: Elevator to be provided with firefighter service and shall conform to Rule 211.3 "Firefighter Service" of ASME A17.1.

## 2.4 SIGNAL EQUIPMENT

- A. General: Provide signal equipment for elevator to comply with requirements indicated below.
  - 1. Provide illuminated hall-call and car-call buttons that light up when activated and remain lighted until call or other function has been fulfilled; fabricate of acrylic or other permanent translucent plastic.
  - 2. Except for buttons and illuminated signal elements, fabricate signal equipment with exposed surfaces of stainless steel with manufacturer's standard directional polish or satin finish.
  - 3. Car Control Stations: Provide car control station in each car with flush-mounted metal faceplates containing illuminated halo call button for each landing served and other buttons, switches, and controls required for specified car operation and control. Mount as shown or scheduled at

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- height complying with ASME/ANSI A117.1. If not otherwise indicated, mount in return panel adjacent to car door. Provide operating device symbols as required by Code. Mark other buttons and switches with manufacturer's standard identification for required use or function.
4. Car Position Indicator: For passenger elevator cars, provide either illuminated-signal type or digital-display type, located near top of each car or in car control station. Include direction-of-next-travel signal if not provided in car control station.
    - a. In addition to visual indicator, provide audible signal to indicate to passengers that car is either stopping at or passing each of the floors served.
  5. Hall Push-Button Station: Provide hall push-button station at each landing.
    - a. Locate as is most convenient for approaching passengers. Provide unit with flat faceplate designed for flush-mounting on wall with body of unit recessed in wall.
    - b. Provide 2-button station where passengers can travel either direction; 1-button station where only one direction of travel is available and indicate which direction that is.
  6. Hall Lanterns: Provide units with illuminated "up" and "down" signal arrows, but provide single arrow where only one direction is possible. Provide units projecting from faceplate for ease of angular viewing, except provide flush units where a location in hoistway entrance frame is indicated. Match materials, finishes, and mounting method of hall push-button stations.
    - a. At manufacturer's option, hall lantern signals may be placed either above or beside each hoistway entrance or in both jambs of entrance frame for each elevator. Mount at minimum of 6 feet - 0 inches above finished floor.
    - b. In conjunction with each hall lantern device, provide an audible signal to indicate that a car is arriving in response to a hall call and to indicate direction of car travel. Signal shall sound once for up direction of travel and twice for down direction.
  7. Hall Position Indicator: Provide illuminated-signal type or digital-display type, located above each hoistway entrance at ground floor. Match materials, finishes, and mounting method of hall push-button stations.
    - a. Integrate ground-floor hall lanterns with hall position indicators.
  8. Telephone: Provide manufacturer's standard ADA-compliant, vandal-resistant telephone system contained in flush-mounted cabinet and complete with identification and instructions for use.
  9. Alarm System: Provide emergency alarm bell properly located within building and audible outside hoistways, equipped to sound automatically in response to emergency stops and in response to "Alarm" button on each car control station.
  10. Car-Top Alarm: Provide switches on top emergency exits that will cause alarm to sound when cover is opened.

## 2.5 ELEVATOR CAR ENCLOSURES

- A. General: Provide car enclosures as indicated. Include ventilation, lighting, ceiling finish, wall finish, access doors, doors, power door operators, sill (threshold), trim, accessories, and floor finish unless indicated as not work of this section. Unless indicated otherwise, provide horizontal sliding doors of manufacturer's standard flush panel type, with operation and number of panels

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as indicated. Provide manufacturer's standard protective edge trim system for door and wall panels, except as otherwise indicated.

1. Materials and Fabrication: Provide selections as indicated for each car enclosure surface; provide manufacturer's standards, but not less than the following:
  - a. Stainless Steel: AISI Type 302/304 with No. 4 satin finish.
  - b. Aluminum Sills: Extruded aluminum, with grooved surface, 1/4 inch thickness, mill finish.
  - c. Plastic Laminate: High-pressure type complying with NEMA LD3, Type GP-50; color, texture and pattern to match wood panel wall system – vertical applied panels.
  - d. Fabricate car door frame integrally with front wall of car.
  - e. Fabricate car with recesses and cutouts for signal equipment.
  - f. Low voltage downlight ceiling with stainless steel laminate.

## 2.6 PERSONAL PROTECTIVE DEVICES

- A. Handrails: Unless indicated otherwise, provide manufacturer's round tubular stainless steel handrails on side walls and back wall either continuous or segmented units.
- B. Door Edge Protective Device: Provide retractable edge shoe on leading edges of elevator entrance doors that causes doors to stop and reopen upon contacting an obstruction in entrance.
- C. Photo-Eye Detection Device: Provide electronic photo-eye device with timed cutout, projecting dual light beams across car entrance at 5 inch and 29 inch heights, that when interrupted will cause closing doors to stop and reopen. Provide keyed switch in car operating panel or toggle switch in service cabinet for disconnecting photo-eye protective device.
- D. Nudging Feature: After car doors are prevented from closing for a predetermined adjustable time period, through activation of detection device or door edge protective device, a loud buzzer shall sound and doors shall begin to close at reduced rate of speed. Doors shall continue to close unless door edge protective device is activated, which shall cause doors to reopen. Process shall repeat continuously until obstruction is removed from entrance.

## 2.7 PASSENGER HOISTWAY ENTRANCES

- A. General: Unless indicated otherwise, provide manufacturer's standard, pre-engineered, hollow metal type, sliding, door-and-frame hoistway entrances complete with track systems, hardware, safeties, sills, and accessories. Match car enclosure doors for size, number of door panels, and door panel movement. Provide frame-section size and profile to coordinate with hoistway wall construction as indicated.
- B. Materials and Fabrication: Provide selections indicated that comply with manufacturer's standards, but not less than the following:
  1. Stainless Steel Frames: Formed stainless steel sheet, AISI Type 302/304 with No. 4 satin finish.
  2. Satin Stainless Steel Door Panels: Flush stainless steel construction, AISI Type 302/304 with manufacturer's standard directional polish or satin finish.

3. Aluminum Sills: Extruded aluminum, with grooved surface, 1/4 inch thickness, mill finish.
4. Nonshrink, Nonmetallic Grout: Factory packaged nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107. Provide grout specifically recommended by manufacturer for grouting door sills and similar applications.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Prior to commencing elevator installation, examine hoistways, hoistway openings, pits, and machine rooms, as constructed; verify all critical dimensions and examine supporting structure and all other conditions under which elevator work is to be installed. Notify Contractor in writing of any dimensional discrepancies or other conditions detrimental to the proper installation or performance of elevator work. Do not proceed with elevator installation until unsatisfactory conditions have been corrected in a manner acceptable to the installer.

### 3.2 INSTALLATION OF ELEVATOR SYSTEM

- A. General: Comply with manufacturer's instructions and recommendations for work required during installation.
- B. Install plunger-cylinder units plumb and accurately centered for elevator car position and travel; anchor securely in place.
- C. Welded Construction: Provide welded connections for installation of elevator work where bolted connections are not required for subsequent removal or for normal operation, adjustment, inspection, maintenance, and replacement of worn parts. Comply with AWS standards for workmanship and for qualifications of welding operators.
- D. Coordination: Coordinate elevator work with work of other trades for proper time and sequence to avoid construction delays. Use benchmarks, lines, and levels designated by Contractor to ensure dimensional coordination of the work.
- E. Sound Isolation: Mount rotating and vibrating elevator equipment and components on vibration-absorption mounts, designed to effectively prevent transmission of vibrations to structure and thereby to eliminate sources of structure-borne noise from elevator system.
- F. Install piping without routing underground, where possible. Where not possible, cover underground piping with permanent protective wrapping before backfilling.
- G. Lubricate operating parts of systems, including ropes, if any, as recommended by manufacturers.
- H. Alignment: Coordinate installation of hoistway entrances with installation of elevator guide rails for accurate alignment of entrances with cars. Where possible, delay installation of sills and frames until car is operable in shaft. Reduce clearances to minimum, safe, workable dimension at each landing.

- I. Leveling Tolerance: 1/4 inch, up or down, regardless of load and direction of travel.
- J. Set sills flush with finished floor surface at landings. Coordinate with other trades to facilitate and ensure proper grouting of sills.

### 3.3 FIELD QUALITY CONTROL

- A. Acceptance Testing: Upon nominal completion of each elevator installation, and before permitting use of elevator (either temporary or permanent), perform acceptance tests as required and recommended by Code and by governing regulations or agencies.
- B. Operating Tests: Load each elevator to its rated capacity and operate continuously for 30 minutes over its full travel distance, stopping at each level and proceeding immediately to the next. Record temperature rise of pump motor (except submerged pumps) during 30 minute test period. Record failures of elevator to perform as required.
- C. Advise Contractor, Owner, Architect, and inspection department of governing agencies in advance of dates and times tests are to be performed on elevators.

### 3.4 PROTECTION

- A. At time of Substantial Completion of elevator work (or portion thereof), provide suitable protective coverings, barriers, devices, signs, or such other methods or procedures to protect elevator work from damage or deterioration. Maintain protective measures throughout remainder of construction period.
- B. Provide similar protective measures for elevator units that will be placed in temporary service, including inspection and maintenance service during period of temporary service.

### 3.5 DEMONSTRATION

- A. Instruct Owner's personnel in proper use, operations, and daily maintenance of elevators. Review emergency provisions, including emergency access and procedures to be followed at time of failure in operation and other building emergencies. Train Owner's personnel in normal procedures to be followed in checking for sources of operational failures or malfunctions. Confer with Owner on requirements for a complete elevator maintenance program.
- B. Make a final check of each elevator operation with Owner's personnel present and just prior to date of Substantial Completion. Determine that control systems and operating devices are functioning properly.

#### ELEVATOR SCHEDULE - HYDRAULIC PASSENGER ELEVATORS

Capacity:	3,500 pounds center opening.
Speed:	100 / 125 fpm.
Landings Served:	1 and 2.
Power Supplied:	480 volts AC, 3 phase, 60 hertz.
Machinery:	Two-stage plunger-cylinder unit with steel well casing, positive-displacement pump, AC motor.
Control System:	Automatic operation, 1-car group.

#### HYDRAULIC ELEVATORS

#### Outline Specification

Auxiliary Operations:	As specified.
Signal Equipment:	As specified.
Car Enclosure:	<p>6 feet, 8 inches wide by 5 feet, 5 inches deep clear car inside dimensions.</p> <p>3 feet, 0 inches wide by 7 feet, 0 inches high stainless steel car doors. Two-speed center opening.</p> <p>Stainless steel front walls with integral stainless steel car door frames.</p> <p>Ceiling: Manufacturer's low voltage downlight with satin stainless steel laminate.</p> <p>Side and Rear Walls: Vertical applied panels with decorative trim – Mart wood panel wall system.</p> <p>Operating Panel: Satin stainless steel finish.</p> <p>Floor prepared to receive carpet (refer to Division 9, Section 09680 - CARPET).</p> <p>Handrail: round tubular satin stainless steel</p>
Hoistway Entrances:	3 feet, 6 inches by 7 feet, 0 inches. Satin stainless steel entrance doors and frames, rated and labeled for 30-minute temperature rise of 650 degrees F.
Additional Requirements:	Protective blanket hooks in car, 1 complete set of full-height blankets, dark tan color.

END OF SECTION 14240

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

**SECTION 14310 - ESCALATORS**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

- A. Section includes high-traffic escalators.
- B. Related Requirements:
  - 1) Division 3 Section "Cast-in-Place Concrete" for setting sleeves, inserts, and anchoring devices in concrete.
  - 2) Division 5 Section "Structural Steel" for attachment plates, angle brackets, and other preparation of structural steel to support escalator trusses.
  - 3) Division 8 Section "Access Doors and Frames" for wall and ceiling access panels and access doors in escalator enclosures.
  - 4) Division 10 Section "Signs" for "Caution" signs required by ASME A17.1/CSA B44.
  - 5) Division 13 Section "Fire-Alarm System" for smoke detectors that activate escalator alarm and, after at least 15 seconds, cause the interruption of power to the escalator motor and brake and for connection to escalator controllers.
  - 6) Division 16 Sections for electrical service to escalators, including disconnect switches.

**1.3 DEFINITIONS**

- A. High-Traffic Escalators: Designed specifically for high-traffic-volume use that produces dense occupancy resulting in structural, machinery, and brake loads much higher than normal.

**1.4 ACTION SUBMITTALS**

- A. Product Data: Include capacities, sizes, performances, safety features, finishes, and similar information.
- B. Shop Drawings:
  - 1) Include plans, elevations, sections, and details indicating coordination with building structure and relationships with other construction.
  - 2) Indicate maximum loads imposed on building structure at points of support, and power requirements.
  - 3) Indicate access and ventilation for escalator machine space.
- C. Samples for Initial Selection: For exposed materials involving color selection.

- D. Samples for Verification: For exposed escalator finishes, 4-inch- (100-mm-) square Samples of sheet materials, and 4-inch (100-mm) lengths of running trim members.
- E. Delegated-Design Submittal: For escalators.

## 1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Manufacturer Certificates: Signed by manufacturer certifying that escalator layout and dimensions, as shown on Drawings, and electrical service, as shown and specified, are adequate for escalator system being provided.
- C. Sample Warranty: For special warranty.

## 1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For escalators to include in emergency, operation, and maintenance manuals.
  - 1) In addition to items specified in Division 1 Section "Operation and Maintenance Data," include diagnostic and repair information available to manufacturer's and Installer's maintenance personnel.
- B. Inspection and Acceptance Certificates and Operating Permits: As required by authorities having jurisdiction for normal, unrestricted escalator use.
- C. Continuing Maintenance Proposal: Submit a continuing maintenance proposal from Installer to Owner, in the form of a standard five-year maintenance agreement, starting on date initial maintenance service is concluded. State services, obligations, conditions, and terms for agreement period and for future renewal options.

## 1.7 QUALITY ASSURANCE

- A. Installer Qualifications: Escalator manufacturer.

## 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle materials, components, and equipment in manufacturers protective packaging. Store materials, components, and equipment off of ground, under cover, and in a dry location.

## 1.9 COORDINATION

- A. Coordinate installation of sleeves, block outs, escalator equipment with integral anchors, and other items that are embedded in concrete or masonry for escalator equipment. Furnish templates, sleeves, escalator equipment with integral anchors, and installation instructions and deliver to Project site in time for installation.
- B. Coordinate locations and dimensions of other work relating to escalators including sumps and floor drains in pits; electrical service; and electrical outlets, lights, and switches in pits.

## 1.10 WARRANTY

- A. Manufacturer's Special Warranty: Manufacturer agrees to repair, restore, or replace escalator work that fails in materials or workmanship within specified warranty period.
  - 1) Failures include, but are not limited to, operation or control system failure, including excessive malfunctions; performances below specified ratings; excessive wear; unusual deterioration or aging of materials or finishes; unsafe conditions; the need for excessive maintenance; abnormal noise or vibration; and similar unusual, unexpected, and unsatisfactory conditions.
  - 2) Warranty Period: Five (5) years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- B. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
  - 1) Fujitec America, Inc.
  - 2) KONE Inc.
  - 3) Mitsubishi Electric Corporation.
  - 4) Otis Elevator Co.
  - 5) Schindler Elevator Corp.
  - 6) ThyssenKrupp Elevator.
- C. Source Limitations: Obtain escalators from single manufacturer.

### 2.2 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Comply with ASME A17.1/CSA B44.
- B. Braking Performance: Provide brakes that stop escalator in up-running mode at a rate no greater than **3 ft./s<sup>2</sup> (0.91 m/s<sup>2</sup>)**.
- C. Delegated Design: Engage a qualified professional engineer, as defined in Division 1 Section "Quality Requirements," to design escalators.
- D. Structural and Mechanical Performance for High-Traffic Escalators: For the purposes of structural design, driving machine and power transmission calculations, and brake calculations, design high-traffic escalators for loads not less than 1.5 times the design loads required by ASME A17.1/CSA B44.
- E. Structural Performance of Balustrades, Deck Barricades, and Handrails: Provide components and assemblies capable of withstanding the effects of loads indicated in ASCE/SEI 7 for handrail assemblies and guardrail systems.

## 2.3 ESCALATORS

- A. High-Traffic Escalators, General: Manufacturer's high-traffic escalators complying with requirements. Unless otherwise indicated, manufacturer's heavy-duty components shall be used, as included in standard high-traffic escalator systems and as required for complete system.
- B. Design and equip escalators to run in either direction.
- C. Provide escalators with **three** flat steps at top and bottom landings.
- D. Rated Speed: **90 fpm (0.46 m/s)**.

## 2.4 COMPONENTS

- A. Fabricate exposed metalwork, including deck covers, balustrade panels, and trim to provide surface flatness equivalent to stretcher-leveled standard of flatness and sufficient strength for indicated use; increase metal thickness or reinforce with concealed stiffeners, backing materials, or both, as necessary. Support joints with concealed stiffeners as needed to hold exposed faces of adjoining sheets in flush alignment.
- B. Transparent Balustrades: Manufacturer's standard profile or arrangement of moving handrails on guide rail that is supported by tempered glass panels, with deck covers, skirts, trim, and accessories.
- C. Direction Indicator Lights: Provide red and green indicator lights at least **2 inches (50 mm)** in diameter in **right-hand** balustrade newels at both upper and lower landings. Green light indicates entrance end, and red light indicates exit end. When escalator is stopped, red lights are illuminated at both ends.
- D. Guards at Ceiling Intersection: Clear plastic.
- E. Handrails: Smooth, jointless, reinforced neoprene.
  - 1) Color: Black.
- F. Deck Covers and Trim: Satin stainless steel.
- G. Skirt Deflector Devices: Manufacturer's standard brush-type device.
- H. Steps: One-piece, die-cast aluminum with demarcation grooves at front and rear of tread surface.
  - 1) Finish: Powder-coated, gray.
  - 2) Step Demarcation: **1-1/2- to 2-inch- (38- to 50-mm-)** wide yellow stripe at sides and backs of step treads.
  - 3) Nosing Demarcation: **2-inch- (50-mm-)** wide yellow stripe at nosings of step treads.
- I. Combs: Integrally colored structural plastic.
  - 1) Comb Color: Yellow.
- J. Combplate Lights: Provide recessed light fixtures with flush lenses mounted in skirt panels at each side of combplates, designed to illuminate combplate steps.
- K. Floor Plates: with grooved or patterned surface and with abrasive material embedded in or metallically bonded to floor-plate surface.



## 2.5 FEATURES

- A. Operational Control: Provide key-operated starter switches located on exterior deck above newel base at both upper and lower landings of escalators.
- B. Fault Indicator: Provide escalators with a microprocessor unit that monitors safety devices, motor temperature, and escalator speed and records in nonvolatile memory the date, time, and device identification if a safety device is activated or escalator malfunctions.
  - 1) Provide built-in or plug-in unit to display recorded information.
- C. Reduced-Current Starting: Provide escalator motors with wye-delta or solid-state starting.
- D. Energy-Saving Feature: Provide escalator motors and controls designed for motors running on partial windings (at reduced power) when not under full load.
- E. Provide motors complying with NEMA MG 1, Insulation Class B.
- F. Brake-Saving Feature: Provide stopping mechanism that allows escalator to coast to a stop before applying brakes, unless stopping is initiated by a safety device.
- G. Equip step drive mechanism with automatic step-chain lubricators.
- H. Oil Drip Pan: Provide metal pan under full width and length of escalator to collect and hold oil and grease drippings from lubricated components. Design and fabricate drip pan to sustain a load of 250 lbf (1.1 kN) on a 1.0-sq. ft. (0.9-sq. m) area at any location without permanent deflection.
- I. Overspeed Governor: Provide units with overspeed governor that is activated if speed of steps exceeds rated speed by more than 20 percent.
- J. Upper-Landing, Step Upthrust Device: Activated if a step is displaced against upthrust track at upper curve in passenger-carrying line of track system.
- K. Comb-Step Impact Device: Activated if a horizontal force in direction of travel is applied exceeding 112 lbf (500 N) at either side or exceeding 225 lbf (1000 N) at center of front edge of combplate, or a resultant force in upward direction is applied exceeding 150 lbf (688 N) at center of front edge of combplate.

## 2.6 MATERIALS

- A. Stainless Steel: ASTM A 240/A 240M, Type 304.
  - 1) Satin Finish: No. 4 directional satin.
- B. Steel Sheet: Cold-rolled steel sheet, ASTM A 1008/A 1008M, commercial steel, Type B, exposed, matte finish.
- C. Clear Tempered Glass: ASTM C 1048, Condition A (uncoated surfaces), Type 1 (transparent glass, flat), Class 1 (clear), Quality q3 (glazing, select), Kind FT (fully tempered), 12.0 mm thick.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine escalator areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine supporting structure, machine spaces, and pits; verify critical dimensions; and examine conditions under which escalators are to be installed.
- C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Comply with manufacturer's written instructions.
- B. Set escalators true to line and level, properly supported, and anchored to building structure. Use established benchmarks, lines, and levels to ensure dimensional coordination of the Work.
- C. Adjust installed components for smooth, efficient operation, complying with required tolerances and free of hazardous conditions. Lubricate operating parts, including bearings, tracks, chains, guides, and hardware. Test operating devices, equipment, signals, controls, and safety devices. Install oil drip pans and verify that no oil drips outside of pans.
- D. Repair damaged finishes so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop, make required repairs and refinish entire unit, or provide new units as required.

### 3.3 FIELD QUALITY CONTROL

- A. Acceptance Testing: On completion of escalator installation and before permitting escalator use, perform acceptance tests as required and recommended by ASME A17.1/CSA B44 and by authorities having jurisdiction.
  - 1) For escalators specified to comply with requirements more stringent than those of ASME A17.1/CSA B44, perform tests for compliance with specified requirements. Test safety devices that are not required by ASME A17.1/CSA B44 as well as those that are.
- B. Advise Owner, Architect, and authorities having jurisdiction in advance of dates and times that tests are to be performed.

### 3.4 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to operate, adjust, and maintain escalators.
- B. Check operation of escalators with Owner's personnel present before date of Substantial Completion and again not more than one month before end of warranty period. Determine that operation systems and devices are functioning properly.

### 3.5 MAINTENANCE

- A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include **<insert number>** months' full maintenance by skilled employees of escalator Installer. Include monthly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper escalator operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
- 1) Perform maintenance during normal working hours.
  - 2) Include 24-hour-per-day, 7-day-per-week emergency callback service with response time of six hours or less.

END OF SECTION 14310

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

**SECTION 14950 - AIRCRAFT  
PASSENGER BOARDING  
BRIDGES**

**PART 1 – GENERAL**

**1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

- A. The scope of the work includes the turn-key installation of two (2) new “low range” Apron-Drive type units, provided and installed at the Duluth International Airport, Duluth, Minnesota. The proposer shall verify all field conditions prior to bidding and is responsible for any engineering, purchasing, co-ordination, obtaining permits and other related items in order to provide two (2) complete, installed, and operational PBB’s.
- B. Provide new, completely operational telescoping three-tunnel type passenger boarding bridges (PBB) to connect the airport terminal building gate to the aircraft for the purpose of convenient and controlled method for passenger boarding as specified herein and as indicated on the data sheets.
- C. The PBBs shall be 2 or 3-tunnel (as indicated on drawings and specifications) apron drive type to service the aircraft fleet mix as indicated on the drawings without the removal of bolts and / or hardware.
- D. The PBB’s shall have a RJ compatible articulating floor and also provide a gang plank bridge span.
- E. The PBBs shall be adaptable for reuse at the future Replacement Terminal and should include provisions for future 400 Hz ground power and pre-conditioned air equipment.
- F. Provide standard PBB Towbar, PBB Jackstand.

**1.3 SUBMITTALS**

- A. The Contractor shall submit complete and detailed shop drawings and specifications for the new PBB units and items to be refurbished in the existing PBB unit to the Architect-Engineer for review. An index prepared in sequential order listing all drawings, sketches, details, and materials to be submitted shall be provided. All drawings, sketches, details and materials shall be submitted in English language, in United States units, including dimensions, volumes, weights and forces. The use of the metric or SI units is not acceptable.
- B. Shop drawings shall show the following:
  - 1. Interior elements:
    - a. Interior scheme of each bridge model including all components.
    - b. Transition details.

- c. Wall finish attachment.
    - d. Light fixture details and layout.
    - e. Joint details.
    - f. Loading bridge dimensions and general arrangement drawings.
    - g. Tunnel floor finish.
    - h. Cab floor finish.
    - i. Interior walls and ceilings finishes.
    - j. Carpet edging details, including lines of demarcation between carpeted and hard surfaced floor at wall areas and treatment at doors, thresholds and doors to terminal building.
  - 2. Exterior elements:
    - a. General bridge layout.
    - b. Exterior sketch of each bridge element.
    - c. Graphics.
    - d. Paint finishes.
    - e. Handrails and ladder to roof.
    - f. Flashing (building to passenger loading bridge).
    - g. Flashing (bridge segments).
    - h. Cab door seal.
    - i. Ramp service stairway.
  - 3. Cab features:
    - a. Operator's cone of visibility from control console.
    - b. Control panel location and functional layout.
    - c. View panels.
    - d. Safety devices.
    - e. Interface with aircraft.
    - f. Modifications necessary for appropriate mating with required aircraft types (including auto-leveling devices).
    - g. Safety strips.
    - h. Signage (exterior).
    - i. Signage and plaques (interior).
    - j. Electric heater
  - 4. Appearance and Safety Markings:
    - a. Color and finish, exterior.
  - 5. Finish Samples:
    - a. Provide samples of all interior and exterior passenger boarding bridge finishes.
- C. Engineering Calculations: The Contractor shall submit to the Architect-Engineer structural calculations and power requirement computations including the following:
- 1. Electrical power and control schematic diagrams.
  - 2. Hydraulic schematics.
  - 3. Structural drawings including all pertinent calculations which shall be signed and sealed by a professional Engineer licensed in the State of Minnesota.
  - 4. Interface requirements for existing foundations and buildings supplied utilities.
- D. Electrical Disconnect and Control Panels:
- 1. Provide complete details on the electrical disconnect and controls panel.
- E. Maintenance Manuals:

1. The Contractor shall provide 30 days prior to acceptance inspections of each loading bridge, 2 copies of technical manuals per each loading bridge. The shop drawings and manuals shall reflect the exact construction (not typical construction) of each unit including manufacturer's part number and pictorial drawings for each item.
2. The technical manuals shall contain the following information:
  - a. Description and operation.
  - b. Maintenance instructions including troubleshooting / diagnostics guidelines.
  - c. Overhaul instructions.
  - d. List of parts and part numbers including manufacturer's name and part number, as well as the supplier's name and part number.
  - e. Illustrated parts list.
  - f. Recommended spare parts list and source.
3. Manual shall be compact and produced in such a manner that the maintenance personnel can easily refer to any of its pages or schematics while standing on the apron while subjected to jet blast, wind, etc. All binder punch holes shall be reinforced by proper material to prevent tearing.
4. Electrical drawings shall reflect the wiring for each unit as it has been constructed and not general drawings. Place 1 set of drawings in control console of the bridge and 1 in the manual.

#### 1.4 PERFORMANCE REQUIREMENTS

- A. Industry Standards:
  1. The Passenger Boarding Bridge (PBB) shall be designed in accordance with good engineering practices and the standards developed and adopted by the passenger boarding bridge industry. Particular attention will be given to keeping components simple rugged and easily accessible for routine maintenance, including lubrication component exchange and ease of adjustment. All access panels and openings shall be sized to accommodate the component being changed or adjusted, as well as the equipment and personnel necessary to accomplish the work.
- B. Structural Loads:
  1. The passenger boarding bridge will support the following loads. The design will be based on the combination, which imposes the most adverse loading. In addition to the dead loads and strain caused by movement, the entire passenger boarding bridge shall support:
- C. Floor Live Loads: 30 pounds per square foot (191 kg per square meter).
- D. Wind Loads:
  1. Retracted and Stowed: 25 pounds per square foot (120 kg per square meter).
  2. Operational: 12.5 pounds per square foot (61 kg per square meter).
  3. Seismic Loads: The PBB shall be designed to withstand the earthquake induced forces.
- E. Roof Live Loads: 25 pounds per square foot.
  1. The structural design shall provide sufficient torsional rigidity to avoid excessive sway when the passenger boarding bridge is brought to a stop.

2. All mechanisms for actuating, guiding and restraining the passenger boarding bridge and its components shall be designed so that no noise, sway or sense of insecurity is apparent to passengers. No operating vibrations or loads shall be transmitted to the terminal building.
- F. Environmental Considerations:
1. Passenger boarding bridge shall operate satisfactorily under ambient temperature conditions of –40 degrees F (-40 degrees C) to 125 degrees F (52 degrees C), with wind up to 60 mph (96.56 kph).
  2. All components and materials shall be individually and collectively designed or selected for long service life under such conditions.
- G. Power Characteristics:
1. The passenger boarding bridge shall operate on 480 V.A.C., 3 phase, 60 Hz. Electrical power, and separate ground (4 wire). The 480 V.A.C. shall be transformed to 120/240 V.A.C. for lighting and controls.

## 1.5 QUALITY ASSURANCE

- A. The Contractor shall verify that no asbestos products, components or additives have been used in this work or supplied to the job.
- B. Manufacturer: Minimum of ten years successful experience in the design, fabrication and installation of similar passenger boarding bridges.
- C. Installer: Either passenger boarding bridge manufacturer or a licensee of the manufacturer with no less than 10 years experience in the installation of comparable passenger boarding bridges.
- D. Regulatory Requirements: Conform to the following codes and standards:
1. AISC – American Institute of Steel Construction.
  2. ASME – American Society of Mechanical Engineers.
  3. ASTM A36 – Specification for Carbon Structural Steel.
  4. ASTM A53 – Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
  5. ASTM A307 – Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
  6. ASTM A311 Grade 1018 and Grade 1144 Hinge Pins.
  7. ASTM A325 – Specification for Structural Bolts, Steel, Heat-Treated, 120/105 ksi Minimum Tensile Strength or SAE-J429 Grade 5 or 8.
  8. ASTM A490 – Specification for Heat-Treated Steel, Structural Bolts, 150 ksi Minimum Tensile Strength.
  9. ASTM A500 – Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
  10. ASTM A514 and A517– Specification for High-Yield Strength, Quenches and Tempered Alloy Steel Plate, Suitable for Welding.
  11. ASTM A1011 – Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon Structural, High-Strength Low-Alloy with Improved Formability.
  12. AWS – American Welding Society.
  13. NEC – National Electric Code.
  14. NEMA – National Electrical Manufacturers Association.
  15. NPA – National Plywood Association.
  16. SAE – Society of Automotive Engineers.
  17. SSPC – Structural Steel Painting Council.

## 1.6 WARRANTY

- A. Warranty shall include all parts, labor, travel time, and expenses necessary for remedial repairs or replacement of defective or malfunctioning bridge units or defective system components.
- B. Manufacturer shall guarantee all components and accessories comply fully with the Contract Documents and are free from defects in material and workmanship, under normal use, for a period of twelve (12) months from the date of acceptance by the Owner with the following exceptions.
  - 1. The design of the PBB structure, shell, mechanical assemblies, and electrical systems shall be designed with a life expectancy of twenty (20) years with the exception of normal maintenance components.
  - 2. Paint coatings shall not peel, blister, chip, crack, check, and shall not chalk more than represented by a No. 8 rating based on ASTM D659 for a period of ten (10) years.
  - 3. Vertical Drive components and assemblies shall have a minimum of a ten (10) year design life and associated warranty.
  - 4. Door closures shall have an extended warranty as provided by the manufacturer, with a design life of ten (10) years against failure. Extended warranty shall be included in the Operation and Maintenance Manual.
  - 5. Warranty shall include the performance of all Service Bulletins by the PBB manufacturer issued by the manufacturer during the warranty period.
- B. All work by the Contractor within this warranty period shall be provided without cost to the Owner and shall include all labor and necessary materials required to replace defective material and workmanship. If a component is replaced, the warranty period begins again as if the part were new.
- C. Contract shall warrant that the equipment and all components and accessories furnished in connection therewith, shall comply fully with contract documents; be free of any defect in design, material, or workmanship; be new and of good quality; and free and clear from any liens, encumbrances and title defects.

## 1.7 MAINTENANCE

- A. Preventive maintenance: Prior to formal acceptance and during the on-airport storage and installation, the Contractor shall be responsible for the preventive maintenance and general protection from deterioration of the passenger loading bridge. After formal acceptance, the Owner shall be responsible for all preventive maintenance, in accordance with manufacturer's manual.
- B. Corrective maintenance: The Contractor shall be responsible for all corrective maintenance, under the terms of the guarantee - (parts and labor) for one (1) year from date of acceptance of the passenger loading bridge. Corrective maintenance shall include all maintenance except minor and routine adjustments and lubrication. In the event that the Contractor fails to respond within twenty-four (24) hours to correct a maintenance occurrence (and expediently perform whatever repairs necessary to restore the loading bridge into service), the Owner reserves the right to perform (with its own maintenance forces or otherwise) such corrective maintenance work and the Contractor shall reimburse the Owner



whatever expenses incurred by the Owner in performing such corrective maintenance work.

- C. The Contractor shall provide the maintenance personnel of the Owner with service bulletins outlining product improvement data resulting from continuing field operation experiences.

## 1.8 PERMITS

- A. Project Permits: The PBB Contractor shall be responsible to apply for and obtain all required permits, including the FAA Crane Permit, if a deviation from the current permit is desired. The FAA Crane permit may entail a 30 to 60 day lead time, so immediate application is required by the PBB Vendor. All airport required special permit requirements/conditions are the responsibility of the PBB manufacturer.

## 1.9 AIRPORT SECURITY

- A. The PBB Contractor shall be responsible for determining and complying with Airport Security, Badging and Vehicle access requirements. PBB Contractor shall not rely on Owner's representatives for airport access/escorts. No extension of the performance period will be allowed due to the Contractor's ability to comply with Airport Security requirements.

## 1.10 PROJECT / SITE CONDITIONS

- A. The Contract Documents indicate the location of each passenger loading bridge foundation and types of aircraft at each gate. The Contractor shall be responsible to verify all locations (rotunda foundation, aircraft position, for the various types of aircraft serviced at each gate, etc.) and advise the Architect-Engineer of any conflict or code violation (such as excessive slope, etc.) prior to beginning the fabrication of the passenger loading bridges.
- B. Contractor shall visit the site and familiarize himself regarding the existing conditions at the project site.
- C. Foundation anchor nuts shall be provided by PBB Manufacturer, coordinate anchor bolt size and pattern with existing terminal building.

## PART 2 – PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following, or approved equal:
  - 1. Passenger Boarding Bridge:
    - a) FMC –Jetway Systems
    - b) ThyssenKrupp Airport Systems

### 2.2 PASSENGER BOARDING BRIDGE (PBB)

- A. General: Passenger Boarding Bridge (PBB) specified shall be complete with requirements of this section.

1. The PBB shall be apron drive type with two or three tunnels as indicated on the drawings.
  2. All door locks are the Best brand.
  3. Intended Aircraft; See PBB Data Sheets for specific fleet mix requirements.
- B. Rotunda Assembly: The rotunda assembly shall be made up of a corridor, rotunda and support pedestal. The assembly shall be designed so that it does not transmit any live or dead loads or vibrations to the terminal building.
1. The rotunda assembly shall be designed at the terminal end pivot for passenger boarding bridge's vertical and horizon motion. As the main pivot for passenger boarding bridge, the rotunda assembly shall allow the passenger boarding bridge to rotate a total of 175 degrees, 87 ½ degrees clockwise and 87 ½ degrees counter clockwise for the corridor center line.
  2. Slope, over-travel and operational swing limits shall be located on the rotunda assembly. Slope limits shall be adjustable up to 8.33 percent for both up and down slopes. This limit shall be adjustable to meet local operating conditions and requirements.
  3. Over-travel swing limit shall be provided. When activated, limit switch shall cut off all power preventing bridge from traveling further. Rotunda frame shall be equipped with rubber bumper type mechanical stops, or electrical limit switches, to prevent collapse of telescoping tunnel sections.
  4. A potentiometer, or limit switches, shall be provided at rotunda, which senses the position of the passenger boarding bridge and sounds a warning buzzer at control console prior to activation of the over-travel swing limit. Actuation of the warning buzzer shall be adjustable within the over-travel limit envelope and shall signal rotational operational limits.
  5. Corridor: The corridor interface between the rotunda and the terminal building shall have a minimum inside clear width of 4'-11" and minimum clear height of 7'-6" for a minimum of 15 inches. Corridor design shall allow installation of flexible weather seals and floor threshold to the face of the building.
  6. Rotunda: Rotunda floor shall remain stationary and level at all times and provide a smooth transition between the terminal and telescoping tunnels. Flap type seals shall be provided for weather protection between the rotunda and the hinged telescoping tunnel section.
  7. Support Pedestal: Support pedestal shall provide the structural support for the passenger boarding bridge. The support column shall rest on a foundation and anchor bolt pattern that is supplied by others. The pedestal shall be custom built to meet specific site conditions.
    - a. The electrical disconnect panel, mounted on the pedestal, shall provide the electrical disconnects and transformers required to adapt specified terminal power to the passenger boarding bridge's electrical requirements.
- C. Tunnel Assembly: Tunnel assembly connects the rotunda assembly and aircraft cab assembly.
1. Telescoping tunnels shall be rectangular in cross section. The tunnel with the largest cross section shall be closest to the aircraft.
  2. The exterior roof, and floor panels of the telescoping tunnel sections shall be manufactured from corrugated, or galvanized flat steel panels attached to a framework of angle and tubing. These panels are formed,

welded, sealed and painted to form the tunnel enclosure. Roof shall be flat to prevent the collection of water.

3. Solid-Sided PBB: The exterior sides of the telescoping tunnel sections shall be manufactured from corrugated, or galvanized flat steel panels attached to a framework of angle and tubing. These panels are formed, welded, sealed and painted to form the tunnel enclosure.
4. Hinged transition ramps shall accommodate the difference in elevation where telescoping tunnel sections overlap.
5. Minimum interior clear dimensions are as follows:
  - Minimum Floor Width: 4'-10" (1473mm)
  - Minimum Interior Height: 6'-11" (2134mm)
  - Minimum Inter-Tunnel Ramp Width: 4'-8" (1422mm)
  - Minimum Corridor Width: 4'-4-1/2" (1334mm)
6. The telescoping tunnels shall be equipped with an under bridge mounted exterior electrical cable conveyance system. This system is accessible to maintenance personnel for inspection or cable addition at all passenger boarding bridge positions and operations conditions. Access to the conveyance system shall not impede passenger traffic or passenger boarding bridge operation. The system shall be capable of supporting a combination of cables and hoses with a maximum weight of 12 pounds per square foot (17.9 kg per meter) and a maximum cross-sectional area of 12 square inches (7742 sq mm) consisting of two 6 square inch (3871 sq mm) areas. The largest tunnel shall be equipped with an aluminum or galvanized wire way to continue electrical cable routing beyond the electrical cable conveyance system

D. Aircraft Cab:

1. The aircraft cab shall be designed to rotate 135 degrees. Rotation is 95 degrees counterclockwise and 40 degrees clockwise from tunnel centerline.
2. The cab shall be rotated at a speed of 138 degrees per minute (2.41 degrees/sec). Limit switches and physical stops shall control the rotation limits.
3. The cab shall be equipped with a forward facing control console. The console shall be located behind laminated glass windows. Operation of the passenger boarding bridge will be accomplished without opening the weather doors. Visibility shall be provided with vision panels in the cab side-coiling curtains and windows located in front and to the left and right of the operator.
4. An electric roll up door is to be installed on the right side of the operators control console to secure the passenger boarding bridge from unauthorized access and seal in the interior of the passenger boarding bridge from adverse weather conditions when the door is closed. The minimum clear width of the weather door is 5'-0" and the minimum door height is 7'-8 1/2".
5. A full width spacer shall be located at the aircraft end of the cab floor. The spacer material shall meet the fire protection specifications of NFPA-415 shall be flexible and non-abrasive to prevent scratching or other damage to aircraft fuselage.
6. The aircraft end of the cab shall be equipped with a cab floor that adjusts to the optimum relative to the aircraft doorsill. The floor shall be actuated and independently adjustable to adapt to all aircraft doorsills. It shall be designed to level automatically and shall be equipped with a manual override control switch. The floor shall be capable of providing a level

- surface adjacent to the aircraft doorsill for passenger boarding bridge slopes from -10% to +10%.
7. A double hinge floor shall be included in the system to provide a smooth transition between the level floor and the tunnel section. The transition floor shall provide a smooth platform sloped in the direction of the passenger traffic flow. No raised surfaces which may introduce a tripping hazard to the passenger shall be permitted.
  8. Exterior floodlights shall be provided for nighttime operation to illuminate the apron area ahead of the passenger boarding bridge. A floodlight shall also be provided to illuminate the drive column wheel bogey area. This light shall be located under the tunnel section.
  9. A weatherproof fluorescent fixture shall be provided outside the weather doors to illuminate the cab-aircraft interface.
  10. A ventilator shall be mounted on the cab bubble roof, which exhausts hot air from the passenger boarding bridge. The damper shall be gravity operated. The exhaust fan control shall be console operated. Ventilator shall be 1500 CFM model.
  11. Electric heater.
- E. Aircraft Closure: The aircraft end of the cab shall be equipped with a folding bellows aircraft closure. The closure, when fitted against the fuselage, shall surround both the open aircraft door and the doorway to protect passengers from the elements. Covering shall not absorb water, shall be highly tear resistant and shall remain flexible from -31 degrees F (-35 degrees C) to 127 degrees F (52.8 degrees C). The aircraft enclosure color shall be black or dark gray.
1. Each side of the aircraft closure shall independently seal against aircraft contours.
  2. If necessary, pressure sensitive switches shall be incorporated into the closure mechanisms to prevent excessive pressure on the aircraft.
  3. The contacting seal shall be a soft material to prevent scratching or damage to the aircraft skin. The seals that contact the aircraft shall be designed for easy replacement.
- F. Service Access: A service door, landing and stair leading to the apron areas shall constitute the service access. Service access shall be located on the right hand side of the cab end of the passenger boarding bridge; it provides access between the passenger boarding bridge and apron for authorized personnel.
1. Service door shall be steel, hollow core with wire glass window, and meets or exceeds the 3/4-hour fire rating per ASTM E 152. The minimum door width is 3 feet 0 inches, (914 mm) wide and 6 feet 8 inches (2032mm) high. Door shall be equipped with heavy-duty commercial-type hardware (Best Brand core) and automatic door closure. The door shall open outward onto the service stair landing. A cipher lock is to be provided on the exterior and knob on the interior. A 30-inch (762mm) stainless steel kick plate shall cover the lower inside portion of both interior and exterior sides of the door.
  2. Service stair landing shall be parallel to the adjacent tunnel floor. The landing shall be made of hot dipped galvanized steel, open mesh grating. The landing shall be protected on the open sides by galvanized steel handrails, which meet OSHA standards. A switch operated, full cut-off luminaire shall be provided above the landing.
  3. Service stair shall be equipped with self-adjusting risers and treads made from expanded metal with a serrated edge for a gripping surface. All steps shall have an equal rise. The tread width shall be 28 inches (711

mm) and the maximum tread height shall be 9-1/2 inches (241 mm). The service stair shall be protected on each side by handrails designed to meet OSHA standards. The entire service stair assembly shall be galvanized steel. The service stair assembly accessible to ramp service personnel at all operational heights and positions of the passenger boarding bridge.

- G. Control Station: The control station shall be located at the aircraft end of the passenger boarding bridge. It shall provide the operator with a control console, service utilities, and control interlocks required to accomplish passenger boarding bridge operation. Station shall be positioned on the left side of the cab and oriented to position the operator facing forward in full view of the aircraft during maneuvering and docking operations.
1. Control Console: The control console shall be located –in the operator compartment and shall be protected from the outside environment.
    - a. Controls: All passenger boarding bridge motion controls shall be momentary contact type (deadman) controls. All of the motion controls shall be designed to be relative to the function of the passenger boarding bridge being controlled, i.e., raise and lower functions, the “raise” push button will be located above the “lower” push button. The control console shall include the following controls-.
      - 1) A three-position master key switch used to select "OFF", "OPERATE", or "AUTO" (automatic leveling). The key may be removed only in the "OFF" or "AUTO" positions,
      - 2) A 4- way lever arm or "joystick" to control forward and reverse and steering motions. As the joystick is moved progressively forward or back, passenger boarding bridge speed increases proportionally with the position of the joystick. Steering, left or right, may be accomplished at the same time as forward and reverse motions. An interlock shall prevent the passenger boarding bridge from being driven forward when the aircraft closure is deployed.
      - 3) Push button switches for raising and lowering the cab end of the passenger boarding bridge.
      - 4) Push button switches for cab rotation, left or right.
      - 5) Push button(s) to deploy the bellows-type aircraft closure.
      - 6) Switch for floodlights that illuminate the apron area under the aircraft and drive column undercarriage.
      - 7) Digital position indicator
      - 8) Switch to change the cab floor level adjustment from an automatic operation to a manual operation,
      - 9) Relative motion push-button switch to control the cab floor level adjustment while in the manual mode.
      - 10) Emergency stop button, which shuts down all passenger boarding bridge movement when pressed.
      - 11) Lamp test button to allow function testing of all indicator lights.
      - 12) Switch for cab light to illuminate the area forward of the cab door.
      - 13) Horn button to alert that the bridge is about to move.
    - b. Indicators: The control console shall have indicators that display the current passenger boarding bridge status. The passenger boarding bridge status indicators shall be as follows:

- 1) Digital position indicator to display the relative vertical position of the lift column. This indicator is used to vertically pre-position the passenger boarding bridge prior to the arrival of the aircraft.
- 2) Wheel position indicator, which displays wheel orientation with respect to the operator's position. A wheel position indicator maintains correct wheel orientation while cab is being rotated.
- 3) An amber light to indicate auto-leveling system is energized and functioning.
- 4) A red light and audible warning to indicate the auto leveler sustained travel timer has tripped.
- 5) A red light to indicate the passenger boarding bridge has reached the operational horizontal rotation limits. This light is preceded by an audible warning.
- 6) A red light to indicate drive wheels have reached an over steer condition.
- 7) A red light to indicate aircraft closure is deployed.
- 8) A red light to indicate vertical drive column fault (for electromechanical lift).
- 9) A green light to indicate power is on.
- c. A flashing amber beacon shall be mounted under the cab. The beacon shall indicate that power is on and the passenger boarding bridge may move at any moment.
- d. An audible warning bell shall be mounted on the underside of the cab and shall ring when the passenger boarding bridge is moving. The bell sound loudness shall be at least 92 db at 10 feet.
2. Utilities:
  - a. A six pair (twelve conductor) wire outlet for the installation of telephone or intercom equipment shall be located on left side wall adjacent to the control console.
  - b. Duplex outlets (unswitched 120 volt, single phase, 15 ampere) shall be located on the side wall of the control console, on the lower portion of the drive column (GFI), and in the rotunda corridor.
3. Control Features and Interlocks
  - a. Mechanical interlocks shall be provided to prevent damage to control circuits or passenger boarding bridge components by selecting opposite motions simultaneously. For example, depressing the up button prevents depressing the down button.
  - b. When the master key switch is in the "OFF" or "AUTO" position, the controls for horizontal and vertical movement, steering, aircraft closure and cab rotation shall be inoperative.
- H. Automatic Leveling: The passenger boarding bridge shall be equipped with an automatic leveling system, allowing the passenger, boarding bridge to adjust to changes in the aircraft elevation that occur during aircraft loading and unloading, The system shall function with equal reliability for all aircraft contours. The auto leveler shall be located on the right side of the cab and in full view of the operator at the control console
  1. The auto leveler shall be engaged when the master key switch is positioned to "AUTO".
  2. The auto leveler circuit shall include a sustained travel timer, Timer shall limit auto level operation shall be adjustable from 1.6 seconds to a maximum of 6 seconds. If the operation exceeds the set time limit a fault

condition is assumed, all motor power shall be disconnected; audible and visual alarms shall be energized.

3. The main auto level-sensing switch is activated by a 5-degree or more auto level wheel rotation.

- I. Drive Column- The drive column shall provide the vertical and horizontal motion for the passenger boarding bridge. The drive column and control systems shall be designed for smooth, quiet operation. The vertical and horizontal movements shall be operable at the same time. The drive column shall be divided into two major components: Vertical Drive and Horizontal Drive.

1. Vertical Drive:
2. Hydraulic Lift System:
3. The passenger boarding bridge shall move vertically by means of two extra capacity hydraulic ram assemblies,
  - a. Each ram is independent of the other and shall be capable of supporting the passenger boarding bridge under full design load. The design shall provide 100% redundancy,
  - b. The lift cylinders are equipped with internally mounted pilot operated check valves that prevent the bridge from descending in the event of fluid loss or other system failure,
  - c. Mechanical stops in the cylinders shall be provided to prevent over-travel of the lift column. The system shall not be damaged if the bridge is raised or lowered into the cylinder stops
  - d. The vertical travel speed shall be 2.5 feet per minute, measured at the spacer.
4. Electro-Mechanical Lift System:
  - a. The lift mechanism shall consist of two (2) re-circulating ball bearing screw assemblies. Each assembly shall be independent of the other, with individual motors, and be capable of supporting the bridge under full design load and raising and lowering the bridges at and approximate speed of 2 feet, 6 inches per minute measured at the cab bumper. The ball nut of this assembly shall be equipped with wiper brushes to remove grit or dirt from screw threads and a self-locking Acme type thread to prevent unit collapse in the event of a ball nut failure.
  - b. The vertical drive motors shall be fitted with spring-applied brakes that release only when electric power is applied and vertical motion, up or down, is signaled from operator's console or the auto-leveler system.
  - c. The brakes shall hold securely at all elevations, without creeping, whether the bridge is in operation or not.
  - d. The fault detector circuit shall shut down the electrical power to the vertical drive motors and set the brakes independently of the operator. This shall occur if the bridge is in the vertical operate mode and there is differential motion at the ball screws.
5. Horizontal Drive: A variable speed, electromechanical drive system shall provide horizontal travel.
  - a. Solid tires shall be aircraft casings with high wear tread design.
  - b. Drive wheels shall be driven independently by electric motors with integral brakes. A solid-state controller shall be provided for drive wheel speed control. Horizontal speed shall vary from 0 to 90 feet (27.4m) per minute.
  - c. A steer angle of 180 degrees shall be possible.

- d. A regenerative braking system shall allow the passenger boarding bridge to come to smooth controlled stops. Integral spring-applied electrically released brakes shall be provided with each drive motor. The brakes shall lock the passenger boarding bridge in place when it is not being driven horizontally.
  - e. Horizontal drive motors shall be equipped with manual brake releases, allowing the passenger boarding bridge to be towed in the event of a power failure.
  - f. Tow lugs shall be a component of the lower wheel frame.
  
- J. Interior Finishes: The interior finish of the passenger boarding bridge shall be designed to be durable and easy to clean.
  - 1. Ceiling should be continuous coil coat painted galvanized sheets or brushed finish aluminum planks. Planks shall run perpendicular to the tunnel centerline and continuously from wall to wall,
  - 2. Interior light fixtures shall be recessed linear fluorescent type and blend with the ceiling design, Light fixtures shall run perpendicular at 6'-0" ft on center (maximum). Fixtures shall be 1'-0" wide (maximum) by 3'-0" long (minimum) The average light intensity at the floor shall be 18-foot candles (194 lux) (minimum). Fixture trim shall be painted black or shall match ceiling finish,
  - 3. Light fixture in the rotunda shall be a flush mounted fluorescent type.
  - 4. Single three-way switches shall be located in the rotunda and on wall near the service door at the aircraft cab. These switches shall control interior tunnel, bubble and rotunda lights and the weatherproof fluorescent cab floodlight.
  - 5. To the ends of the ceiling panels and the top edge of the wall panels, aluminum corner molding shall be used.
  - 6. Insulation in the ceiling shall be 1 1/2-inch (12.7mm) thick, fire resistant
  - 7. Sub floor in the cab and bubble area shall be smooth galvanealed steel or 3/4 inch (19mm) marine grade plywood with high resistance to moisture and moisture damage. Sub floor in the remainder of the passenger boarding bridge 3/4-inch (19mm) thick moisture resistant, fire retardant plywood or oriented strand board-exposure 1, made with exterior phenolic resin adhesive, or smooth galvanealed steel.
  - 8. Ribbed rubber 3/16 inch (4.76mm) thick shall be applied to the floor from the aircraft and of the passenger boarding bridge to the terminal side of the service door.
  - 9. Passenger boarding bridge interior floor covering, other than covered in the cab and bubble area shall be carpet tile, color and pattern to be selected by the Architect from manufacturer's standards, provided and installed by the passenger boarding bridge manufacturer.
  - 10. The tunnel wall treatment shall consist of floor to ceiling glazing and finish panel. Glazing shall be per Glazing Specification Section Wall treatments in the pivoting sections (rotunda and cab support) shall be galvanized steel slats.
  
- K. Other Surfaces Exposed to Passengers: The coating system shall be specifically designed to provide long-term protection from the harmful affects of corrosion on passenger boarding bridges:
  - 1. A prime coat of Epoxy followed by a topcoat of Polyurethane for a combined average dry film thickness of 7 mils (175 microns).
  - 2. A topcoat Polyurethane that is available in a wide variety of standard colors. Custom colors are also available per contractual agreement.



3. Exceptional performance in all environments.
4. Normal life expectancy is 10-15 years with proper maintenance, which consists of monthly inspection and repair of scratches, broken film, or delamination. Semi- annual power washing is also recommended.
5. These coatings are environmentally friendly due to very low VOC (Volatile Organic Compounds) in the primer and the topcoat.

I. INTERIOR COATING SYSTEM – Surface Preparation

1. Clean area to be painted in accordance with SSPC-SP1, solvent cleaning. This specification calls for the removal of all visible oil, grease, dirt, loose mill scale, rust, and loose paint.
2. Surface must be dry immediately prior to application of paint. There must also be at least a 5 point differential between the atmospheric temperature and dew point before painting can commence.

J. Coating Description

1. American Coatings Rustlok 8000 Series
2. American Coatings SU Series Polyurethane
  - a. 60% solids color base (Part A)
  - b. 60% solids urethane catalyst (Part B)
  - c. Mix just prior to application per manufacturer's instructions

K. Application Requirements.

1. Apply to a total dry film thickness of 6-7 mils (150-175 microns).
2. Allow to dry per manufacturer's instructions prior to application of topcoat.

L. Inspection Criteria

1. Take five random film build readings per 100 square feet (9.3 sq. meters) of coverage area to verify correct millage.
2. Minimum acceptable dry film thickness is 3 mils (75 microns).

## 2.3 EXTERIOR COATING SYSTEM

A. Surface Preparation – Hot Roll / Cold Roll Steel Only

1. Clean area to be coated in accordance with SSPC-SP6, commercial blast cleaning. This specification calls for the removal of all rust, mill scale, paint, and other foreign matter except for any slight staining of same in less than one third of each square inch of blasted area.
2. The anchor pattern shall be no less than 1.5 mils (37.5 microns) nor more than 2.5 mils (62.5 microns).
3. Surface must be dry and free of any foreign matter to include blast debris prior to coating.

B. Surface Preparation – Galvanized Steel Panels Only

1. Clean area to be coated in accordance with SSPC-SP1, solvent cleaning.
2. Do not blast or utilize any chemical cleaning product that could inhibit proper adhesion to the galvanized surface.
3. Surface must be dry prior to coating application. There must be at least a 5 point differential between the atmospheric temperature and dew point.

C. Coating Description – Primer - Hot Roll / Cold Roll Steel Only

1. 80% volume of solids Epoxy Primer
2. American Coatings Rustlock 8000 Series Epoxy (Two Components)
  - a. 80% solids epoxy primer base (Part A)

- b. 80% solids epoxy catalyst (Part B)
  - c. Mix just prior to application per manufacturer's instructions.
- D. Application Requirements
  - 1. Apply to a total dry film thickness of 3-5 mils (75-125 microns).
  - 2. Allow to dry per manufacturer's instructions prior to topcoat application.
- E. Inspection Criteria
  - 1. Take five random millage readings per 100 square feet (9.3 meters) of coverage area.
  - 2. Minimum average dry film thickness is 4 mils (100 microns).
- F. Coating Description – Topcoat – All Surfaces
  - 1. Aliphatic Polyurethane color coat with satin gloss finish (60-65 @ 60 degree gloss meter).
  - 2. American Coatings SU Series High Solids Polyurethane
    - a. High solids urethane color coat (Part A)
    - b. High solids urethane catalyst (Part B)
    - c. Mix just prior to application per manufacturer's instructions.
- G. Application Requirements
  - 1. Apply to a total dry film thickness of 2-4 mils (50-100 microns).
  - 2. Allow to dry per manufacturer's instructions.
- H. Inspection Criteria
  - 1. Take five random millage readings per 100 square feet (9.3 meters) of coverage area
  - 2. Minimum total average dry film thickness is 7 mils (175 microns) for carbon steel surfaces and 7 mils (175 microns) for galvanized steel surfaces.

## 2.4 PRE-PAINTED ITEMS

- A. Purchased components that are factory painted shall be repainted. Typical items include the hydraulic power unit, cab rotate drive motor, hydraulic drive motor, control power transformer, control console, limit switches, electrical junction boxes, conduit, etc.
- B. The finish color for the above items will be the individual manufacturer's standard.
- C. The finish color of the hydraulic unit is gray.
- D. The finish color of the control console is beige.

## 2.5 FIRE PROTECTIVE COATING – Fixed and Rotating Cab Floors only

- A. Surface Preparation
  - 1. Cab floors must be primed per exterior coating application procedures.
  - 2. Surface must be dry prior to coating application. There must be at least a 5 point differential between the atmospheric temperature and dew point.
- B. Coating Description
  - 1. Fire Protective Epoxy Coating

2. Thermo Lag 220
- C. Application Requirements
  1. Apply to a total dry film thickness of 7-8 mils (175-250 microns).
  2. Allow to dry per manufacturer's instructions prior to topcoat application.
- D. Inspection Criteria
  1. Take five random millage readings per 100 square feet (9.3 meters) of coverage area.
  2. Minimum average dry film thickness is 13 mils (325 microns).

## 2.6 COATING REPAIR PROCEDURE

- A. Surface Preparation
  1. Prepare area to be painted using wire brush or power tool to remove any loose paint or other foreign matter.
  2. Clean area to be painted by wiping with a general cleaning solution to minimize presence of rust, oil, grease, or other contaminants.
  3. Surface must be dry prior to paint application.
- B. Application Requirements
  1. If damage is to bare metal, apply Rustlock primer in accordance with above sections. An alternative primer selection is American Coatings' AK 11187 Phenolic primer if recoat time is a consideration.
  2. Apply urethane topcoat in accordance with above sections.
  3. Verify total film builds meet specification requirements.

## 2.7 TOW BAR AND TOW BAR ATTACHMENT

- A. The PBB shall have provision for attaching a standard tow bar to move the bridge in the event of motor / power failure. Provide one (1) standard towbar capable of connecting to a standard Tug vehicle shall be provided to facilitate towing of the PBB in the event of power failure. The Tow Bars shall be painted Safety Yellow.

## 2.8 STANDARD JACK STAND

- A. Provide one (1) standard PBB Jack Stand. The Jack Stand shall be capable of bearing the maximum load of the PBB's. The Jack Stand shall be equipped with adjustable height caster wheels and a handle bar allowing a person to maneuver the stand. When not in use the Jack Stand shall be capable of being securely parked by means of a wheel locking (braking) system. The Jack Stand shall bear directly on the apron when supporting the weight of a PBB. The Jack Stand shall distribute the weight of the PBB as to assure that excessive loading of the apron shall not occur. The Jack Stands shall be painted Safety Yellow.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verify that the following are of proper size and type to receive the Passenger Boarding Bridge (PBB):
  1. Foundations including anchor bolt patterns,

2. Electrical work including electrical Power, emergency power and circuit protection.
  3. Location of assigned gates and aircraft parking positions,
- B. Report conditions detrimental to proper and timely completion of the installation of the passenger boarding bridge.

### 3.2 PREPARATION

- A. Furnish all anchors, inserts and the like required to install the passenger boarding bridges
- B. Arrange for temporary electrical power for installation through the Owner.

### 3.3 INSTALLATION / APPLICATION / ERECTION

- A. Installation shall be provided either by the passenger boarding bridge manufacturer or a licensee of the manufacturer.
- B. Coordinate installation of passenger boarding bridge with Owner and General Contractor.
- C. Installation shall be provided in strict compliance with all governing regulations.
- D. Installation shall conform to the manufacturer's recommendations and to the standards established by the industry.
- E. All permanent utility connections shall be the responsibility of the installer, connections will be provided in a weather tight condition.
- F. The rotunda corridor of the passenger boarding bridge will be flashed to the exterior face of the concourse. The flashing will provide a neat and weather tight condition.
- H. Structural Support Elements
1. Verify the design dimensions from the top of the foundation to the floor of the terminal building door sill at each gate location.
  2. All anchor bolts shall be properly protected from bending and damage during and after construction. All anchor bolts shall be double nutted, with 3 full threads minimum showing. The Contractor shall install anchor and leveling nuts, provide an appropriate size flat washer to cover the slotted opening in PBB support column base plate and provide proper installation of the nuts as required to complete the installation. After installation, tack weld the anchor nuts to the base. All zinc coating removed or damaged by welding or by any other reason shall be cleaned and repaired with galvanizing repair primer meeting the requirements of Federal Specifications TT-P-641 G (1), Type II. Anchor bolts are provided by others.
  3. An approved non-shrinking grout shall be used underneath the column base plate and leveling plate and fill all anchor bolt pipe sleeves. Grout shall be nonferrous to avoid unsightly rust marks. Form all grout pours. The grouting shall be done to ACI standards. Grouting by dry packing and filling the center area with bags and blocks is not acceptable.

### 3.4 FIELD QUALITY CONTROL

- A. Acceptance testing, perform tests with the Owner present prior to placing the passenger boarding bridge in service.
- B. Adjust the passenger boarding bridge for proper and smooth operation

### 3.5 PROTECTION AND CLEANING

- A. Protect the passenger boarding bridge from time of installation until acceptance by the Owner.
- B. All finish surfaces shall be delivered to the Owner free of any soil or damage.
- C. Repair or replace any damage to the passenger boarding bridge prior to Owner acceptance.

### 3.6 MANUALS

- A. Operation and Maintenance Manuals shall be provided and be prepared in accordance with Air Transport Association (ATA) Specification 101. Included in the manuals shall be preventative maintenance requirements and problem solving procedures.
- B. Manuals Shall be Furnished According to the Following Schedule:
  - 1. One passenger boarding bridge: Three Operation and Maintenance Manuals.
  - 2. Two passenger boarding bridges: Four Operation and Maintenance Manuals.
  - 3. Three boarding bridges or more: Five Operation and Maintenance Manuals

### 3.7 DEMONSTRATION AND TRAINING

- A. The Contractor shall provide as a minimum 8 hours of operator and 8 hours of maintenance training, in separate sessions by a qualified Manufacturer's representative. Training shall be conducted at the installation site and in classrooms as designated and provided for by the Owner and airlines. Maintenance training shall include proper demonstration of cut-away models of critical parts, full instruction on proper maintenance and trouble shooting, instructions on proper use of manuals, etc. Operation training shall include proper training of the operators on correct bridge operations to avoid damaging the equipment by improper use of the controls. The Contractor shall provide a complete operation training program and maintenance training program both recorded on separate video tapes to enable the Owner to train additional employees in the future.
- B. Training shall be conducted by the Contractor utilizing prepared texts, slides, actual passenger boarding bridges and other instructional material as appropriate.
- C. The Contractor shall, upon completion of the training program, provide the airline and Owner with 2 operating instruction manuals and 2 maintenance manuals for each passenger boarding bridge.

- D. Training dates shall be mutually agreed upon by the Contractor, airlines and the Owner and shall be at dates prior to bridges going into regular operational service.
- E. The airlines and Owner will assign persons or companies to be trained.

## 2.9 SPARE PARTS

- A. The Contractor shall furnish, not less than forty-five (45) days prior to completion of a passenger loading bridge, a list of suggested spare parts, including prices and sources, to the Architect / Engineer for review by the Owner. Spare parts as recommended in this context are those items which are necessary to maintain in stores in order to maintain service availability of bridges.

## 2.10 APPENDIX "A"

- A. See attached Appendix "A" for standard performance and procedure checklist.

**APPENDIX "A"**  
**STANDARD PERFORMANCE**  
**AND**  
**ACCEPTANCE TEST PROCEDURES**  
**FOR APRON DRIVE LOADING BRIDGES**  
**STANDARD PERFORMANCE TEST PROCEDURES**

Preliminary / Final Inspection (circle one)    Date \_\_\_\_\_  
 Loading Bridge Gate Number: \_\_\_\_\_  
 Airline Served: \_\_\_\_\_  
 Airline / Airport Representative present during demonstration: \_\_\_\_\_  
 Architect / Engineer's Representative present during demonstration: \_\_\_\_\_  
 Owner's Representative present during demonstration: \_\_\_\_\_

**A. ELECTRICAL INSTALLATION**

General: Prior to connecting power supply, check all circuits as follows:

		Functioning <u>Properly</u>	<u>Malfunctioning</u>
1.	Insulation resistance	_____	_____
2.	Continuity	_____	_____
3.	Polarity	_____	_____
4.	Earth loop resistance from each main part of the ground connection with building ground	_____	_____
5.	Disconnect operation	_____	_____

		Functioning <u>Properly</u>	<u>Malfunctioning</u>
<b>B.</b>	<b><u>FUNCTIONAL TESTS</u></b>		

1.	Electrical: Demonstrate the following:		
a.	Emergency lights	_____	_____
b.	Emergency stops	_____	_____
c.	Warning lights	_____	_____
d.	Obstruction lights	_____	_____
e.	Floodlights	_____	_____
f.	Bogie visual alarms	_____	_____
g.	Bridge lighting	_____	_____
h.	Stair lighting	_____	_____
i.	Heatable window (if fitted)	_____	_____
j.	Key switch for manual & automatic operation	_____	_____
k.	Height indicator	_____	_____
l.	Signal lamps	_____	_____
m.	Main control panel	_____	_____
n.	Cabin floor heater	_____	_____
o.	Selector switches:		
	1) Lifting / lowering	_____	_____
	2) Cabin rotation	_____	_____
	3) Wheels - steer right / left	_____	_____
	4) Bridge – extend / retract	_____	_____
	5) Emergency back-off	_____	_____
	6) Main / Aux changeover switch (if fitted)	_____	_____
p.	Safety interlocks:		
	1) Maintenance switches	_____	_____

	2)	Main panel isolator	_____	_____
	3)	Safety barrier (if fitted)	_____	_____
	q.	Fault Monitoring (if fitted)	_____	_____
2.		Mechanical: Demonstrate the following:		
	a.	Cabin window shutters (if fitted)	_____	_____
	b.	Door closer on service door	_____	_____
	c.	Tires	_____	_____
	d.	Self sustaining elevation screw	_____	_____
<b>C.</b>		<b><u>OPERATION TESTS (ALL DONE TWICE)</u></b>		
1.		Extension / Retraction		
	a.	Extension limit switch No. 1	_____	_____
	b.	Extension limit switch No. 2	_____	_____
	c.	Retraction limit switch No. 1	_____	_____
	d.	Retraction limit switch No. 2	_____	_____
	e.	Speed reduced (if fitted)	_____	_____
2.		Lifting / Lowering		
	a.	Height switch No. 1 fully extended	_____	_____
	b.	Height switch No. 2 fully extended	_____	_____
	c.	Lower switch No. 1 fully extended	_____	_____
	d.	Lower switch No. 2 fully extended	_____	_____
	e.	Height switch No. 1 fully retracted	_____	_____
	f.	Height switch No. 2 fully retracted	_____	_____
	g.	Lower switch No. 1 fully retracted	_____	_____
	h.	Lower switch No. 2 fully retracted	_____	_____
	i.	Inclination switch bridge up fully retracted	_____	_____
	j.	Inclination switch bridge down fully retracted	_____	_____
3.		Rotation (Bridges)		
	a.	Approach switches left hand	_____	_____
	b.	Approach switches right hand	_____	_____
	c.	Check slow-down or supplementary switches as above	_____	_____
	d.	Ultimate limit switches L/R	_____	_____
4.		Rotation (Cabin)		
	a.	Limit switch left hand	_____	_____
	b.	Limit switch right hand	_____	_____
5.		Canopy		
	a.	Extension, check both side switches	_____	_____
	b.	Retraction, check both side switches	_____	_____

END OF SECTION 14950